Lidia Kłos, PhD
University of Szczecin

https://doi.org/10.26366/PTE.ZG.2017.108

Selected environmental determinants of sustainable development of the rural areas in the West Pomerania

Abstract

In the concept of sustainable development attention should be paid to rural areas. In the Poland 90% of the areas are rural areas and because of it, those areas have significant impact on the whole environmental condition of our country. Aim of this paper is presents couple of selected environmental determinants of the rural areas in the West Pomerania. The article used analysis of available data from Ministry of Agriculture and Rural Development, Central Statistical Office of Poland, as the research method and literature from subject of study.

Keywords: sustainable development, rural areas, environment.

JEL CODE: Q25, Q20, R11.

Wybrane uwarunkowania środowiskowe zrównoważonego rozwoju obszarów wiejskich województwa zachodniopomorskiego

Abstrakt

W koncepcji zrównoważonego rozwoju szczególną uwagę należy zwrócić na obszary wiejskie, gdyż stanowią one ponad 90% powierzchni Polski i mają znaczący wpływ na stan całego środowiska kraju. W artykule przedstawiono wybrane uwarunkowania środowiskowe na obszarach wiejskich województwa zachodniopomorskiego w zakresie zasobów wodnych. Jako metodę badań wykorzystano analizę dostępnych danych z Ministerstwa Rolnictwa i Rozwoju Wsi, Głównego Urzędu Statystycznego, Urzędu Statystycznego w Szczecinie oraz raportów i opracowań z zakresu badanego przedmiotu.

Słowa kluczowe: zrównoważony rozwój, obszary wiejskie, środowisko.

Introduction

Rural areas constitute one of the most important elements of Polish socio-economic realities, and at the same time one of the most difficult problems to solve in the process of sustainable and long-lasting development of the country. Preventing environmental degradation and maintaining its proper functioning while using the production function requires multidirectional solutions in this field.

One of the most important environmental resources are water resources, which provide appropriate conditions for human life and functioning in the environment by stimulating the development of ecosystems, but they also condition the socio-economic development of the country. (Borecki, Pierzgalski, Żelazo 2004, pp. 221-222).

Water resources are among the goods whose improper use may limit socio-economic development or, at best, the efficiency of production of almost all industries, agriculture, transport and services. The agricultural sector is a very particular consumer and user of water, which results mainly from:

- basing plant production mainly on rainwater, retained in the pores of the soil or in shallow aquifers,
- the biggest water intake in the summer half-year, exceeding the atmospheric precipitation occurring at that time,
- occupying 60% of the country's area for agricultural production and consuming more than 40% of the total yearly precipitation in order to produce food,
- the occurrence of periods of excessive waterlogging and water shortages due to high climate variability (Mioduszewski, Szymczak, Kowalewski 2011, p. 180).

On the other hand, the impact of agricultural activity on the condition of waters and the extent of its degradation is very significant, although it is still not always possible to detect mainly due to the lack of monitoring surveys, particularly in the case of area pollution (mineral and natural fertilizers and plant protection chemicals) as well as point pollution (state of the household infrastructure, including farm hygiene and economic circumvention) (Kłos 2011, pp. 255-275).

The specificity of agriculture referred above – as a consumer and user of water – poses difficult challenges to sustainable development. Therefore, it is important to maintain a balance between environmental protection and economic benefits in order to ensure the regeneration of natural resources necessary for further production activities.

The aim of the article is to present selected environmental conditions in rural areas of Zachodniopomorskie Province regarding the water quality (surface and underground); the level of use of water resources for agricultural activity and the main threats from agriculture to water resources. As a research method, an in-depth analysis of available studies and reports as well as other publications from the studied range including statistical data and source materials were used. As the research material, both primary and secondary data, which underwent thorough analysis, were used.

Characteristics of Zachodniopomorskie Province in terms of water quality status

Zachodniopomorskie Province (or West Pomeranian Voivodship) is located in the north-western part of Poland, occupying an area of 22,892,000 km^2 (as of 31.12. 2014, GUS, 2016) The West Pomeranian region is of agricultural and industrial character. Almost 49% (11 232 thousand ha) of its area is agricultural land, followed by forests and wooded or coniferous land – 36.2% (8543 thousand ha), marshlands – 5.2% (1202 thousand ha), built-up and urbanized lands – 4.2% (996 thousand ha), including communication areas constituting 2.6% of the area. The total population in the province in 2014 was 1,735.1 thousand people, of which rural population accounted for 31.2% (536.8 thousand) (Statistical Yearbook of Zachodniopomorskie Province, 2014, pp. 35-36).

