

## ANALYSIS OF THE AVAILABILITY OF EDUCATIONAL AND TECHNICAL INFRASTRUCTURE, AS FACTOR OF SUSTAINABLE DEVELOPMENT FOR BIEBRZA NATIONAL PARK COMMUNES

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### ABSTRACT

This article is an attempt to show changes which concern social state of inhabitants living in Biebrza National Park communes, in terms of their equipment of water supply and sewage system and accessibility to basic educational facilities, such as primary and junior high schools. Multi-indicator characteristics was performed for time interval equal to 13 years (from 2001 to 2014), with 3–5 year step, i.e: 2001, 2004, 2009, 2014. Information was based on statistical data of Central Statistical Office, available in Local Data Bank (LDB). The assessment of socio-spatial availability has been based on the measures showing the given indicator in relation to the area or the number of population. The conducted analysis allowed to show differences in life quality of inhabitants living in communes where development highly depend on environmental factors. Except for actual state, attached graphics show the rate of change for socio-technical infrastructure, which is basic for sustainable development.

**Keywords:** commune, socio-technical infrastructure, national park, sustainable development, spatial planning.

### INTRODUCTION

On each stage of planning operations in commune, spatial planning is a mandatory element to consider. A proper development of almost each area of economic and social life is driven by well-developed infrastructure. Its lack discourages investments, which leads to increasing the number of people, who emigrate to find better opportunities for personal development [Wasiluk and Wojsławowicz 2013]. Standards of living for local communities is determined by appropriate equipment of educational facilities and technical infrastructure. However, the realization of water supply-sewage system infrastructure is of great ecological significance for units with great natural values and requires interest from local government units, local communities and scientists.

The rural infrastructure is a common problem, and it is addressed not only in research but in government programs, such as: previous Rural De-

velopment Plan 2007–2013 (Program Rozwoju Obszarów Wiejskich – PROW), current PROW 2014–2020 or Regional Operational Programme Podlaskie for the years 2014–2020 (Regionalny Program Operacyjny Województwa Podlaskiego na lata 2014–2020). The level of technical infrastructure, especially in the field of water-sewage system, is considered as a very important factor for activation of rural regions in terms of multi-functional development. In reports, analyses and literature, it was concluded that providing the social and technical infrastructure is a necessary condition for achieving economic success.

Many authors deal with the protected areas issues, as a whole or natural parts that are connected with various relationships and processes [Mastalska-Cetera 2007; Ptaszycka-Jackowska and Baranowska-Janota 1996]. There are only a few of them who attempt to combine the problems of spatial planning and sustainable development of the commune with appropriate conser-

vation of nature and environment [Chmielewski 2001]. It is hard to find scientific approach for socio-technical infrastructure issue for communes located partly in national park borders [Pawłat-Zawrzykraj and Podawca 2011].

The inspiration for analysis came from survey made in 2015 for social diagnosing of 12 communes gathered in Local Action Group – Biebrza Foundation (*pl. Lokalna Grupa Działania Fundacja Biebrzeńska*). Of the aforementioned, up to 9 communes (Bargłów Kościelny, Dąbrowa Białostocka, Goniądz, Jaświły, Lipsk, Nowy Dwór, Suchowola, Sztabin, Trzciannie) are partly located in the Biebrza National Park, the rest is outside. The survey included both citizens and local authorities. The reflection is that there was a variance of results in aspects, such as: kids and young adults education, a scale from 1 to 5 (average citizens opinion 3.2; authorities 4.1), infrastructure (citizens 2.6; authorities 3.4) [Leńczuk et al. 2015].

## PURPOSE AND SCOPE OF ANALYSIS

The aim of the study is to understand the changes that have occurred in 2001–2014 in terms of technical infrastructure and educational service of the communes located in the impacted zones of national parks. The most important aspects is widely understood spatial planning issues with comparative analysis of parameters defining the accessibility and providing the communes with water and sewage network equipment, quality of education and accessibility of primary and junior high schools. The analysis did not take into account the accessibility to gas pipeline network. Due to the fact that previous analysis [Podawca 2015] showed that all administrative units of the Biebrza National Park, considered as communes, are so-called “zero communes”, which means that the number of citizens serviced by gas pipeline was less than 10 and/or there was no information about the length of gas pipeline network.

Mostly, the analyses are based on the statistical data of CSO (Central Statistical Office). Because of the type of specific indicators, the analysis has demographic-economic-infrastructure nature [Rakowska 2013]. Typologies of rural areas have been compiled by many authors, during the political transformation in Poland, before Poland’s EU accession and currently in terms of widely understood sustainable develop-

ment [Stola 1987; Rosner 1999; Bański and Stola 2002; Rosner 2007; Rakowska and Wojewódzka-Wiewiórska 2010]. It is also possible to find studies mostly focused on infrastructural aspects [Siemiński 1992; Kłos 2012].

The Biebrza National Park (BNP) is an example of a national park with the most complex administrative structure. In the scope of research, there were 14 communes within the park. Beside of presenting the current state, the aim of the analysis is to show infrastructural differentiation in BNP communes, in which the most important role is played by natural conditions and ecology. Referring to previous research, mostly concerning natural and touristic aspects [Grygoruk et al. 2013, Batyk 2012, Batelaan et al. 2009, Kaznowska 2006, Okruszko and Mioduszewski 2004, Bołtromiuk 2001], specificity of approach will also concern socio-spatial factors [Sadowska-Snarska 2001; Kapusta 2012]. Very important assumptions of the study have been stated:

- communes partly located within the national park should be regarded as specific cases of territorial unit, different than communes located within a landscape parks or protected landscape areas,
- accessibility of social infrastructure is a highly important issue which should be analysed taking various natural conditions into consideration (nature element will be treated as static, but having an important impact on the location of public facilities, which are elements of space created in decision-making process.)

