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Research on the Dynamics of Changes in the Sight-aesthetic Quality of Rural Lake District Landscapes in the Aspect of Implementing the European Landscape Convention

Adam Senetra

University of Warmia and Mazury in Olsztyn, Department of Planning and Spatial Engineering, Olsztyn, Poland
E-mail: adam.senetra@uwm.edu.pl

Abstract. The article presents selected methodological assumptions of developing and evaluating landscape attribute maps that could be used in the process of the implementation of the European Landscape Convention (ELC). The Convention led to the passing of the Act of 24th April 2015 on the modification of some acts due to the enhancement of landscape protection tools. Article 7 implements changes in the Act of 23rd March 2003 on spatial planning and land use management. Determining general rules for landscape auditing and defining the priority landscape are elements of the changes. On 11th September 2015, the regulations that partially carry out the recommendation of the Convention entered into force. The regulations oblige local governments to conduct landscape auditing (not less often than every 20 years).

The article presents a new method for evaluating the aesthetic-scenic value of landscape (EEVL), developed by the author on the basis of conceptual works done between 2004 and 2008. Tests of this method started in 2008. Then an assessment of the aesthetic value of the municipality of Pozezdrze in the Masurian Lake District was made. The three measurements, collected in 2008, 2012 and 2016, were then used in comparing the dynamics of landscape transformations considering the aesthetic value over 8 years. The research enabled the assessment of the usefulness of the method in landscape auditing.

Keywords: landscape auditing, landscape protection, sight-aesthetic quality, point valuation.

Conference topic: Environmental protection.

Introduction

An increase in the dynamics of environmental hazards resulting from civilisation development and from improper space management causes unfavourable changes in the quality of life of the threatened areas' population. The deterioration of landscape aesthetics is one of the effects of such processes. Its conscious shaping and protection are priorities from the point of view of the necessity to prevent further negative transformations. Such processes result in the increase in new technologies supporting the process of landscape auditing and protecting, in particular those most valuable from the point of view of preserving the individual character of the geographical environment (Sahraoui *et al.* 2016; Eiter, Vik 2015; Wagtendonk, Vermaat 2014; Tsunetsugu *et al.* 2013). In 2004 Poland ratified the European Landscape Convention (ELC) adopted in Florence in 2000. On 11 September 2015 regulations partly implementing the Convention's recommendations took effect in Polish legislation (Act of 27 March 2003 on Spatial Planning and Development). Provincial regional governments were obliged to perform landscape auditing not less frequently than every 20 years. To a large degree the implementation of those tasks should depend on the adopted methods for landscape delimitation, regionalisation and typology. The determination of priority landscapes' location (especially valuable for the society due to natural, cultural, historical or sight-aesthetic values) is one of the more important tasks (Solon 2013).

The paper is aimed at the determination of the sight-aesthetic quality changes dynamics for a rural lake district landscape. The study was carried out using the author's method for evaluating the aesthetic value of landscape (EEVL). The field measurements were carried out three times between 2008 and 2016, which allowed the observation of changes occurring for the studied phenomenon over time.

The sight-aesthetic value of rural landscapes

Landscape attractiveness from the sight-aesthetic point of view is very often a guideline in the determination of the detailed functions of the area. A rural space characterised by a low level of development, an attractive landscape value, and peculiar practical features, is predisposed to develop social functions (van Zanten *et al.* 2016; Stotten 2016; Zoderer *et al.* 2016; de Groot *et al.* 2010). The evaluation of the sight-aesthetic value of landscapes is one of the space planning and management stages, as well as an element of controlling the directions and pace of transformations caused both by human activities and by the forces of nature. A correct methodology for the landscape components' evaluation is a

guarantee of the proper perception and correct observations of changes proceeding in the space (Benovsky 2016; Casado-Arzuaga *et al.* 2014; Wagtendonk, Vermaat 2014).

Landscape shaping and its protection planning depends on the directions and dynamics of anthropogenic processes. Landscape system transformations may be processes that are both planned and accidental (Käyhkö, Skånes 2006). The understanding of their complexity is a condition for rational space planning, both in the socio-economic sphere, and in the field of maintaining biological diversity (Aretano *et al.* 2013).

