

## EVALUATION OF ENVIRONMENTAL ORDER IN WARMIA AND MAZURY VOIVODSHIP

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**Key words:** sustainable development, environmental order, indicator-based evaluation.

### Abstract

The studies aimed at evaluation of the environmental order at regional level. The study covered Warmia and Mazury voivodship. The data obtained from the resources of the Regional Data Bank (RDB) was processed by means of comparative indicator method. Selected indicators of sustainable development were selected from the perspective of environmental order characteristic and computed on the available statistical data from the years 2002–2006. The studies show that the majority of indicators for Warmia and Mazury voivodship showed rankings and values above the average for the remaining voivodships. Only indicators  $W_3$  and  $W_{13}$  obtained negative results during all the years covered. Year 2004 that was a breakthrough for environment protection did not generate major changes. The changes concerned mainly the financing of outlays on environment protection.

## OCENA ŁADU ŚRODOWISKOWEGO WOJEWÓDZTWA WARMIŃSKO-MAZURSKIEGO

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**Słowa kluczowe:** rozwój zrównoważony, ład środowiskowy, ocena wskaźnikowa.

### Abstrakt

Celem badań była ocena ładu środowiskowego na poziomie regionalnym. Badaniami objęto województwo warmińsko-mazurskie. Dane zebrane z zasobów Banku Danych Regionalnych (BDR) opracowano wskaźnikową metodą porównawczą. Wybrane wskaźniki zrównoważonego rozwoju wyselekcjonowano pod kątem charakterystyki ładu środowiskowego i obliczono na podstawie danych statystycznych dostępnych z lat 2002–2006. Z badań wynika, że większość wskaźników dla województwa warmińsko-mazurskiego wykazywała oceny i wartości powyżej średniej, jaką osiągały pozostałe województwa. Tylko wskaźniki:  $W_3$  i  $W_{13}$  otrzymały we wszystkich badanych latach ujemne oceny. Przełomowy dla ochrony środowiska rok 2004 nie przyniósł większych zmian. Dotyczyły one głównie finansowania nakładów inwestycyjnych na ochronę środowiska.

## Introduction

Sustainable development is the socio-economic development within which the process of integration of political, economic and social activities takes place while maintaining the natural balance and durability of elementary natural processes to secure the possibility of satisfying the basic needs of individual communities or citizens, both of the present and the future generations<sup>1</sup>. Among the principles of sustainable development accepted in Rio de Janeiro within the frameworks of the Earth Charter 18 apply directly to the environmental order. The majority of environmental order principles focus on two pillars of sustainable development: supporting equality of generations in access to natural environment resources and supporting the capacity of the environment (BORYS, KUSTERKA 2005, pp. 247–253).

The concept of sustainable development understood as integrated order must be implemented by interdependent development of the environmental, economic, spatial and social orders at all levels: local, regional, national and even global (BORYS 2005, pp. 22–60). Selected, adjusted and theoretically elaborated measures for expressing the environmental, economic, social and spatial order will allow development of the sustainable development model for the region.

## Methodology of studies

The studies aimed at evaluation of the environmental order at regional level. The study covered Warmia and Mazury voivodship.

The data was processed by means of comparative indicator method. Sustainable development indicators were selected from the perspective of environmental order characteristics and computed on the basis of statistical data available from the resources of the Regional Data Bank (RDB) for the years 2002–2006. Evaluation of the environmental order was based on fifteen indicators of sustainable development in four areas (SZADZIEWSKA 2008, pp. 27–30): environment and landscape protection, protection and sustainable development of forests, emissions into the environment and water management.

1) Environment and landscape protection:

- $W_1$  – share of arable land area in the agricultural land area (%),
- $W^2$  – share of natural sanctuaries in the total area of legally protected areas (%),

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<sup>1</sup> Act of the 27<sup>th</sup> of April 2001 Environment protection law (Dz.U. No. 62 item 627 as amended, Art. 3 point 50).