## STUDIES METHOD

The method used in the study is a multi-dimensional comparative analysis using interdisciplinary indicators, understood as numbers expressing the level of the given phenomenon, presented in absolute or relative form [Zielińska 2006]. Indicator analysis currently plays a specific role in economic and spatial information system, determining a commonly used tool [Borys 1999]. The commune assessment based on spatial planning indicators is not a new task. In the source literature there are many publications considering both methodical approach as well as research examples [Kocur-Bera 2011]. Communes located near the Biebrza National Park were also analysed in terms of functionality of their public technical infrastructure [Wasiluk and Wojsławowicz 2013].

This study uses research methods, which can be divided into:

- filtering and aggregation data, gathered in Local Data Bank (LDB), based on characteristics contained in categories: primary and junior high school education, secondary education; groups: primary and junior high school, communal and house economy and so called network devices;
- data processing method, using variable stimulants, understood as indicators which greater values allow to classify specific unit as better from sustainable development point of view.

Choosing the diagnostic variables was based on the following criteria: versatility, measurability, availability, data quality, and possibility of comparing and objective interpretation. The basic task was to define a set of appropriate diagnostic features represented by correct indicators seen from technical point of view, and with possibility to apply in research purposes [Kiniorska 2007].

It was concluded that characteristics showing the sanitation accessibility would be network length and number of population using that network. Depending on its character, the above-mentioned characteristics would be referenced to as built-up and urban (residential, including farm buildings) areas or commune population. This kind of approach should eliminate commune size issue and make comparing subdivisions an easier task. Sanitation availability measures are:

- the relative availability of water supply/sewage network in time, expressed by surface density indicator

$$w_{gw(k)t} = d_{sw(k)}/p_{tz} \quad (1)$$

where:

- $w_{gw(k)t}$  – indicator of surface density of the water supply/sewage network in statistical year [ $\text{km} \times \text{km}^{-2}$ ];
- $d_{sw(k)}$  – water supply/sewage network length [km];
- $p_{tz}$  – total surface of built-up and urban (residential) areas and agricultural lands (farm buildings) in commune [ $\text{km}^2$ ], based on data from 2014

- the absolute availability of water supply/sewage network in time, expressed by population service indicator:

$$w_{dsw(k)t} = (l_{mow(k)}/L_{mg}) \times 100\% \quad (2)$$

where:

- $w_{dsw(k)t}$  – indicator of water supply/sewage network in statistical year [%];

$l_{mow(k)}$  – number of population serviced by water supply/sewage network [person];

$L_{mg}$  – total commune population [person];

The assessment of educational services for population in the school age was assessed taking into consideration the number of primary and junior high schools and the number of classes and students. These characteristics show how the amount of educational institutions has been changing since the educational reform in 1999. The analysis started in 2001, in a year when classes I-III were in junior-high schools and there were no classes VII-VIII in primary schools.

$$w_{kisp(g)t} = lu_{sp(g)}/lo_{sp(g)} \quad (3)$$

where:  $w_{kisp(g)t}$  – indicator of the class size in primary school or junior-high school in statistical year [person];

$lu_{sp(g)}$  – amount of students in primary or junior-high school [person];

$lo_{sp(g)}$  – amount of divisions in primary or junior-high school.

Because of the aim of this, which is to show the availability of educational services in spatial point of view, the following indicators of educational services on primary and junior-high school level were adopted:

- the relative availability of educational services in 2014:

$$d_{wsp(g)2014} = p_{osp(g)}/p_{gn} \quad (4)$$

where:

$d_{wsp(g)t}$  – indicator of the availability density of educational service in statistical year [-];

$p_{osp(g)}$  – total surface of educational facilities area equal to 3km radius in terms of primary school and 4km radius in terms of junior-high school [ $\text{km}^2$ ];

$p_{gn}$  – net area of the commune [ $\text{km}^2$ ] (as the net area of the commune, it was adopted the territorial unit area decreased by a part of national park, located in specific commune)

- the absolute availability of educational services in 2014:

$$d_{bsp(g)2014} = p_{tzsp(g)}/p_{tz} \quad (5)$$

where:

$d_{bsp(g)t}$  – indicator of the absolute availability density of educational service in statistical year 2014 [-];

$p_{tzsp(g)}$  – total surface of built-up areas located in 3km radius maximum (in terms of primary school) and 4km radius (in terms of junior-high school) [km<sup>2</sup>];

$p_{tz}$  – total surface of built-up and urban (residential) areas and agricultural lands (farm buildings) in the commune [km<sup>2</sup>], based on statistical data from 2014.

It should be emphasized, that adopted range of educational service support has been based on act – Educational law [Ustawa o systemie oświaty Art. 17.] which says that: public schools network organization should allow every child to fulfill the educational duty, and distance from school facility to child's home mustn't be greater than 3km – in terms of primary school students in class I-IV and 4km in terms of primary (in class V and VI) and junior-high school students.