In recent years scientific circles in Poland have undertaken extensive research on the development of a methodology necessary to identify and to evaluate landscapes throughout the country in order to implement the European Landscape Convention. It has resulted in many methodological reports on the need to implement the provisions of the Convention and of Polish legislation in the field of landscape auditing (Chmielewski *et al.* 2015; Solon *et al.* 2015; Myga-Piątek *et al.* 2015; Plit 2015).

The object of studies

The rural municipality of Pozezdrze (Fig. 1), situated in Poland, is the object of studies. From the administrative point of view Pozezdrze is located in the northern-eastern part of the Province of Warmia and Mazury, in the borderland of the Great Masurian Lake District and the Eastern-Masurian Lake District. According to the geological division, it is situated on the Pre-Cambrian East-European platform, within a tectonic unit referred to as a Peri-Baltic syneclise, bordering with the Masurian-Suwałki uplift. The western part of the municipality is covered by the Giżyce-Węgorzewo Lake District, with many large water regions. The area is dominated by flatlands with numerous kame hillocks up to a dozen or so metres high. The southern part of the municipality is the Pozezdrze-Kożuchów Uplift, with a wavy, and in places hilly bottom moraine high plain (Kondracki 2011, Kondracki and Richling 2000). The vertical topography of the analysed area is pretty intensive, but with small local denivelations. The ground rises towards the south from approx. 140 m a.s.l. to approx. 170 m a.s.l. Sandr grounds with a sandy subsoil prevail in the central part of Pozezdrze municipality. Numerous lakes are hydrographically connected to the Sapina river. The land is wavy with vast landforms. The northern part of the municipality is dominated by a wavy and in places hilly moraine high plain. The northern-eastern part of the study area, referred to as the Piłackie Hills, features the most intensive relief. This is a characteristic area of frontal moraine situated at elevations between 180 m a.s.l. and 218 m a.s.l., with local denivelations reaching up to 40 metres. The ground slopes in this part of the municipality in places reach 30% (Kondracki 2011). The municipality of Pozezdrze is a small unit with an area of 17,622 ha. The selection of this municipality as the study area was dictated by the necessity to develop and test a methodology for evaluating rural lake district landscapes which could be applied in similar geographic conditions.

Fig. 1. Study area location (source: author's own elaboration)

Fig. 2 presents the arrangement of lakes, forests, villages and transport routes. The municipality of Pozezdrze is a typical object for this part of Poland. It features a not very high level of development, and there are no developed town functions in its area. On the other hand, large forest (28.9%) and lake (17.3%) areas should be noted within the object of studies. Eighteen lakes with a surface exceeding 5 ha, favourable climate conditions and a diversified land relief create the potential for the development of recreational functions. Not too fertile soils were not an obstacle to the development of agricultural functions, in particular prior to systemic changes from the turn of the 1980s and 1990s. It

is possible to consider the municipality of Pozezdrze a representative object for the entire region, and the results of testing the suggested method can provide the basis on which to develop maps of values in other municipalities which are similar from the point of view of geographical location and socio-economic conditions.

