Managing Suburban Area Using Landscape Evaluation and Valorisation Methods

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Abstract: Suburban zone is an extremely conflicted area exposed to very dynamic changes. Popularity of the suburbs increases every year. The rapid increase of population density and net migration from cities to rural areas changes the spatial, aesthetic and social character of these areas. Hence, it is a very important task to manage the suburban areas and to adequate planning for the environmental protection and development. A tool that can be used for this purpose is the landscape valorization. There are many methods of landscape valorization, therefore, they should be used skillfully by selecting the most important elements and rejecting those that may unfavorably affect spatial evaluate, maintaining the most objective approach.

1. Introduction

Every year suburban areas become more popular for people migrating from the big cities. Since the 90s. in many European countries dynamic growth of agricultural land use has been noticable on outlying areas from the cities center (Tammaru et al., 2016: 845). Migrations to these areas are increasing. Effect of such people's relocations and urban sprawl to the rural areas causes serious consequences. The process of suburbanization affects daily life of inhabitants of villages and towns, communication (especially commuting to work) and work itself. Furthermore, urban sprawl on the rural areas diametrically changes the character of traditional villages (Kajdanek, 2011: 10-

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11). There are visible spatial and aesthetic changes, ie. land use, where agricultural areas are transformed into residential areas; fragmentation of lands, where the new buildings arise, usually in the form of grand housing estates or detached houses. Additionally, dynamic population growth of suburban areas leads to diversity of inhabitants. The rural traditions and local communities progressively disappear, what causes transformation of the social character of these areas. The rapid transformations cause changes in a traditional understanding of the rural landscape, its dominant character and natural and cultural values.

In order to maintain adequate landscape protection and shape of urban-rural areas it is necessary to exercise planning control with the use of appropriate tools. The example of such space with dynamic changes where evaluation and planning control should be a priority, can be Poland and Polish suburban areas, located near the major cities. Based on changes in the number of rural inhabitants since 90s. until 2014, Poland is among the countries where the proportions significantly increased (United Nations, 2014: 23). Furthermore, in 2015 Poland started implementation of the European Landscape Convention (2000) in the form of landscape audits. In light of the Polish Act of 24 April 2015 amending certain acts in relation to strengthening landscape protection instruments ("Landscape Act") landscape audits have to be realized at least once every 20 year for the voivodship area. The main tasks of the audits are to determine the types of landscapes and location of the priority landscapes, indication of the location and boundaries of selected forms of protection of nature and the objects proposed to protection, identification of risks, values, recommendations and conclusions concerning protection and shaping of landscapes. To execute this control planning, especially in the dynamics suburban areas, an useful tool for this type of research can be landscape valorization, assuming the selection of appropriate methods.

The aim of the present study was to analyse and evaluate the most important and the most common in the literature and practice methods of landscape valorization, and the execution of model valorization on dynamically changing suburban area using the best evaluated features of each landscape valorization methods.

2. Dynamics of the suburban area

In recent years the development of the suburbs has become very dynamic. Many places located close to major urban agglomeration multiplied the number of their inhabitants. The data below are

collected from the Central Statistical Office and refer to 8 Wrocław neighboring municipalities, presenting net migration per 1000 population between urban and rural areas in 2000-2014 (Table 1).

Table 1. Net migration per 1000 population between urban and rural areas on the example of Wrocław neighboring municipalities 2000-2014

Municipalities	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002	2001	2000
Czernica	337	438	337	425	423	352	314	341	396	306	235	210	236	122	65
Długołęka	890	825	735	633	511	428	388	598	463	379	531	434	289	216	217
Katy Wrocławskie	249	348	360	398	414	340	288	409	285	249	249	153	131	35	56
Kobierzyce	358	435	341	355	443	338	465	439	510	306	195	179	275	83	94
Miękinia	273	332	317	233	261	226	163	240	309	44	148	203	139	51	28
Oborniki Śląskie	149	198	249	216	333	250	203	247	149	97	144	170	176	214	133
Siechnice	739	694	534	467	523	405	320	445	439	201	174	215	128	112	108
Wisznia Mała	76	164	109	136	163	110	137	191	95	28	86	38	72	117	83

Source: Central Statistical Office of Poland.