In order to localize specific facilities, spatial information tool called Geoportal 2 has been used and address data included on the websites of specific communes. Designation of specific spatial parameters and numerical data elaboration in spatial point of view was made using the LDB and ArcGis software and SQL language.

## RESULTS AND DISCUSSION

By analyzing changes that have occurred over the 10 years in the Biebrza National Park communes in terms of sanitation, it should be noted that there is an improvement (Table 1). Spatial density indicator of water supply network  $w_{gwt}$  and sewage  $w_{gkt}$  system proves this statement. Trend change of indicator is positive or equal to 0 (except Nowy Dwór commune in terms of water supply network, where the indicator is negative). Noticeable progress of water-sewage investments during 2004–2014 was in: Dąbrowa Białostocka, Suchowola and Jedwabne. In terms of water-supply infrastructure length relative to built-up areas, the situation looked favorably (in terms of 10 years) in communes: Nowy Dwór, Rajgród, Bargłów Kościelny, Grajewo, Sztabin; in terms of sewage system: Jaświły, Trzcianna, Goniądz and Rajgród. In the following administrative units, the situation worsened in terms of water-supply, between 2004–2009 and 2009–2014 in: Trzcianna, Jaświły, Radziłów and Wizna, but in Lipsk and Goniądz this aspect improved recently. Improving the development of the sewage system in last five-year period can be seen in: Wizna, Lipsk,

Sztabin and Radziłów. The stagnation in terms of sewage system infrastructure has been observed in Grajewo, Wizna and Bargłów Kościelny.

From the point of view of social sustainable development, the indicators of absolute availability of sewage system  $w_{dskt}$  and water supply network  $w_{dswt}$  seem to be much more important, because they reference to population serviced by this infrastructure. Those indicators are increasing in a period of 10 years, although in Grajewo the situation in terms of sewage system is constant (Table 1). Moreover, those indicators can show the efficiency of building water supply and in some way sewage systems through increase of the population, which have access to these services and thus prove the rightness of investments localization. Dąbrowa Białostocka commune is a leader in terms of availability to sewage system, where over 44% of population is serviced. Average value of this indicator is between 20–30%. According to water supply the situation is much better. For example, in Bargłów Kościelny commune, 89% of population is serviced. Not much less is in: Suchowola, Dąbrowa Białostocka, Nowy Dwór, Radziłów, Lipsk, Grajewo, Jaświły and Goniądz. In terms of availability to water supply, the worst are Jedwabne and Rajgród.

In the analyzed administrative units, the amount of junior-high schools is a very stable indicator, which has not changed in years 2001–2014 in 13 of 14 communes. Only in Sztabin Commune there an additional junior-high school has been created. Different situation is with primary schools whose number is decreasing. Only in Suchowola, Wizna, Grajewo and Radziłów the number of these facilities has not been reduced since 2001. In other units, the count dropped mostly by 1–2 objects, but in Lipsk and Jaświły by 3, and Jedwabne up to 7 (Table 2).

It is clear that reducing the number of school facilities is determined by demographic conditions, mostly by decreasing number of citizens. Given the indicator of class size  $w_{klsp(g)t}$  it must be concluded that curriculum standard in terms of class students has not worsened and even in most cases it has increased, both on primary and junior-high school level (Table 2).

The major attempt of the conducted analysis is to show the spatial availability of specific educational infrastructure objects after reform in 1999 and entering the junior-high schools, but before returning of 8-class primary school. Small number of class, especially in primary schools, might not compensate the distance between chil-