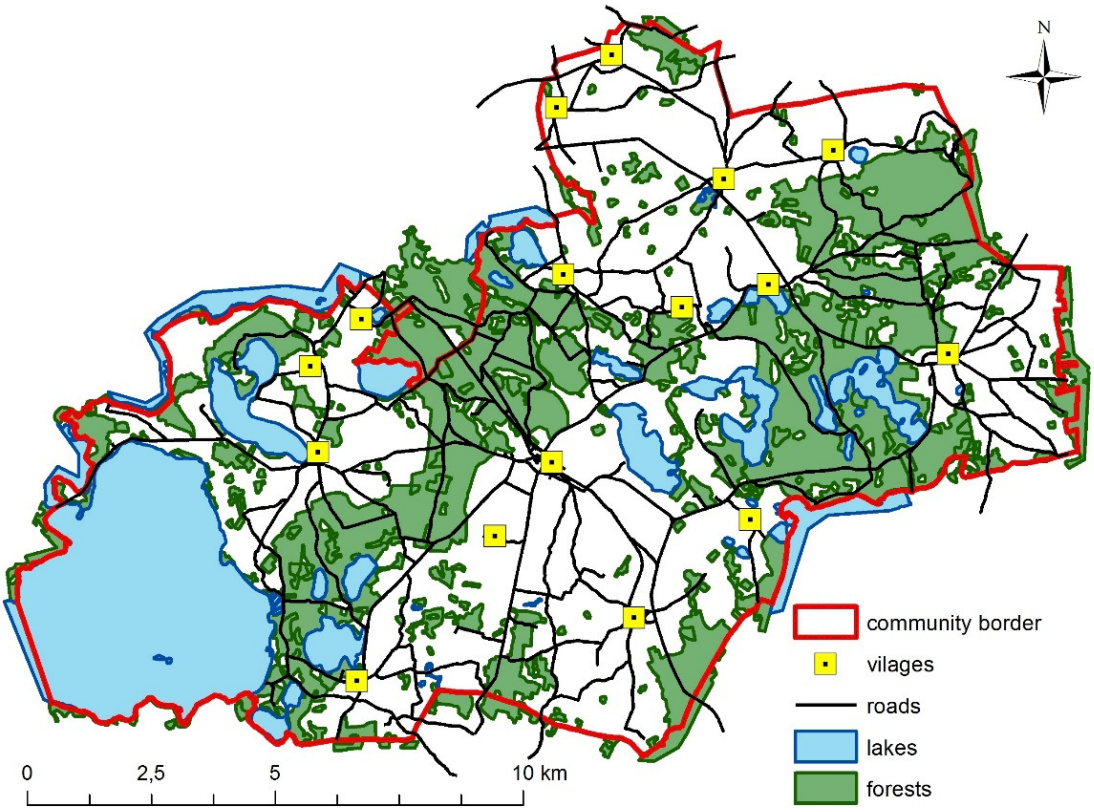

Fig. 2. Map of Pozezdrze municipality (source: author's own elaboration)

Method for evaluating the aesthetic values of the landscape – EEVL

The conceptual work on the method for evaluating aesthetic values of landscape (EEVL) was carried out in the years 2004–2008. A questionnaire survey was conducted to classify three groups of space elements and features making up these groups. The questionnaire survey was carried out using photos showing individual landscape-forming elements. The list of such elements for expert tests was narrowed to the most important areas characteristic of rural lake districts situated in Central Europe. The experts were people with great experience in the field of space assessment and valuation. The number of respondents was 607. The survey respondents had to rank photos presenting the elements being evaluated.

The questionnaire survey was used to design the point valuation (Table 1). The survey respondents also indicated which group of landscape-forming elements affects the landscape aesthetic to the largest degree, which allowed the determination of the scoring ranges in the three suggested groups. The point valuation depends on the influence of individual element groups on the sight-aesthetic value of the landscape. In relation to the obtained results, the range of scale in the three groups of landscape-forming elements was diversified. An assumption was made that the valuation would be within the 0–30 points range due to the summary amount of elements evaluated during the questionnaire survey (30 elements).

Table 1. Method for evaluating the aesthetic value of landscape (EEVL) – point scores (source: Senetra 2015)

Lp.	Groups and subgroups of elements (grading scale)	Points
group I – natural elements (0–12)		
Subgroups – water bodies		
1.	water bodies that occupy most of the area (co-exist with other elements)	6
2.	water bodies dominate the landscape (other elements are visible at a distance or are not noticeable)	4
3.	noticeable water bodies	2
4.	no water bodies	0

End of Table 1

Lp.	Groups and subgroups of elements (grading scale)	Points
group I – natural elements (0–12)		
subgroup – land relief		
5.	hilly terrain	3
6.	undulating terrain	1
7.	flat terrain	0
subgroup – vegetation		
8.	low and tall vegetation	3
9.	tall vegetation	1
10.	low vegetation/no vegetation	0
11.	conservation areas, swamps, marshes, moors	0
group II – landscape planes and composition (0–8)		
subgroup – planes		
12.	three or more landscape planes	2
13.	fewer than three landscape planes	0
subgroup – arrangement of landscape-forming elements		
14.	more than three landscape-forming elements, including one dominant element	6
15.	three landscape-forming elements, including one dominant element	4
16.	two landscape-forming elements, including one dominant element	1
17.	three concomitant elements	1
18.	fewer or more than three concominant elements	0
group III – anthropogenic elements (0–10)		
19.	no anthropogenic elements	10
Subgroup – residential/farm/recreational buildings		
20.	farm buildings	8[1)]
21.	single residential/recreational buildings	6[1)]
22.	dense residential/recreational buildings	4[1)]
23.	farm/service buildings	0[1)]
Subgroup – Infrastructure and industry		
24.	access roads to settlements and fields (unpaved)	8[2)/3)]
25.	main transit roads (bituminous surface)	0
26.	mining land	0
27.	overhead power lines	0
28.	industrial buildings	0
1) the value of the dominant element should be adopted for items 20–23 2) the score is 8 points if the attribute coexists with the element in item 19 3) the presence of a road with elements from the residential/farm/recreational buildings subgroup does change the number of points scored by those elements **SCALE: 0–30**		