- $W_3$  – share of ecological use areas in the total area of legally protected areas (%),
- $W_4$  – share of voivodship budget funds in total outlays on environment protection (%),
- 2) Protection and sustainable development of forests:
  - $W_5$  – woodiness (%),
  - $W_6$  – share of forest areas in the area of the voivodship (%),
  - $W_7$  – share of total forest renewals and afforestation areas in the area of the voivodship (%),
  - $W_8$  – share of public SP forest areas in the total area of forests (%),
- 3) Emissions to the environment:
  - $W_9$  – share of population serviced by wastewater treatment plants in the total population (%),
  - $W_{10}$  – share of population serviced by sewers networks in the total population (%),
  - $W_{11}$  – share of waste stored in the total volume of waste produced during the year (%);
- 4) Water management:
  - $W_{12}$  – share of population serviced by water supply networks in the total population (%),
  - $W_{13}$  – share of water consumption in agriculture and forestry in the total water consumption in the national economy and by the population (%),
  - $W_{14}$  – share of underground water intake for the industrial purposes in the total water consumption in industry (%),
  - $W_{15}$  – share of surface water intake for the industrial purposes in the total water consumption in industry (%).

Indicators  $W_1$ ,  $W_{11}$ ,  $W_{13}$ ,  $W_{14}$  and  $W_{15}$  are destimulants while the other indicators are stimulants. For each indicator the so-called presentation ranking showing by how many percents the indicator is better or worse than the average for the compared voivodships was (ROGALA 2005, pp. 237–246). The evaluation considers uniform preference of the value, i.e. the higher the scored value the better the situation in the studied unit. The zero unitarisation methods were applied for comparison of the unitarised indicator values to the average by applying the following formulas (BORYS 1984, pp. 284, BORYS and ROGALA 2004, pp. 601–608, ROGALA 2005, pp. 237–246):

- for stimulants

$$O_P = [(W_i - W_{\min}) / (W_{\max} - W_{\min.})] \times 100\% \quad (1)$$

- for destimulants

$$O_R = [(W_{\max} - W_i) / (W_{\max} - W_{\min.})] \times 100\% \quad (2)$$

– for the average value of the stimulator

$$O_{P-\acute{s}r} = [(W_{\acute{s}red} - W_{min.}) / (W_{max} - W_{min.})] \times 100\% \quad (3)$$

– for the average value of destimulator

$$O_{R-\acute{s}r} = [(W_{max} - W_{\acute{s}red}) / (W_{max} - W_{min.})] \times 100\% \quad (4)$$

where:

- $O_P$  or  $O_R$  – point score of the  $W$  indicator value for the voivodship,
- $O_{P-\acute{s}r}$  or  $O_{R-\acute{s}r}$  – point score of the average indicator value for the compared group of units (voivodships), that score depends on the distribution of indicator values,
- $W_i$  – value of indicator for the evaluated unit,
- $W_{min.}$  – minimum value of the indicator for the given population.
- $W_{max.}$  – maximum value of the indicator for the given population,
- $W_{\acute{s}red}$  – average value of the indicator for the given population.

Next the values of indicators were referred to the average values in the compared group of units according to the formula:

$$[(O_P / O_{P-\acute{s}r}) \times 100\%] - 100\% \text{ or } [(O_R / O_{R-\acute{s}r}) \times 100\%] - 100\% \quad (5)$$

The tables present the values of indicators, minimum values, maximum values, average values in the compared group and deviations from the average. The graph presents the relation of indicator value for the studied voivodship to the average value computed for the remaining voivodships in the baseline year 2002, in the year of accession of Poland to the EU and in the last year covered by the study 2006.

## Results of studies

Four indicators of sustainable development covering the aspect of environment and landscape protection in Warmia and Mazury voivodship were analysed (Tab.1). Three covered the characteristics of land use and legal protection of land while the fourth one covered financing of environment protection from voivodship budget funds.