**Table 1.** Indicators of the availability of technical infrastructure in the BNP communes in years 2004, 2009, 2014

Commune	P <sub>tz</sub> [km <sup>2</sup> ]	Year	L <sub>mg</sub> [per]	Trend	D <sub>skt</sub> [km]	W <sub>gkt</sub> [1/km]	Trend	L <sub>mokt</sub> [per]	W <sub>dskt</sub> [-]	Trend	D <sub>swt</sub> [km]	W <sub>gwt</sub> [10/km]	Trend	L <sub>mowt</sub> [per]	W <sub>dswt</sub> [-]	Trend
Dąbrowa Białostocka	14.87	2004	12939	-541	16.9	<b>1.137</b>	0.141	5611	<b>0.434</b>	0.001	209.8	<b>1.411</b>	0.156	10251	<b>0.792</b>	0.008
		2009	12398		19	<b>1.278</b>		5399	<b>0.435</b>		233	<b>1.567</b>		9920	<b>0.800</b>	
		2014	12054	-344	24.6	<b>1.654</b>	0.377	5314	<b>0.441</b>	0.006	252.5	<b>1.698</b>	0.131	10192	<b>0.846</b>	0.045
Nowy Dwór	6.55	2004	2966	-154	12.5	<b>1.908</b>	-0.229	668	<b>0.225</b>	0.002	87.7	<b>1.339</b>	0.255	2220	<b>0.748</b>	0.027
		2009	2812		11	<b>1.679</b>		639	<b>0.227</b>		104.4	<b>1.594</b>		2180	<b>0.775</b>	
		2014	2790	-22	11	<b>1.679</b>	0.000	645	<b>0.231</b>	0.004	109.7	<b>1.675</b>	0.081	2179	<b>0.781</b>	0.006
Suchowola	12.66	2004	7453	-325	17	<b>1.343</b>	0.237	1673	<b>0.224</b>	0.009	204.8	<b>1.618</b>	0.047	6345	<b>0.851</b>	0.017
		2009	7128		20	<b>1.580</b>		1659	<b>0.233</b>		210.8	<b>1.665</b>		6189	<b>0.868</b>	
		2014	7099	-29	31.7	<b>2.504</b>	0.924	1973	<b>0.278</b>	0.045	238	<b>1.880</b>	0.215	6209	<b>0.875</b>	0.006
Jedwabne	7.60	2004	5634	-171	6.4	<b>0.842</b>	0.026	902	<b>0.160</b>	0.017	30.9	<b>0.407</b>	0.008	1982	<b>0.352</b>	0.017
		2009	5463		6.6	<b>0.868</b>		965	<b>0.177</b>		31.5	<b>0.414</b>		2015	<b>0.369</b>	
		2014	5478	15	8.1	<b>1.066</b>	0.197	1181	<b>0.216</b>	0.039	70.9	<b>0.933</b>	0.518	2489	<b>0.454</b>	0.086
Wizna	7.53	2004	4361	-33	10	<b>1.328</b>	0.000	644	<b>0.148</b>	0.068	45.3	<b>0.602</b>	0.359	2228	<b>0.511</b>	0.081
		2009	4328		10	<b>1.328</b>		934	<b>0.216</b>		72.3	<b>0.960</b>		2563	<b>0.592</b>	
		2014	4165	-163	14.2	<b>1.886</b>	0.558	963	<b>0.231</b>	0.015	72.3	<b>0.960</b>	0.000	2678	<b>0.643</b>	0.051
Bargłów Kościelny	7.25	2004	5772	-126	9.4	<b>1.297</b>	0.000	593	<b>0.103</b>	0.011	213.7	<b>2.948</b>	0.012	5038	<b>0.873</b>	0.008
		2009	5646		9.4	<b>1.297</b>		645	<b>0.114</b>		214.6	<b>2.960</b>		4971	<b>0.880</b>	
		2014	5700	54	9.4	<b>1.297</b>	0.000	709	<b>0.124</b>	0.010	224.1	<b>3.091</b>	0.131	5071	<b>0.890</b>	0.009
Lipsk	7.91	2004	5724	-254	9.2	<b>1.163</b>	0.000	2030	<b>0.355</b>	0.004	79.2	<b>1.001</b>	0.000	3531	<b>0.617</b>	-0.096
		2009	5470		9.2	<b>1.163</b>		1962	<b>0.359</b>		79.2	<b>1.001</b>		2849	<b>0.521</b>	
		2014	5407	-63	9.8	<b>1.239</b>	0.076	1988	<b>0.368</b>	0.009	143.5	<b>1.814</b>	<b>0.813</b>	3955	<b>0.731</b>	0.211
Sztubin	11.01	2004	5503	-204	7	<b>0.636</b>	0.000	804	<b>0.146</b>	0.004	148	<b>1.344</b>	0.385	3192	<b>0.580</b>	0.036
		2009	5299		7	<b>0.636</b>		795	<b>0.150</b>		190.4	<b>1.729</b>		3265	<b>0.616</b>	
		2014	5245	-54	7.9	<b>0.718</b>	0.082	1028	<b>0.196</b>	0.046	191.5	<b>1.739</b>	0.010	3285	<b>0.626</b>	0.010
Grajewo	12.30	2004	6156	-102	1	<b>0.081</b>	0.000	130	<b>0.021</b>	0.000	177.6	<b>1.444</b>	0.089	3684	<b>0.598</b>	-0.069
		2009	6054		1	<b>0.081</b>		128	<b>0.021</b>		188.6	<b>1.533</b>		3206	<b>0.530</b>	
		2014	5984	-70	1	<b>0.081</b>	0.000	126	<b>0.021</b>	0.000	197.7	<b>1.607</b>	0.074	4757	<b>0.795</b>	<b>0.265</b>
Radziłów	8.20	2004	5142	-148	12.7	<b>1.549</b>	0.000	1027	<b>0.200</b>	0.015	76.2	<b>0.929</b>	0.300	4169	<b>0.811</b>	0.008
		2009	4994		12.7	<b>1.549</b>		1075	<b>0.215</b>		100.8	<b>1.229</b>		4088	<b>0.819</b>	
		2014	4908	-86	25.1	<b>3.061</b>	1.512	1330	<b>0.271</b>	0.056	101.1	<b>1.233</b>	0.004	4023	<b>0.820</b>	0.001
Rajgród	8.33	2004	5615	-177	6.5	<b>0.780</b>	0.312	1230	<b>0.219</b>	0.006	27.6	<b>0.331</b>	0.479	1474	<b>0.263</b>	0.118
		2009	5438		9.1	<b>1.092</b>		1226	<b>0.225</b>		67.5	<b>0.810</b>		2068	<b>0.380</b>	
		2014	5407	-31	12.6	<b>1.513</b>	0.420	1376	<b>0.254</b>	0.029	119.6	<b>1.436</b>	0.625	2957	<b>0.547</b>	0.167
Goniądz	10.91	2004	5253	-92	11.8	<b>1.082</b>	0.266	1035	<b>0.197</b>	0.012	66.5	<b>0.610</b>	0.000	3743	<b>0.713</b>	0.008
		2009	5161		14.7	<b>1.347</b>		1079	<b>0.209</b>		66.5	<b>0.610</b>		3720	<b>0.721</b>	
		2014	5071	-90	18.2	<b>1.668</b>	0.321	1415	<b>0.279</b>	0.070	70.3	<b>0.644</b>	0.035	3788	<b>0.747</b>	0.026
Jaświły	8.36	2004	5485	-221	10.4	<b>1.244</b>	0.538	898	<b>0.164</b>	0.039	125.7	<b>1.504</b>	0.197	3992	<b>0.728</b>	0.022
		2009	5264		14.9	<b>1.782</b>		1068	<b>0.203</b>		142.2	<b>1.701</b>		3948	<b>0.750</b>	
		2014	5154	-110	29.9	<b>3.577</b>	1.794	1545	<b>0.300</b>	<b>0.097</b>	142.3	<b>1.702</b>	0.001	4016	<b>0.779</b>	0.029
Trzcianne	10.06	2004	4737	-127	9.5	<b>0.944</b>	0.557	554	<b>0.117</b>	0.080	57.9	<b>0.576</b>	0.176	2946	<b>0.622</b>	0.054
		2009	4610		15.1	<b>1.501</b>		864	<b>0.187</b>		75.6	<b>0.751</b>		3118	<b>0.676</b>	
		2014	4488	-122	23.2	<b>2.306</b>	0.805	1238	<b>0.276</b>	0.089	75.6	<b>0.751</b>	0.000	3061	<b>0.682</b>	0.006