Zachodniopomorskie Province is characterized by a higher than the average national proportion of forested areas and one of the highest saturation with surface waters. Surface waters occupy about 5.2% of the area of the province, and in addition to the ZalewSzczeciński, they are composed of numerous lakes occurring in Pojezierze: Wałecki, Iński, Myśliborskie, Drawskie, and PobrzeżeSłowiński. There are 172 lakes with an area of over 50 ha in the province. The Dąbie and Miedwie lakes are the most important. The most important rivers of the province are: Odra with tributaries (Myśla, Płonia, Iną), Drawa, Gwda and Świniec, as well as rivers that go directly to the Baltic Sea: Rega, Parsęta and Wieprz. There are 11 Major Underground Water Reservoirs in the province.

Despite the considerable improvement in water quality noted in recent years, which is the result of reduced production in many industries, the construction and modernization of industrial and municipal wastewater treatment plants, the state of cleanliness of rivers and lakes is still insufficient. Of the 71 water bodies assessed included in the rivers category, the waters of 45 (63.4%) were assessed as in good state / potential – II class, and 26 (36.6%) in moderate state / potential – III class (WIOŚ 2016, pp. 38-45, 2015 *Raport*, pp. 34-42).

In the years 2013-2015, the state / ecological potential of lakes was assessed in terms of nitrate loads in lakes located within the boundaries of the so-called Partially Endangered Area (OSN). As a result of the tests carried out, the following results were obtained[1]:

from among 16 monitored water bodies – lakes, the criteria for good ecological status (class II) were met by 5 lakes,

[1] The survey was carried out by the Regional Inspectorate for Environmental Protection as part of the State Program for the Monitoring of the Environment of Zachodniopomorskie Province for 2013-2015, Szczecin 2012, pp. 29-76.

- the moderate (class III) were met by 6 lakes,
- the poor ecological status (class IV) were met by 3 lakes,
- the bad condition (V class) were met by 2 lakes,

two lakes that do not have the status of a „uniform water body" have been included in the third class.

On the other hand, the results of groundwater quality tests carried out in 2013-2015 showed that waters with good chemical status were predominant in Zachodniopomorskie Province, including good quality water (Class II) and satisfactory water (Class III). On the other hand, no very high quality waters (Class I) were recorded.

The extent of use of water resources for agriculture and fisheries

The main source for meeting the needs of the economy are surface waters, obtained from rivers and lakes, which cover over 90% of the province's needs and are mainly used for industrial purposes, mainly as cooling waters. On the other hand, groundwater resources are intended primarily to provide the population with good quality drinking water (Statistical Yearbook of Provinces 2014, p. 195). The level of water consumption for the needs of the economy and population in Zachodniopomorskie Province in 2000-2013 is presented in Table 1.

Table 1.Water intake for needs of the national economy and population in Zachodniopomorskie Province in the years 2000-2013 (hm^3)

Waterintake (hm^3)	2000	2005	2008	2010	2012	2013
Total	1703,8	1 487,3	1 708,3	1632,8	1716,1	1523,6
For production purposes, including:	1559,6	1413,2	1787,9	1499,6	1587,4	1398,7
surface waters	1544,5	1403,1	1626,4	1491,3	1578,6	1390,3
groundwater	15,1	10,01	16,15	8,3	8,8	8,4
Agriculture and forestry *	**22,8**	**16,8**	**26,4**	**34,2**	**31,9**	**31,2**
Water intake for water supply purposes, including:	121,4	104,3	103,0	99,0	96,8	93,7
surfacewaters	29,4	24,5	23,8	22,2	22,0	21,4
groundwater	92,0	79,8	79,2	76,8	74,8	72,4

*Includes irrigation in agriculture and forestry as well as filling and replenishing fish ponds.

Source: own study based on (Statistical Yearbook of Zachodniopomorskie Province 2009, 2014, pp. 65-66, Statistical Yearbook of Provinces 2014, p. 195).

Upon analysis of the data on water intake for the needs of the economy and population in Zachodniopomorskie Province in the years 2000-2013 a downward trend can be noted. The largest share of water intake in Zachodniopomorskie Province was for production purposes - nearly 94%, and the smallest share of water intake was 1.9% for agricultural and forestry

purposes. The remaining part of water intake is water supply (5.6%). The current volume of surface water intake for agricultural and forestry purposes is approximately 31.2 hm^3 (Statistical Yearbook of Zachodniopomorskie Province 2014, p. 66). The amount of water used to fill and maintain the fish ponds with an area of 1358 ha is 31072 dam^3, the remaining 860 dam^3 of water is used for irrigation of only 1798 ha of arable land and forest land. The distribution of water use in Zachodniopomorskie Province is presented in Table 2.