One can therefore safely say that the example of the Wroclaw population moving from town to neighboring municipalities increases every year and it is several thousands.

A similar trend is also noticeable in the case of population density in the neighboring municipalities of Wroclaw. In all analyzed municipalities population density increased significantly, with the exception of 2015, where the results coincide with those of the data of the 2014 (Table 2).

**Table 2. Population density in Wrocław neighboring municipalities 2002-2014 (people per km^2)**

Municipalities	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	2003	2002
Czernica	160	160	156	150	146	140	128	123	119	114	108	104	102	99
Długołęka	129	129	125	120	116	113	107	105	102	99	97	95	93	91
Katy Wrocławskie	128	128	126	124	122	119	109	106	104	102	100	98	97	96
Kobierzyce	125	125	122	118	116	112	102	99	95	92	88	86	85	83
Miękinia	81	81	79	77	75	74	69	68	67	66	64	64	63	62
Oborniki Śląskie	128	128	128	127	125	124	120	119	118	116	116	115	115	114
Siechnice	193	193	184	176	170	164	153	148	145	140	136	134	132	130
Wisznia Mała	95	95	94	93	91	90	83	81	80	78	77	76	75	75

Source: Central Statistical Office of Poland.

Also in this case changes are similar. Population density in the Wrocław neighboring municipalities is clearly increasing, without any declines in the analyzed years.

Such considerable interest in suburban areas is according to projection made by Central Statistical Office of Poland in 2014. Population Project 2014-2050 (Waligórksa et al., 2014: 111) show that the number of inhabitants of Polish cities will continue falling. In rural areas we can observe more or less constant trend in the number of their inhabitants (Figure 1).

**Figure 1. Projection of urban and rural areas population until 2050 (in mln) based on Population Project 2014-2050**
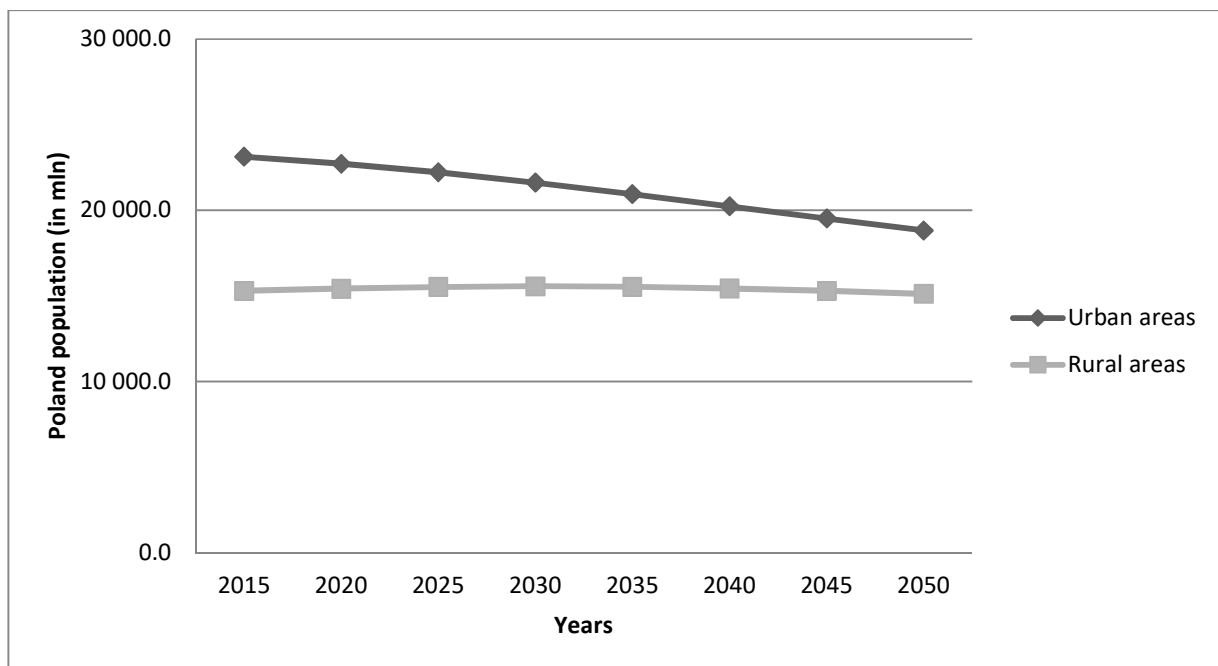
Source: Central Statistical Office of Poland.