As indicated by the data presented in Table 1, the share of arable land area in agricultural land area ( $W_1$ ) changed slightly during the years covered. During the years 2002–2004 it increased from 69,14% to 69,96%, while in 2004 it decreased to 69,51%.

Table 1

Values of indicators from the environment and landscape protection section

Indicator [%]	Year	Indicator value for Warmia and Mazury voivodship $W_i$	Indicator value in Poland			Indicator evaluation deviation from the average [%]
			$W_{min.}$	$W_{max}$	$W_{sred}$	
$W_1$ Share of arable land area in the agricultural land area (D)*	2002	69,14	65,96	87,10	76,70	72,68
	2003	69,26	64,41	87,28	76,50	67,16
	2004	69,96	64,43	87,00	76,49	62,13
	2005	69,51	64,47	87,01	76,53	66,98
	2006	73,79	64,8	88,85	77,44	31,99
$W_2$ Share of natural sanctuaries in the total area of legally protected areas (S)	2002	2,2	0,31	3,03	1,42	70,27
	2003	2,67	0,31	3,56	1,53	93,44
	2004	2,66	0,31	3,56	1,56	88,00
	2005	2,66	0,31	3,66	1,59	83,59
	2006	2,66	0,31	3,66	1,62	79,39
$W_3$ Share of ecological use areas in the total area of legally protected areas (S)	2002	0,32	0,04	1,31	0,48	-36,36
	2003	0,37	0,04	1,27	0,52	-31,25
	2004	0,27	0,04	1,27	0,50	-50,00
	2005	0,27	0,04	1,33	0,53	-53,06
	2006	0,28	0,04	1,35	0,54	-52,00
$W_4$ Share of voivodship budget funds in the total outlays on environment protection (S)	2002	9,36	0,32	6,16	2,23	373,22
	2003	3,82	0,02	3,24	0,97	300,03
	2004	0,63	0,00	1,63	0,59	6,77
	2005	0,62	0,00	0,88	0,39	58,96
	2006	0,40	0,04	2,05	0,59	-34,54

\* D – destimulant, S – stimulant.

Source: Prepared on the basis of: SZADZIEWSKA 2008, pp. 35–56 and RDB data.

It reached the highest level at 73,79% in 2006. However, the deviation from the average decreased systematically down to 31,99% during the last year of studies, 2006. The increasing share of arable land (in the studies it was assumed as destimulant) has a negative influence on the status of the environment as a consequence of vegetable production intensification.

Indicators concerning legally protected areas were treated as stimulants. At the same time, although the area of legally protected land increases (both in Poland and in the voivodship), no increase in the area of strictly protected areas has been recorded in Warmia and Mazury voivodship. No national parks have been established in the voivodship; on the other hand numerous sanctuaries exist and their ranking as compared to other voivodships was high and in 2003 exceeded it by 93,44%. The last year of the studies was characterised by the value of 79,39%. One of the area protection indicators – share of ecological use areas in the total protected area ( $W_3$ ), was also evaluated. It is characterised

by relatively modest restrictions and in the areas of high natural values with intensive economic development it does not cause major conflicts. During the years encompassed by the study that indicator was characterised by a decreasing trend from  $-31,36$  in 2002 to  $-52,00$  in 2006. At the same time the share of that form of protection systematically decreased in the voivodship. This resulted mainly from increasing share of other nature protection forms, mainly areas of protected landscape. The fourth indicator ( $W_4$ ) concerned the share of funds from the voivodship budget in total outlays on environment protection. It indicates high involvement of regional level authorities in environment-oriented investments. In 2002 it exceeded the national average significantly by over 300% while the year 2006 brought a decrease below the average to  $-34,54\%$ . The decrease of the outlays from the voivodship budget as well as the inflow of European Union funds after Poland's accession in 2004 could be the cause (Fig. 1).