**Table 2.** Primary and junior-high school education in the BNP communes in 2001, 2004, 2009, 2014

Commune	Year	$L_{sp}$ [piece]	Trend	$Lu_{sp}$ [per.]	Trend	$Lo_{sp}$ [piece]	Trend	$W$ [per./ piece]	Trend	$L_s$ [pie- ce]	Trend	$Lu_g$ [per.]	Trend	$Lo_g$ [piece]	Trend	$W$ [per./ piece]	Trend
Dąbrowa Białostocka	2001	9	0	1540	-461	87	-24	<b>17.7</b>	-0.6	2	0	701	-59	29	-2	<b>24.2</b>	-0.4
	2004	9	-1	1079	-284	63	-10	<b>17.1</b>	-2.1	2	0	642	-140	27	-5	<b>23.8</b>	-1.0
	2009	8	-1	795	-284	53	-10	<b>15.0</b>	-2.1	2	0	502	-140	22	-5	<b>22.8</b>	-1.0
	2014	8	0	589	-206	52	-1	<b>11.3</b>	-3.7	2	0	328	-174	16	-6	<b>20.5</b>	-2.3
Nowy Dwór	2001	3	-1	338	-125	28	-16	<b>12.1</b>	5.7	1	0	145	-28	6	-1	<b>24.2</b>	-0.8
	2004	2	0	213	-59	12	0	<b>17.8</b>	-5.0	1	0	117	-11	5	1	<b>23.4</b>	-5.7
	2009	2	0	154	-42	12	-6	<b>12.8</b>	5.7	1	0	106	-24	6	-2	<b>17.7</b>	2.8
	2014	1	-1	112	-42	6	-6	<b>18.7</b>	5.7	1	0	82	-24	4	-2	<b>20.5</b>	2.8
Suchowola	2001	5	0	803	-153	49	-17	<b>16.4</b>	3.9	1	0	344	-2	12	2	<b>28.7</b>	-4.3
	2004	5	0	650	-201	32	0	<b>20.3</b>	-6.3	1	0	342	-29	14	-1	<b>24.4</b>	-0.3
	2009	5	0	449	-37	32	-2	<b>14.0</b>	-0.3	1	0	313	-96	13	-3	<b>24.1</b>	-2.4
	2014	5	0	412	-37	30	-2	<b>13.7</b>	-0.3	1	0	217	-96	10	-3	<b>21.7</b>	-2.4
Jedwabne	2001	9	-3	674	-248	48	-19	<b>14.0</b>	0.7	1	0	285	-38	12	-3	<b>23.8</b>	3.6
	2004	6	-4	426	-95	29	-12	<b>14.7</b>	4.8	1	0	247	-46	9	0	<b>27.4</b>	-5.1
	2009	2	0	331	-43	17	1	<b>19.5</b>	-3.5	1	0	201	-38	9	-2	<b>22.3</b>	1.0
	2014	2	0	288	-43	18	1	<b>16.0</b>	-3.5	1	0	163	-38	7	-2	<b>23.3</b>	1.0
Wizna	2001	3	0	518	-117	37	-15	<b>14.0</b>	4.2	1	0	250	-23	10	-1	<b>25.0</b>	0.2
	2004	3	0	401	-107	22	1	<b>18.2</b>	-5.4	1	0	227	-17	9	0	<b>25.2</b>	-1.9
	2009	3	0	294	-68	23	-4	<b>12.8</b>	-0.9	1	0	210	-96	9	-3	<b>23.3</b>	-4.3
	2014	3	0	226	-68	19	-4	<b>11.9</b>	-0.9	1	0	114	-96	6	-3	<b>19.0</b>	-4.3
Bargłów Kościelny	2001	6	0	655	-159	45	-11	<b>14.6</b>	0.0	1	0	291	-21	11	-1	<b>26.5</b>	0.5
	2004	6	0	496	-87	34	-1	<b>14.6</b>	-2.2	1	0	270	-38	10	-1	<b>27.0</b>	-1.2
	2009	6	0	409	-36	33	-2	<b>12.4</b>	-0.4	1	0	232	-51	9	-1	<b>25.8</b>	-3.2
	2014	4	-2	373	-36	31	-2	<b>12.0</b>	-0.4	1	0	181	-51	8	-1	<b>22.6</b>	-3.2
Lipsk	2001	6	-1	736	-246	42	-14	<b>17.5</b>	0.0	1	0	302	10	12	8	<b>25.2</b>	0.8
	2004	5	-1	490	-126	28	-7	<b>17.5</b>	-0.2	1	0	312	-85	12	-1	<b>26.0</b>	-5.4
	2009	4	-1	364	-97	21	-4	<b>17.3</b>	-1.6	1	0	227	-61	11	-3	<b>20.6</b>	0.2