3. Characterization of study area

The study area is located in the south-west Poland, in the Wisznia Mała municipality and it is the northern border of Wrocław. This is a part of Psary village (about 1150 inhabitants) and Krzyżanowice village (about 500 inhabitants). It covers about 1,6km2. The study area was determined assuming its natural boundaries, which are the communication routes and Widawa river (Figure 2).

Figure 2. Location of Wisznia Mała and Krzyżanowice within the limits of Wroclaw suburban area (black dot, top right panel). Ortophoto map shows the limits of study area in its natural borders (communication routes and Widawa river)
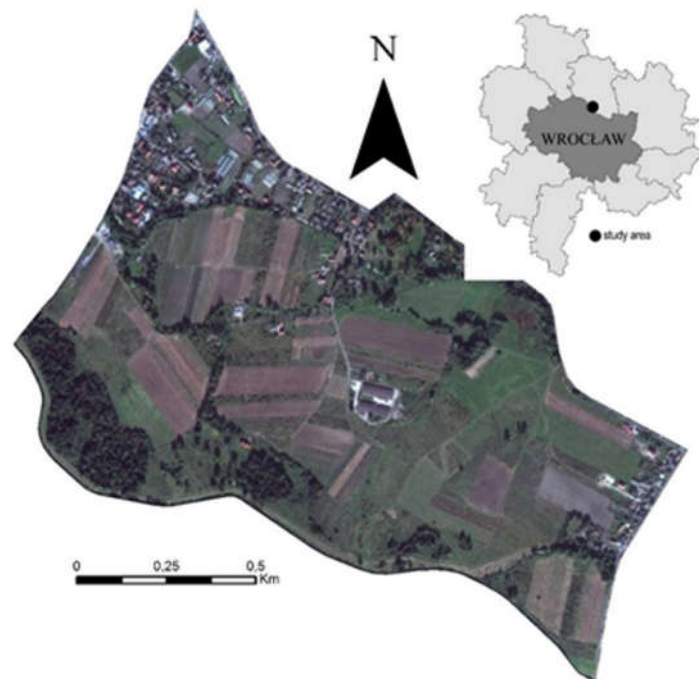
Source: Author's own elaboration.

4. Review of the most popular landscape valorization methods

There are many methods of landscape valorization. In present study one selected 10 most popular and used in practice methods ie. (in alphabetical order):

- Bajerowski's value matrix method (Litwin et al., 2009: 14);
- Cymerman and Hopfer's photographic method (Cymerman and Hopfer, 1988a: 39-48);
- Janecki's straight lines method (Janecki, 1981: 35-42);
- Kowalczyk's method (Kowalczyk, 1992: 25-36, 2000);
- Lynch's mental map (Lynch, 1960: 91-117);
- Social evaluation method;
- Senetra's Bonitation method (Senetra, 2001);
- Söhngen'smethod (Cymerman, Hopfer, 1988b: 15-28);
- Units and architectural-landscape interior method (Bogdanowski, 1990);

- Wejchert's impression curve method (Wejchert, 1994).