Field measurements

The study area was divided into 804 basic evaluation fields in the shape of squares with 500 m long sides, constituting a regular measuring network. The measurement points were situated in the squares' centres. If the field centre was inaccessible, the observation was made in the closest place with a favourable view of the surroundings. The sight-aesthetic attractiveness of the landscape was measured by the author's EEVL method in 2008, 2012, and 2016, at the turn of July and August. Similar weather conditions were ensured (sunny, moderate wind) and the time of day (between 9 a.m. and 6 p.m.) The field measurements were performed by an expert with great experience, which increases the reliability of results. Strictly defined criteria of measurements, similar performance conditions, and four-year intervals ensure the survey's objectivity and the possibility to observe the dynamics of landscape aesthetic changes in the studied municipality of Pozezdrze.

Maps of landscape aesthetic value were prepared based on the measurement results, using ArcGIS 10 software. In the case of obtained data the division into equal ranges is justified. The evaluator cannot affect the landscape attractiveness at the measurement point (assuming that he properly uses the imposed evaluation criteria), and hence the spatial distribution of data. The evaluation scale of the EEVL method was divided into five categories of attractiveness:

- category I – very attractive landscape <24–30>
- category II – attractive landscape <18–23>
- category III – neutral landscape <12–17>
- category IV – unattractive landscape <6–11>
- category V – very unattractive landscape <0–5>

Results of landscape sight-aesthetic evaluation – attractiveness maps

Fig. 3 presents the results of the field evaluation of landscape aesthetic value using the author's EEVL method. The most attractive areas are situated in the western part of Pozezdrze municipality, in the vicinity of the largest lake. Mainly low values were recorded in the central and northern part, which is related to a higher level of land development (residential functions, technical infrastructure) and existing elements of agriculture services. The level of economic functions' negative impact is confirmed by the fact that the northern part features a very high vertical diversification of the land relief. This feature, positive from the landscape attractiveness point of view, is compensated by the negative impact of economic functions (agriculture, processing) prevailing in this part of the study area. However, in the central part, in the immediate vicinity of the smaller lakes and dense forest complexes situated there, a clear increase in the sight-aesthetic value was recorded. This creates the second pole of visual attractiveness increase, allowing the separation of a compact functional area, predisposed to the development of recreational functions and to intensified protection of landscape values.