	2014	3	-1	267	-97	17	-4	<b>15.7</b>	-1.6	1	0	166	-61	8	-3	<b>20.8</b>	0.2
Sztabin	2001	5	0	662	-190	42	-14	<b>15.8</b>	1.1	1	1	293	-31	13	-1	<b>22.5</b>	-0.7
	2004	5	-1	472	-140	28	-5	<b>16.9</b>	-2.5	2	0	262	-22	12	0	<b>21.8</b>	-1.8
	2009	4	0	332	-44	23	0	<b>14.4</b>	-1.9	2	0	240	-78	12	-3	<b>20.0</b>	-2.0
	2014	4	0	288	-44	23	0	<b>12.5</b>	-1.9	2	0	162	-78	9	-3	<b>18.0</b>	-2.0
Grajewo	2001	3	0	582	-128	30	-9	<b>19.4</b>	2.2	1	0	221	36	8	2	<b>27.6</b>	-1.9
	2004	3	0	454	-92	21	-2	<b>21.6</b>	-2.5	1	0	257	-40	10	-1	<b>25.7</b>	-1.6
	2009	3	0	362	-33	19	0	<b>19.1</b>	-1.8	1	0	217	-54	9	-2	<b>24.1</b>	-0.8
	2014	3	0	329	-33	19	0	<b>17.3</b>	-1.8	1	0	163	-54	7	-2	<b>23.3</b>	-0.8
Radziłów	2001	5	0	585	-147	39	-7	<b>15.0</b>	-1.3	1	0	286	-37	12	-1	<b>23.8</b>	-1.2
	2004	5	0	438	-120	32	-3	<b>13.7</b>	-2.7	1	0	249	-38	11	-1	<b>22.6</b>	-1.5
	2009	5	0	318	-35	29	-3	<b>11.0</b>	-0.1	1	0	211	-66	10	-4	<b>21.1</b>	3.1
	2014	5	0	283	-35	26	-3	<b>10.9</b>	-0.1	1	0	145	-66	6	-4	<b>24.2</b>	3.1
Rajgród	2001	6	-1	622	-166	56	-24	<b>11.1</b>	3.2	1	0	249	19	11	-1	<b>22.6</b>	4.2
	2004	5	0	456	-96	32	-3	<b>14.3</b>	-1.7	1	0	268	-85	10	-2	<b>26.8</b>	-3.9
	2009	5	0	360	-65	29	-3	<b>12.4</b>	-1.1	1	0	183	-44	8	-2	<b>22.9</b>	0.3
	2014	5	0	295	-65	26	-3	<b>11.3</b>	-1.1	1	0	139	-44	6	-2	<b>23.2</b>	0.3
Goniądz	2001	6	0	621	-215	41	-9	<b>15.1</b>	-2.4	1	0	263	6	9	1	<b>29.2</b>	-2.3
	2004	6	-2	406	-104	32	-9	<b>12.7</b>	0.4	1	0	269	-90	10	-2	<b>26.9</b>	-4.5
	2009	4	-1	302	-29	23	-5	<b>13.1</b>	2.0	1	0	179	-53	8	-2	<b>22.4</b>	-1.4
	2014	3	-1	273	-29	18	-5	<b>15.2</b>	2.0	1	0	126	-53	6	-2	<b>21.0</b>	-1.4
Jaświły	2001	5	0	658	-169	44	-16	<b>15.0</b>	2.5	1	0	296	-28	12	0	<b>24.7</b>	-2.4
	2004	5	-3	489	-156	28	-10	<b>17.5</b>	1.0	1	0	268	-30	12	-2	<b>22.3</b>	1.5
	2009	2	0	333	-68	18	0	<b>18.5</b>	-3.8	1	0	238	-96	10	-4	<b>23.8</b>	-0.1
	2014	2	0	265	-68	18	0	<b>14.7</b>	-3.8	1	0	142	-96	6	-4	<b>23.7</b>	-0.1
Trzcianne	2001	5	0	593	-184	46	-13	<b>12.9</b>	-0.5	1	0	242	-14	9	2	<b>26.9</b>	-6.2
	2004	5	0	409	-118	33	-6	<b>12.4</b>	-1.6	1	0	228	-56	11	-2	<b>20.7</b>	-1.6
	2009	5	0	291	-57	27	-7	<b>10.8</b>	0.9	1	0	172	-42	9	-3	<b>19.1</b>	2.6
	2014	3	-2	234	-57	20	-7	<b>11.7</b>	0.9	1	0	130	-42	6	-3	<b>21.7</b>	2.6

dren's home and school. Table 3 presents indicators of the relative  $d_{wsp(g)2014}$  and absolute  $d_{bsp(g)2014}$  availability of educational services in 2014.