Table 2. Water use for needs of the national economy and population in Zachodniopomorskie Province in the years 2000-2013 (in hm^3)

Wateruse	**2000**	**2005**	**2008**	**2010**	**2012**	**2013**
Total	1679,0	1467,5	1686,5	1612,5	1695,4	1504,3
Industry	1558,6	1366,0	1579,6	1500,6	1588,4	1400,0
Agriculture and forestry	**22,8**	**16,8**	**26,4**	**34,9**	**31,9**	**31,2**
Operation of the water supply network	97,6	84,6	80,6	77,4	75,0	73,2

Source: own study based on (Statistical Yearbook of Zachodniopomorskie Province 2009, p. 69, 2014, p. 65, Statistical Yearbook of Provinces 2012, p. 197).

The very low level of utilization of existing resources is evidenced by the fact that in Zachodniopomorskie Province the from the total area of agricultural land, amounting to 1123286 ha, in total 404939 ha, has been ameliorated, i.e. about 50%. On the other hand, drained arable land covers an area of 241340 ha, of which 38563 ha are adapted for irrigation. According to the Regional Water Management Authority, water rights permits issued for irrigation purposes account for only 10% of all permits issued for surface water intake in the area of RZGW in Szczecin[1].

Threats to water resources in rural areas of Zachodniopomorskie Province

The magnitude of pollution discharged from rural households is principally affected by the degree of availability of water and waste treatment infrastructure in rural areas, and the possibility to treat wastewater originating from the rural households.

The increase in the length of the water supply and sewage networks in Zachodniopomorskie Province, and its connections to residential buildings, is presented in Table 3.

[1] Source materials of the Regional Water Management Authority in Szczecin (RZGW). For more on this topic see Kłos L., 2013c, Water drainage as an element of water management in rural areas of Zachodniopomorskie Province, an article on the Seminar of the Section of Economics of Use and Water Protection organized by the State Higher Vocational School in Głogów and the European Association of Environmental and Natural Economists between 8 -9 May 2013 in Głogów.

Table 3. Water supply and sewage network in Zachodniopomorskie Province in the years 2000-2013 in thousands of kilometers

Years	2000	2005	2008	2010	2012	2013
Watersupply network length						
Total:	7173,3	8080,0	8707,0	9661,8	10465,8	10620,7
Urban	N/a	N/a	N/a	2862,1	3035,0	3096,9
Rural	N/a	N/a	N/a	6799,7	7430,8	7523,8
Water supply connections leading to residential buildings						
Total:	135940	153006	162683	168239	178427	**180270**
Urban	61719	68948	72357	76212	80296	81310
Rural	**74221**	**84058**	**90326**	**92027**	**98131**	98960
Sewerage network length						
Total:	2990,3	4307,0	4992,3	5578,8	7102,7	**7284,1**
Urban	N/a	N/a	N/a	2613,0	2699,1	2747,1
Rural	N/a	N/a	N/a	**2965,8**	**4403,6**	4536,3
Sewerage connections leading to residential buildings						
Total:	66047	86186	98033	104968	120246	124085
Urban	50799	60474	65550	68764	72445	73369
Rural	**15248**	**25712**	**32483**	**36204**	**47801**	**50716**
Water supply use in households in hm^3						
Total:	76,2	65,9	60,6	58,2	57,3	**55,9**
Urban	57,3	48,6	44,2	42,5	41,3	39,8
Rural	**18,9**	**17,3**	**16,5**	**15,7**	**16,0**	**16,1**

Source: own study based on: Statistical Yearbook of Zachodniopomorskie Province 2009, p. 174; 2012, p. 188; 2014, p. 185).

When analyzing data on the length of the water supply and sewage network in Zachodniopomorskie Province, it should be noted that in 2000-2013 there was an increase in investments in water and sewerage infrastructure. In the case of the water supply network, its length increased by 48% in relation to 2000, and it was more intensive in the countryside where in the last 3 years this increase amounted to about 11% (724 km) (Statistical Yearbook of Provinces 2014, pp. 186-189). In case of the sewage system, its growth was more spectacular, and in 2000-2013 it amounted to over 143%; in case of rural areas it was an increase of 1,570.5 km in the last 3 years.

However, the construction of the sewerage system is still lagging behind the water supply network. One of the reasons for this is undoubtedly the nature of water and sewerage investments and the specificity of rural areas and their considerable dispersion (Klos 2013b, pp. 111-119).