Foregoing methods of landscape valorization were evaluated on 1-3 point scale, where the evaluation criteria was scope (number of landscaping elements under consideration), precision (clearly defined criteria, subjectivity/objectivity of method) and simplicity (runtime of landscape valorization, necessary equipment and knowledge). The arithmetic mean was the final result of the evaluation:

$$x = \frac{\text{scope} + \text{precision} + \text{simplicity}}{3}$$

Using a combination of the highest-rated methods, choosing only positive qualities and rejecting negative qualities, conducted landscape valorization of the suburban area. The evaluation final results are shown in Figure 3. The evaluation was performed on a specially designed evaluation cards, analyzing each method. In this study one uses combination of two methods, that obtained the highest score: Cymerman and Hopfer's photographic method and Kowalczyk's method.

**Figure 3. Evaluation of landscape valorization methods**
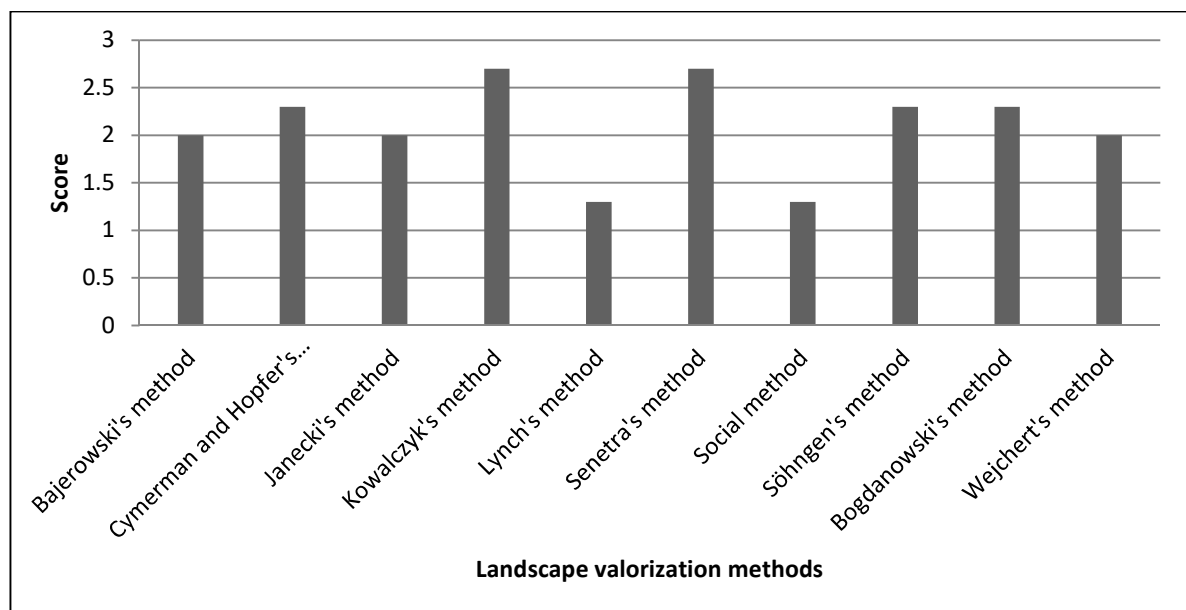
Source: Author's own elaboration.

5. Landscape valorization

Presented landscape valorization is based on cartographic, photographic and field data. The first stage of valorization was to determine the land use changes, direction of development and indicate relict and priority elements of landscape, based on historical cartographic data (Messtischblatt) and comparing them with the current maps (Figure 4).