The relative availability is greater than absolute in 11 BNP communes. This means that educational facilities service area covers large part of the commune, not including BNP area, but those objects location are not appropriate in terms of rural villages location. Only in Bargłów Kościelny, Lipsk and Sztabin real availability to educational services, which means the village layout in terms of school service range, is favorable from relative availability (Figure 1).

## CONCLUSION

On the basis of the typology of communes nearby the national park [Podawca 2014] in terms of direct availability to sanitation, it must be concluded that BNP communes are similar.

Water availability for inhabitants from water supply network has been evaluated positively. In 4 communes (Suchowola, Dąbrowa Białostocka, Bargłów Kościelny, Radziłów), the availability is on a very good level (>80%), good in 8 communes (Goniądz, Nowy Dwór, Wizna, Lipsk, Sztabin, Grajewo, Jaświły, Trzcianne), and only in 2 on a medium level (Jedwabne, Rajgród). In the last decade, trend for both water supply density and percent of serviced inhabitants have been increasing, which can be seen through improvement of availability in 6 of 14 communes.

The situation is different in the case of the availability to sewage system. In 3 communes: Bargłów Kościelny, Sztabin and Grajewo, it has been assessed below 20%. The largest group is determined by communes, where 20 to 40% of the population has access sewage system. These are: Nowy Dwór, Suchowola, Lipsk, Rajgród, Jedwabne, Wizna, Radziłów, Goniądz, Jaświły and Trzcianne. In case of last 8 one can observe some improvement. Population service in these units must be considered as unsatisfactory state, though. Only in Dąbrowa Białostocka, availability to sewage system can be considered on the medium level, which is over 44%.

The educational services availability areas, measured within a circle having a radius equal to 3-kilometers for primary schools and 4-km for junior-high schools, should be related to residential and farm buildings in these parts of the communes which are located outside of the Biebrza National Park and to location of and it was concluded that because of communes' agricultural nature, the relative availability indicator for educational services can be considered satisfactory if it exceeds 60%. Unfortunately, only Dąbrowa Białostocka and Radziejów fulfill this condition for primary schools, and none of the communes for junior-high schools. The average for primary schools service, is on 40–60% level and it occurs in: Suchowola, Bargłów Kościelny, Rajgród, Goniądz. For junior-high schools this level is only in Nowy Dwór. In other communes, the relative availability indicator is below 40%, which must be considered as disappointing.

**Table 3.** Indicators of the spatial availability of primary and junior-high schools in the BNP communes

Commune	$p_g$ [km <sup>2</sup> ]	$p_{PNg}$ [km <sup>2</sup> ]	$p_{gn}$ [km <sup>2</sup> ]	$p_{osp2014}$ [km <sup>2</sup> ]	$d_{wsp2014}$ [-]	$p_{og2014}$ [km <sup>2</sup> ]	$d_{wg2014}$ [-]	$p_{lz}$ [km <sup>2</sup> ]	$p_{lzs2014}$ [km <sup>2</sup> ]	$d_{bsp2014}$ [-]	$p_{lzs2014}$ [km <sup>2</sup> ]	$d_{bg2014}$ [-]
Dąbrowa Białostocka	263.84	18.43	245.41	176.87	<b>0.72</b>	82.77	<b>0.34</b>	14.87	8.68	<b>0.58</b>	4.69	<b>0.32</b>
Nowy Dwór	121.14	1.71	119.43	29.58	<b>0.25</b>	49.86	<b>0.42</b>	6.55	1.11	<b>0.17</b>	1.34	<b>0.20</b>
Suchowola	255.7	31.32	224.38	126.28	<b>0.56</b>	56.70	<b>0.25</b>	12.66	4.68	<b>0.37</b>	2.36	<b>0.19</b>
Jedwabne	159.21	3.26	155.95	52.63	<b>0.34</b>	50.33	<b>0.32</b>	7.60	2.25	<b>0.30</b>	1.83	<b>0.24</b>
Wizna	133.38	0.25	133.13	46.86	<b>0.35</b>	41.22	<b>0.31</b>	7.53	1.09	<b>0.14</b>	1.32	<b>0.18</b>
Bargłów Kościelny	187.81	2.81	185	110.25	<b>0.60</b>	47.65	<b>0.26</b>	7.25	5.92	<b>0.82</b>	2.10	<b>0.29</b>
Lipsk	184.21	17.56	166.65	66.07	<b>0.40</b>	31.11	<b>0.19</b>	7.91	4.24	<b>0.54</b>	2.16	<b>0.27</b>
Sztabin	363.11	55.59	307.52	87.84	<b>0.29</b>	69.92	<b>0.23</b>	11.01	4.61	<b>0.42</b>	4.12	<b>0.37</b>
Grajewo	308.22	9.72	298.5	84.05	<b>0.28</b>	40.87	<b>0.14</b>	12.30	2.58	<b>0.21</b>	0.77	<b>0.06</b>
Radziłów	199.54	41.77	157.77	114.24	<b>0.72</b>	50.70	<b>0.32</b>	8.20	3.99	<b>0.49</b>	1.90	<b>0.23</b>
Rajgród	207.26	14.66	192.6	97.2	<b>0.50</b>	44.29	<b>0.23</b>	8.33	3.99	<b>0.48</b>	1.51	<b>0.18</b>
Goniądz	376.58	217.87	158.71	72.24	<b>0.46</b>	38.06	<b>0.24</b>	10.91	3.53	<b>0.32</b>	2.42	<b>0.22</b>
Jaświły	175.49	11.89	163.6	57.62	<b>0.35</b>	49.82	<b>0.30</b>	8.36	2.49	<b>0.30</b>	1.33	<b>0.16</b>
Trzcianne	331.87	165.39	166.48	66.26	<b>0.40</b>	47.88	<b>0.29</b>	10.06	2.79	<b>0.28</b>	2.01	<b>0.20</b>