A similar tendency is visible throughout the country where in 2014 about 92% of the total population used the water supply network, and less than 69% of the population used the sewerage network. In cities, access to the waterworks amounted to 96% of the total population, and in rural areas to more than 84%. In contrast, 89% of the city population and about 37% of the population in rural areas used the sewerage network (Municipal infrastructure 2014, pp. 11-15).

The level of population serviced by sewage treatment plants, which in Poland in 2014 amounted to 72.8% in total (in cities it was much higher as it oscillated around 95%, while in rural areas – 39.6%), supplements information on the condition of the water supply and sewage network (Environmental protection 2016, p. 180).

In Zachodniopomorskie Province, the share of population serviced by sewage treatment plants in 2014 amounted to 80.3% and was higher than the national average. In this case, the analysis of statistical data on the population serviced by sewage treatment plants also indicates a large variation in the extent of municipal wastewater treatment in relation to the villages and cities of the province.

In rural areas, the tendency for biological treatment is clear, whereas in urban areas, sewage was subjected mainly to treatment processes with increased biogen removal. The number of sewage treatment plants by type and degree of treatment, broken down into urban and rural areas in Zachodniopomorskie Province, is presented in Table 4.

Table 4. Quantity and type of wastewater treatment plants in Zachodniopomorskie Province in 2000/2012

	Number of wastewater treatment plants servicing			% of populationserviced	
		urbanareas	ruralareas	urbanareas	ruralareas
Total	260	63	197	96,2	56,7
Mechanical			13	-	-
Biological		29	149	13,1	-
With increased biogen removal		34	35	80,7	-

Source: own study based on: (*Environmental protection* 2016, pp. 183, 190).

One of the most important types of water pollution in rural areas is area pollution (Kłos 2013a, pp. 309-323, Kłos 2014, pp. 128-136). This group includes pollutants reaching the aquatic environment with rainwater from urbanized areas, areas with no sewage system, and pollution resulting from agricultural activities and from forest areas. The main pollutants from agriculture include mainly nutrients (biogenic substances), especially nitrogen and phosphorus compounds, the source of which are the natural and artificial fertilizers not used by arable crops. In Zachodniopomorskie Province, the consumption of mineral fertilizers in the years 1999-2013 decreased more than threefold, and when considered per hectare of arable land it decreased by almost 70% (Table 5).

Table 5. Consumption of artificial fertilizers in tons / year and in tons / hectare of arable land (UAA) in 2000-2013 in Zachodniopomorskie Province

Year	1999/2000	2004/2005	2009/2010	2012/2013
Type	(tons/year)	(tons/year)	(tons/year)	(tons/year)
Chemical or mineral fertilizers	120 018	116 982	117 475	122 628
Nitrogen based	73 642	66 052	68 879	76 299
Phosphorus based	17 328	19 338	21 591	20 811
Potassium based	29 048	31 592	27 005	25 519
Calcium based	152 301	89 543	63 002	40 719
	(kg/ha UAA)	(kg/ha UAA)	(kg/ha UAA)	(kg/ha UAA)
Chemical or mineral fertilizers	111,1	117,8	122,9	141,2
Nitrogen based	68,2	66,5	72,1	87,8
Phosphorus based	16,0	19,5	22,6	24,0
Potassium based	26,9	31,8	28,3	29,4
Calcium based	140,9	90,1	65,9	46,9

Source: own study based on (Statistical Yearbook of Zachodniopomorskie Province 2014, p. 319).

However, in the case of contamination of agricultural origin to surface and groundwater, in addition to the amount of fertilizers used, the type and intensity of agricultural production determines the method of land use[1], animal production intensification and type of breeding - including improper securing of manure, leaking slurry tanks and pollutants from open ranges (Mosiej, Pierzgalski, Jeznach 2011, pp. 25-36).

Summary

Rural development should be conducted in accordance with the principles of sustainable development. The analysis of selected environmental conditions in rural areas of Zachodniopomorskie Province regarding the water quality status, presented in the article, indicates that surface waters, including rivers and lakes, are the leading problem in the field of water resources.

As the main threats to water resources in rural areas of the province, along with the pollution of the area, the condition of the water and sewage infrastructure, should be indicated. The disproportions between the length of the water supply and sewage systems can be an indicator of potential water pollution caused by municipal sewage. As a result, water and sewage management in the rural areas of the province is not balanced, despite the significant increase in the scale of investment in this area in recent years. In order to achieve for the condition of surface water to improve, it is necessary to implement measures aimed at improving water quality.