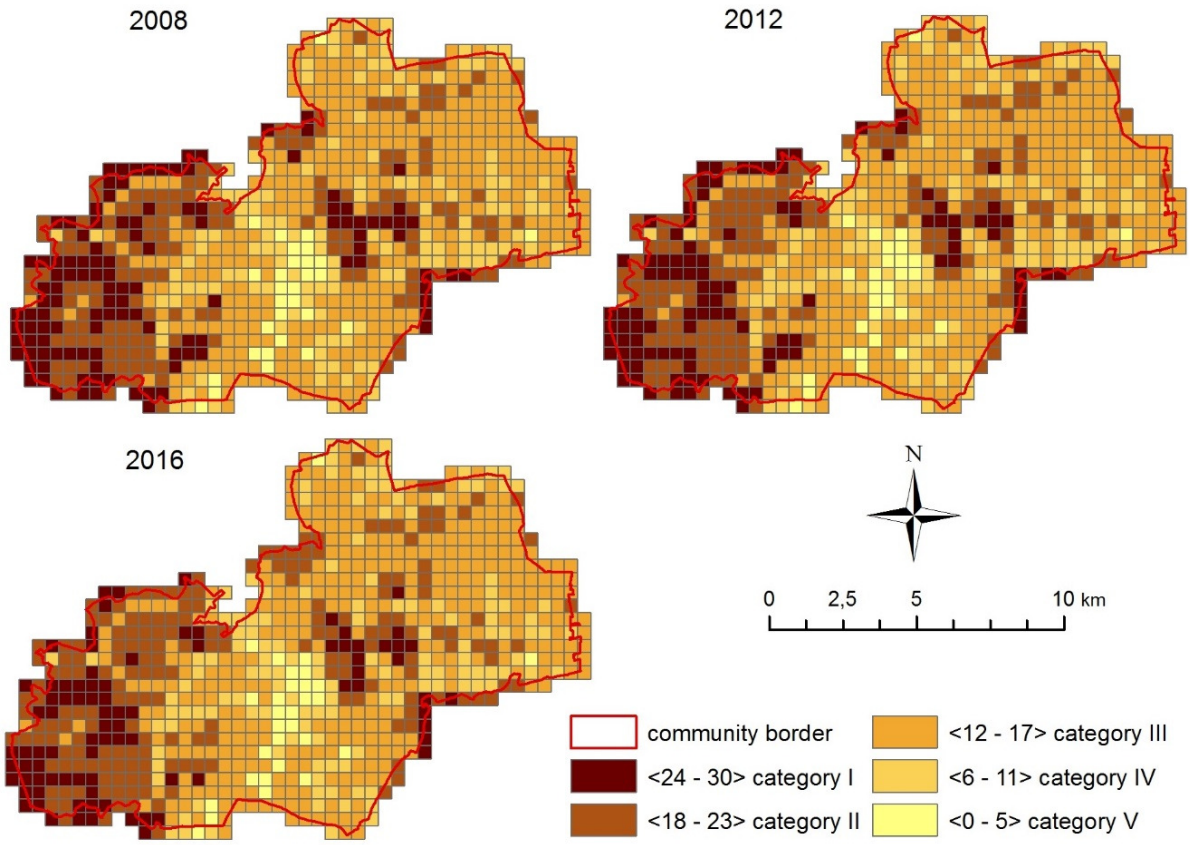

Fig. 3. The maps of the landscape sight-aesthetic value of the Pozezdrze municipality (source: author's own elaboration)

Based on the distribution of point valuation it is possible to conclude that landscape attractiveness is most affected by the closeness of natural elements (water, forests). However, one should not forget that a positive perception of the presented landscape-forming elements derives from the usefulness of individual elements for the development of future space management. The immediate vicinity of natural environment components, most important from the tourism and recreation point of view, is a determinant for the directions of socio-economic activities.

Table 2 and Fig. 4 present the dynamics of landscape aesthetic changes for the studied area. The highest dynamics and most unfavourable changes were observed in the areas situated in the highest landscape categories. The area of category I went down by 3.8%. In the first analysed period (2008–2012) the decrease was 1.7% and was slightly lower than in the second period (2012–2016) – 2.1. Category II went up by 3.6% (1.5% in the first period and 2.1% in the second period). This proves a gradual reduction of the area of the most attractive space in visual terms. Areas from category I move mainly to category II. This is caused by an intensified expansion of tourist-recreational investments in the immediate vicinity of lakes and larger forest complexes situated in the municipality of Pozezdrze. This is confirmed by observations made during the field measurements. Investments in buildings and equipment for farming production are much smaller than in facilities and equipment used for tourism and recreation. The loss of landscape sight-aesthetic value was recorded mainly in the areas which in recent years had been developed, or where work related to the expansion of tourist-recreational infrastructure is being carried out.

Table 2. Changes in the area of landscape categories (Source: author's own elaboration)

	Number of basic fields/area of basic fields [ha]			Number/area of basic fields [%]			Change [%]	Change [%]	Change [%]
	2008	2012	2016	2008	2012	2016	2008–2012	2012–2016	2008/2016
Category I	120/3 000	106/2 650	87/2 225	14.9	13.2	11.1	–1.7	–2.1	–3.8
Category II	161/4 025	173/4 325	192/4 750	20.0	21.5	23.6	1.5	2.1	3.6
Category III	355/8 875	357/8 925	353/8 875	44.2	44.4	44.2	0.2	–0.2	0.0
Category IV	138/3 450	138/3 450	142/3 500	17.2	17.2	17.4	0.0	0.2	0.2
Category V	30/750	30/750	30/750	3.7	3.7	3.7	0.0	0.0	0.0
Sum	804/20 100			100			0.0		