**Figure 4. Analysis of land cover changes**
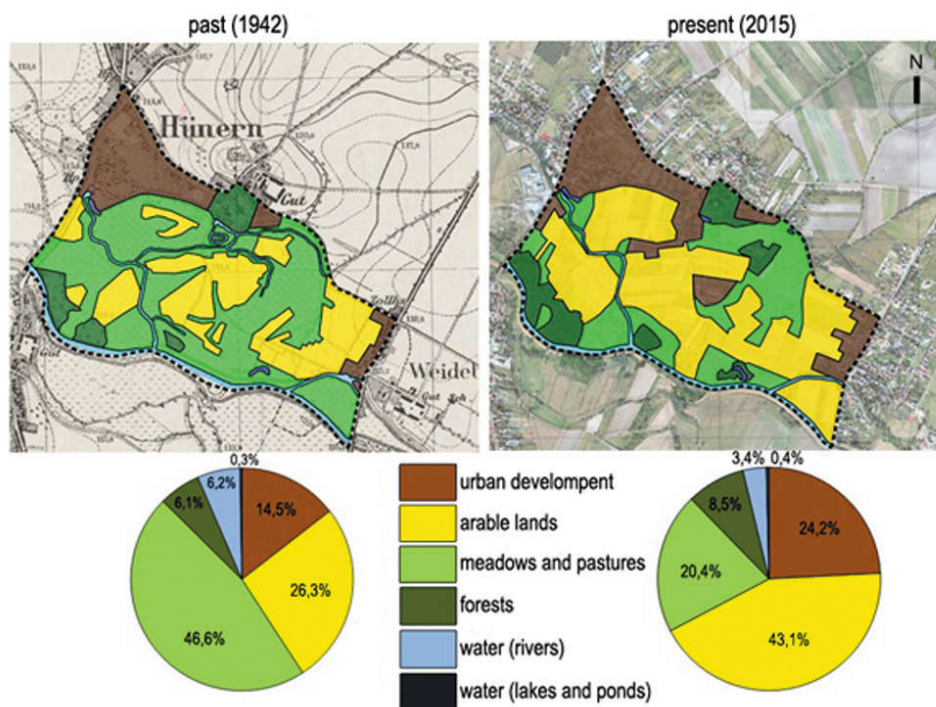
Source: Author's own elaboration.

The analysis showed that the main function of the study area which is agriculture remained intact. However, there is a significant change in the ratio of arable land to grassland and pastures. Also built-up areas significantly increased compared with 1942.

The second stage of valorization was dividing area into equal units using a variation of Cymerman and Hopfer's photographic method. The units are squares with sides 400x400 meters. In the center of each unit one took panoramic photos, which were then analyzed by using the landscape valorization's criteria by Kowalczyk (Figure 5).

Figure 5. Division of study area into units and photographic locations
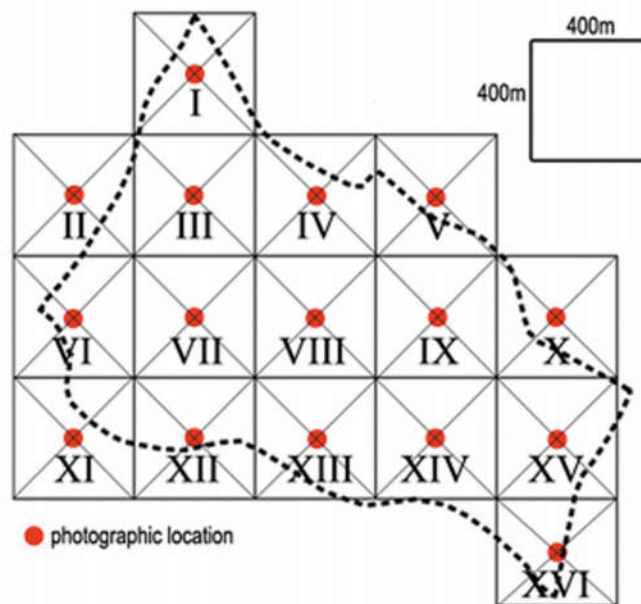
Source: Author's own elaboration.