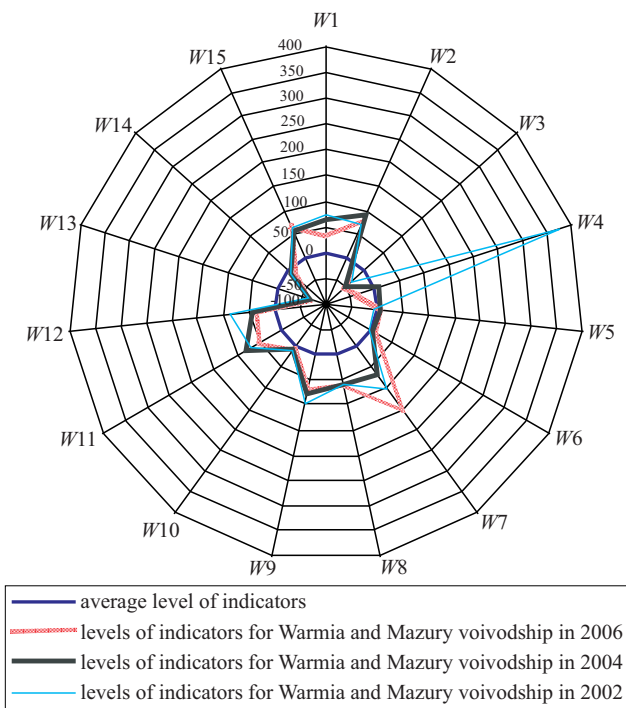


Fig. 1. Evaluation of environmental order indicators in Warmia and Mazury voivodship  
 Source: Prepared on the basis of: SZADZIEWSKA 2008, pp. 35–56 and RDB data.

Table 2 presents the levels and evaluation of indicators from forests protection and sustainable development section.

Table 2  
Values of indicators from the forests protection and sustainable development section

Indicator [%]	Year	Indicator value for Warmia and Mazury voivodship $W_i$	Indicator value in Poland			Indicator evaluation deviation from the average [%]
			$W_{min.}$	$W_{max}$	$W_{sred}$	
$W_5$ Woodiness (S)*	2002	29.70	20.56	48.22	30.27	-5.87
	2003	29.80	22.02	48.50	30.35	-2.94
	2004	29.90	20.63	48.71	29.47	4.52
	2005	30.00	20.73	48.73	29.55	5.10
	2006	30.20	20.79	48.74	29.70	5.27
$W_6$ Share of forest areas in the area of the voivodship (S)	2002	30.51	20.95	49.67	30.92	-4.09
	2003	.	22.34	49.95	31.01	.
	2004	30.71	21.02	50.50	30.14	6.24
	2005	30.84	21.12	50.21	30.21	6.91
	2006	31.03	20.08	50.25	30.32	6.92
$W_7$ Share of total forest renewals and afforestation areas in the area of the voivodship (S)	2002	0,26	0,12	0,37	0,19	100,00
	2003	.	0,13	0,38	0,22	.
	2004	0,27	0,10	0,41	0,20	70,00
	2005	0,27	0,11	0,43	0,20	77,78
	2006	0,36	0,11	0,47	0,21	150,00
$W_8$ Share of public SP forest areas in the total area of forests (S)	2002	94,92	54,43	98,56	80,21	57,06
	2003	94,86	54,20	98,56	80,14	56,75
	2004	94,81	54,19	98,56	80,05	57,08
	2005	94,55	54,21	98,54	79,93	56,84
	2006	94,3	54,32	98,57	79,83	56,72

\* S – stimulant.

Source: Prepared on the basis of: SZADZIEWSKA 2008, pp. 35–56 and RDB data.