[1] In the case of Zachodniopomorskie Province, large-scale farms, of which there are over 3,000, are prevalent. Common Agricultural Census 2010, Report on the results of Zachodniopomorskie Province, US in Szczecin, Szczecin 2011, pp. 20-21.

References

Borecki T, Pierzgalski E., Żelazo J. (2004), *Woda jako strategiczny czynnik rozwoju obszarów niezurbanizowanych*, „Gospodarka Wodna", nr 6.

Kłos L. (2011), *Zrównoważona gospodarka wodna na obszarach wiejskich,* w: Kryk B. (red.), *Trendy i wyzwania zrównoważonego rozwoju*, Wyd. Zapol, Szczecin.

Kłos L. (2013a), *Zintegrowane działania w zakresie gospodarki wodnej na obszarach wiejskich województwa zachodniopomorskiego,* w: Małuszyńska E. (red.) *Dynamika, cele i polityka zintegrowanego rozwoju regionów. Perspektywa europejska*, Bogucki Wydawnictwo Naukowe, Poznań.

Kłos L. (2013b), *Zagrożenia wynikające ze stanu gospodarki wodno-kanalizacyjnej na obszarach wiejskich,* Folia Pomeranae Universitatis Technologiae Stetinensis, 277, Oeconomica 70, Szczecin.

Kłos L. (2014), *Zanieczyszczenia obszarowe na terenach wiejskich województwa zachodniopomorskiego,* w: Potocki J., Ładysz J. (red.), *Gospodarka przestrzenna. Aktualne aspekty polityki społeczno-gospodarczej i przestrzennej*, Prace Naukowe UE we Wrocławiu, Nr 367, Wydawnictwo UE we Wrocławiu, Wrocław.

Kłos L. (2013c), *Melioracje wodne jako element gospodarowania wodą na obszarach wiejskich województwa zachodniopomorskiego,* artykuł na Seminarium Sekcji Ekonomiki Użytkowania i Ochrony Wód organizowanego przez Państwową Wyższą Szkołę Zawodową w Głogowie i Europejskie Stowarzyszenie Ekonomistów Środowiska i Zasobów Naturalnych w dniach 8-9 maj 2013 r. w Głogowie.

Mioduszewski W., Szymczak T., Kowalewski Z. (2011), *Gospodarka wodna jako dyscyplina naukowa w służbie rolnictwa*. w: „Woda- Środowisko- Obszary wiejskie", Instytut Technologiczno-przyrodniczy w Falentach, T. 11, Z. 1 (33).

Mosiej J., Pierzgalski E., Jeznach J. (2011), *Współczesne uwarunkowania gospodarowania wodą w obszarach wiejskich*, „Postęp Nauk Rolniczych", PAN, nr 1.

Raport o stanie środowiska w województwie zachodniopomorskim w latach 2010-201, 2012, Biblioteka Monitoringu Środowiska, Szczecin.

Diagnoza sytuacji społeczno-gospodarczej obszarów wiejskich województwa zachodniopomorskiego wraz z analizą SWOT (2013), Centrum Rozwoju Społeczno-gospodarczego, Szczecin.

Powszechny Spis Rolny 2010 (2011), Raport z wyników województwa zachodniopomorskiego, US w Szczecinie, Szczecin.

Program ochrony środowiska województwa zachodniopomorskiego na lata 2012-2015 z uwzględnieniem perspektywy na lata 2016-2019, 2011, Oszańca K. (red.), Szczecin.

Program Państwowego Monitoringu środowiska województwa zachodniopomorskiego na lata 2013-2015 (2012), Szczecin.

Stan Środowiska w województwie zachodniopomorskim. Raport 2015, Milucha A. (red.), Szczecin.

Ocena jakości wód powierzchniowych w województwie zachodniopomorskim za 2015r., Landsberg-Uczciwek M. (red.), WIOŚ w Szczecinie, Szczecin 2016.

Infrastruktura komunalna w 2014 (2015), GUS Warszawa.

Mały Rocznik Statystyczny Polski 2016 (2016), GUS Warszawa.

Ochrona środowiska 2016 (2016), GUS Warszawa.

Regionalny Zarząd Gospodarki Wodnej w Szczecinie – materiały źródłowe.

Rocznik Statystyczny Województw (2014), GUS Warszawa.

Rocznik Statystyczny Województwa – 2009 (2009),Urząd Statystyczny, Szczecin.

Rocznik Statystyczny Województwa Zachodniopomorskiego (2012), Urząd Statystyczny, Szczecin.

Rocznik Statystyczny Województwa Zachodniopomorskiego (2014), Urząd Statystyczny, Szczecin.