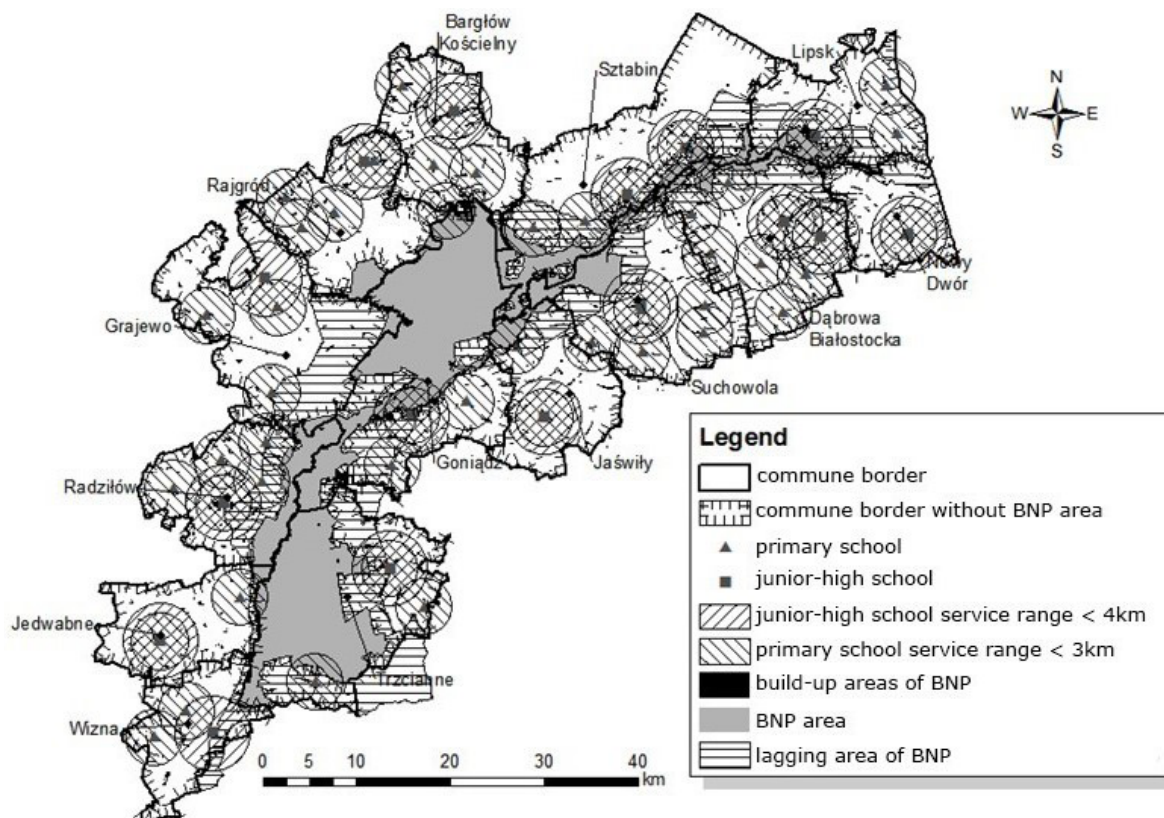


Figure 1. Spatial availability of the educational services in BNP communes

The absolute availability of educational services, which is assessed in terms of location of rural areas in availability circle, is considered to be more important factor. In case of junior-high school service, there have been selected only two groups of communes:

- with very poor absolute availability (Nowy Dwór, Jaświły, Suchowola, Trzcianne, Wizna, Grajewo, Rajgród);
- with unsatisfactory absolute availability (Dąbrowa Białostocka, Bargłów Kościelny, Lipsk, Sztabin, Radziłów, Goniądz, Jedwabne).

According to primary schools service in the BNP communes, 3 groups have been identified:

- with very poor absolute availability (Nowy Dwór, Wizna);
- with unsatisfactory absolute availability (Suchowola, Jedwabne, Grajewo, Goniądz, Jaświły, Trzcianne);
- with satisfactory absolute availability (Dąbrowa Białostocka, Bargłów Kościelny, Lipsk, Sztabin, Radziłów, Rajgród).

The analyzed communes are a specific example of units where one can find dependence between natural and infrastructural aspects. Proper spatial planning for those two systems is the

„common denominator”. In communes located in national parks, as the complex objects, complex socio-economic phenomena that create certain arrangements or spatial concentrations, which are the result of cause-effect dependency often occur. It should be emphasized, that generally in the BNP communes, factors of sustainable development such as water supply infrastructure service are on satisfactory level; sewage infrastructure service on poor level; spatial availability for primary schools on medium level, and spatial availability for junior-high schools is under satisfying level.

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