All the evaluated indicators from  $W_5$  to  $W_8$  are stimulants. Indicators concerning woodiness  $W_5$ , as well as the share of forest lands  $W_6$  in both Warmia and Mazury voivodship and in the other voivodships increased. Increase of woodiness is consistent with the assumptions of the programme of increasing the woodiness of the country. Although the obtained scores (deviation from the national average) were low, their values increased systematically over the years covered.

The woodiness indicator showed a relatively high improvement from -5,87% relative to the average for the other voivodships in 2002 to 5,27 in 2006.  $W_7$  indicator that covers the share of renewed forest areas and afforestation in the total area of forestlands, that is indicates the sustainable development of forest and its durability showed a slight increase until 2005. In 2006 a significant improvement was recorded as the score reached the value higher by 100% than the average for the voivodships compared. The share of public SP forest areas in total area of land  $W_8$  is equally important. In the literature (ŻYLICZ

2008, pp. 32–33) discussions continue on whether it is better when the forest is public or private property, nevertheless, in this paper it was considered a stimulant. State Forests manage the forest resources quite professionally and the experience of other countries (Portugal), where forests were privatised shows that it is difficult to enforce exploitation of forests coupled with observation of principles of sustainability from private owners and numerous cases of purposefully setting forests on fire were recorded (ŻYLICZ 2008, pp. 32–33).

Table 3 presents selected indicators of emissions of pollutions to the environment.

Indicators of emissions of pollutions to the environment

Table 3

Indicator [%]	Year	Indicator value for Warmia and Mazury voivodship $W_i$	Indicator value in Poland			Indicator evaluation deviation from the average [%]
			$W_{min.}$	$W_{max}$	$W_{sred}$	
$W_9$ Share of population serviced by wastewater treatment plants in the total population (S)*	2002	66,06	44,17	74,77	55,39	95,10
	2003	.	45,22	76,46	57,12	.
	2004	68,75	45,29	77,60	58,74	74,42
	2005	69,89	47,30	78,37	60,01	77,73
	2006	70,2	49,04	78,82	61,84	65,31
$W_{10}$ Share of population serviced by sewers networks in the total population (S)	2002	62,12	41,15	72,06	56,20	9,59
	2003	62,74	41,97	72,23	57,00	7,52
	2004	63,74	42,96	72,99	57,44	7,50
	2005	64,36	44,46	73,28	58,35	11,60
	2006	64,64	45,45	73,62	59,65	3,57
$W_{11}$ Share of waste stored in the total volume of waste produced during the year (D)	2002	2,4	1,50	37,90	16,57	66,43
	2003	2	1,40	36,60	16,87	75,37
	2004	1	3,80	33,50	15,39	79,46
	2005	1,4	4,00	33,20	13,64	62,58
	2006	3,7	3,60	39,20	15,29	48,47

\* S – stimulant, D – destimulant.

Source: Prepared on the basis of: SZADZIEWSKA 2008, pp. 35–56 and RDB data.

Indicators  $W_9$  and  $W_{10}$  concern the issue of coverage of the country with the sewers networks and wastewater treatment. In the studies they were considered to be stimulants. Increase in their values is highly important for protection of waters and soils, particularly in case of high level of coverage with water supply networks achieved. The value of indicator  $W_9$  (share of population serviced by wastewater treatment plants in the total population) increased systematically over the years covered by the study while the score exceeded the average for the other voivodships in the country significantly. At the same time the score decreased its value year after year from 95,10% in 2002 to 65,31% in 2006.



Indicator  $W_{11}$  covered the share of waste stored in the total volume of waste produced. This is a destimulant because segregation and recovery of waste are most favourable for environment protection. During the years 2002–2004 a significant improvement can be noticed as the value of the indicator decreases; unfortunately 2005 and 2006 brought a significant increase in the value of that indicator. The score of indicator  $W_{11}$  develops in a similar way because although it is high as in 2002 it was 79,46% above the average for the remaining voivodships, during the last year of the study it decreased to 48,47%.

Water management was the fourth area covered (Tab. 4).