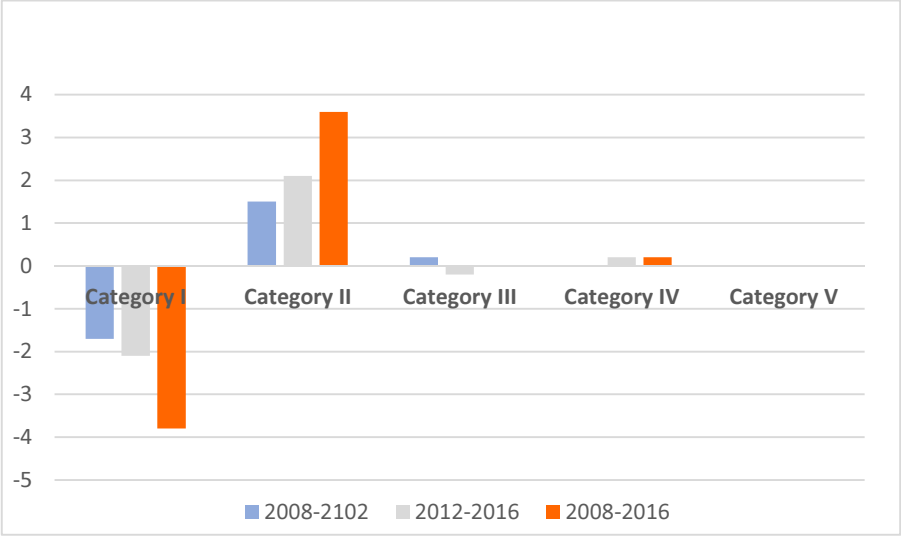

Fig. 4. Dynamics of landscape category changes (source: author's own elaboration)

It should be emphasised that during the whole eight-year study period 775 ha of the municipality area lost the highest attractiveness category. Within a year this gives almost 97 ha of category I areas where the hitherto aesthetic value deteriorated. The increase in category II area surface results primarily from the value loss of the most attractive areas. In turn, for categories III and IV no major changes were observed. In the case of basic fields of the lowest sight-aesthetic attractiveness no changes during the entire studied period were found. This results from the lack of investor interest in land of small aesthetic attractiveness. So it is possible to state that in the studied municipality the area of attractive landscape is perceived mainly as potential land for the development of recreational and tourist functions. At the same time, based on direct field observations, a lack of interest in other types of economic activities was found, which could contribute to changes of the perceived landscape aesthetic under current conditions of the socio-economic development of rural lake districts in Poland.

Conclusions

The new method for evaluating aesthetic values of landscape (EEVL) is the author's development of a practical nature. The presented methodological assumptions could be used in lake district landscape auditing, and they could also be an observation instrument in the process of protecting against and preventing unfavourable landscape transformations. The landscapes' diversification and permanent deterioration of their sight-aesthetic value cause the necessity to develop new evaluation forms, adapted to permanently changing spatial conditions and to socio-economic conditions. The presented studies confirm that, apart from natural elements, anthropogenic elements play a major role in the evaluation of perceived landscape aesthetic. That has been considered in the EEVL method criteria table.

The analysis of spatial and time changes of landscape aesthetic in the municipality of Pozezdrze in the years 2008, 2012, and 2016 allows the location of places especially threatened by the degradation of precious values. The landscape attractiveness of the studied object reaches quite high values, and therefore it should be especially protected. A very fast pace of aesthetic value loss by the area was found. This is related to a diminishing surface of areas with prevailing natural elements, and to intensified expansion of technical and tourist-recreational infrastructure in the municipality of Pozezdrze.

The local authorities should undertake protective measures to slow down the process of losing land with particularly precious landscape values. Local planning in the municipality of Pozezdrze should take into account spatial conditions resulting from the aesthetic attractiveness of the area. The structures of landscape observed there are extremely sensitive to transformations related to civilisation development and investment processes (in particular in tourist services in this area). Rehabilitation measures for the areas of the highest degree of transformations should be subordinated to objectives of restoring the attractiveness of individual landscape-forming elements. The undertaking of efforts aimed at the protection of cultural heritage, and also designing the development processes considering the existing architectural systems are the conditions ensuring the protection of the cultural landscape of the Pozezdrze municipality.

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