Water management indicators

Table 4

Indicator [%]	Year	Indicator value for Warmia and Mazury voivodship $W_i$	Indicator value in Poland			Indicator evaluation deviation from the average [%]
			$W_{min.}$	$W_{max}$	$W_{sred}$	
$W_{12}$ Share of population serviced by water supply networks in the total population (S)	2002	86,38	70,50	94,12	84,99	39,34
	2003	86,40	70,82	94,24	85,31	38,19
	2004	87,00	71,38	93,84	85,91	43,51
	2005	87,87	73,53	93,71	86,38	43,27
	2006	88,02	74,38	93,76	87,55	35,14
$W_{13}$ Share of water consumption in agriculture and forestry in the total water consumption in the national economy and by the population (D)	2002	31,28	0,51	38,75	19,31	-61,57
	2003	31,65	0,48	37,89	18,18	-68,34
	2004	31,3	0,41	38,02	18,96	-64,74
	2005	32,19	1,15	39,48	19,23	-64,00
	2006	32,11	0,46	38,99	18,85	-65,84
$W_{14}$ Share of underground water intake for the industrial purposes in the total water consumption in industry (D)	2002	23,89	0,76	79,55	17,63	-10,11
	2003	21,97	0,68	73,32	16,94	-8,92
	2004	22,71	0,72	76,90	16,68	-10,01
	2005	28,62	0,74	79,06	17,12	-18,57
	2006	28,92	0,66	77,14	17,35	-19,35
$W_{15}$ Share of surface water intake for the industrial purposes in the total water consumption in industry (D)	2002	67,23	14,33	99,27	79,48	61,90
	2003	25,84	14,82	100,06	77,13	223,68
	2004	69,86	14,41	99,31	80,14	53,63
	2005	66,98	12,71	101,09	80,93	69,20
	2006	67,5	12,35	99,90	80,41	66,24

\* S – stimulant, D – destimulant.

Source: prepared on the basis of: SZADZIEWSKA 2008, pp. 35–56 and RDB data.

Four selected indicators are:  $W_{12}$  – share of population serviced by water supply networks in the total population,  $W_{13}$  – share of water consumption in agriculture and forestry in the total water consumption in the national economy and by the population,  $W_{14}$  – share of underground water intake for the industrial purposes in the total water consumption in industry and  $W_{15}$  – share of surface water intake for the industrial purposes in the total water consumption in industry. Indicator  $W_{12}$  is a stimulant that shows an increase in value during the years covered by the study. The score, however, fluctuates assuming the lowest value during the last year of the study at 35,14%. Those values are still higher than the average for the other voivodships.

The other indicators  $W_{13}$ ,  $W_{14}$  and  $W_{15}$  are destimulants. They indicate the use of water resources. The Environmental Policy of the State assumes limitation of water consumption, in particular for production purposes. The indicator of water consumption in agriculture and forestry showed a very low score as compared to the other voivodships (during all the years of the study lower by at least 61,57% from the average. Also the intake of underground waters for the needs of national economy and population, the score of which systematically decreased to reach -19,35% in 2006 showed the same trend. Indicator  $W_{15}$  was characterised by instability and in 2003 it was only 25,84%, while the average for the other voivodships was 77,13. At that time it reached a very high average score at 223,68%.

## Conclusion

The principle of cause and effect according to which human activity has influence on the environment and is the cause of unfavourable changes is important in determination of indicators concerning the environment (BORYS 2005, pp. 62–68). The studies covered four aspects of environmental order: protection of environment and landscape, protection and sustainable development of forests, emissions of pollutions to the environment and water management. The studies indicate that the majority of indicators for Warmia and Mazury voivodship showed scores and values above the average for the other voivodships. Only indicators  $W_3$  and  $W_{13}$  scored negative for all years covered by the study. Even after accession to the European Union in 2004 no major changes were recorded. The changes were found mainly in the area of financing the outlays on environment protection.

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