The third and the last stage of valorization was to analyze panoramic photos and cartographic data by the Kowalczyk's criteria (Figure 6). Subject of evaluations was number of plans in the landscape, number of landscape elements, variety of landscape elements, harmony of landscape and vertical structure of landscape. Each factor was rated based on specific grading point.

**Figure 6. Analysis of panoramic photos by Kowalczyk's criteria**
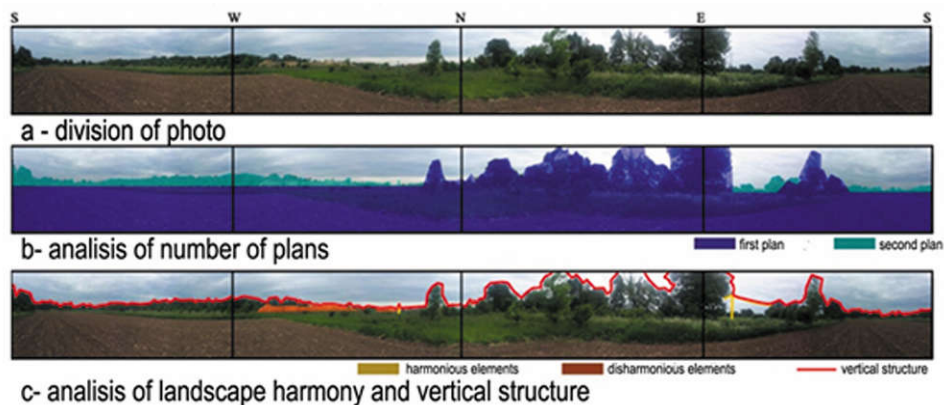
Source: Author's own elaboration.

6. Results

The final map (Figure 7) presents summary of landscape evaluation based on Kowalczyk's criteria. The best rated units are XI, XII and XIII. In this area there is a small forest complex and aquatic ecosystem (Widawa river). This area is harmonious and with high natural values, affecting the positive perception of the landscape. The priority is to keep these units in their natural state and provide them with adequate nature protection.

Figure 7. Result of landscape valorization
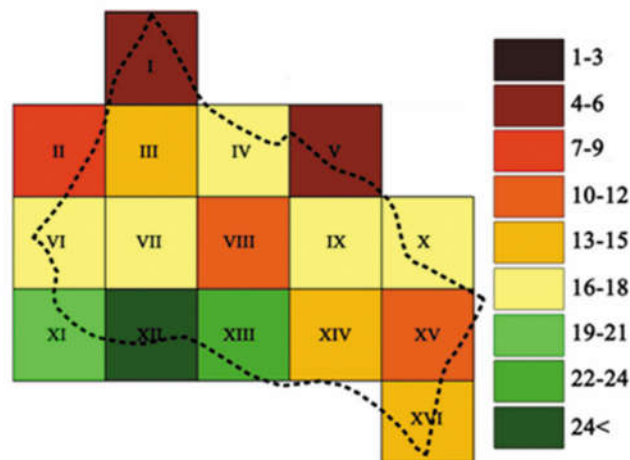
Source: Author's own elaboration.

Units primarily in the central part of study area were rated as medium, where the points are ranges between 10-18. This state is related with partially disrupted harmony in connection to the presence of elements such as poles and power lines, scattered fragments of buildings (residential and commercial) or elements that temporarily affect landscape disharmony (currently performed construction, accidentally parked cars). Furthermore, little variety of landscape elements such as single trees and noticeable water elements affects the evaluation. Tasks that can be proposed for this units are revalorization works.

The areas with the lowest score are units I, II and V. This is mainly due the total building areas which are entirely disharmonious and poor from the nature perspective, and their aesthetic perception and nature is extremely negative. All work related to the new housing investment should

be located in the immediate vicinity of the existing built-up area with minimal interference in the units located in the middle of the study area and far away from the best rated areas.

7. Conclusion

Based on conducted landscape valorization selected fragment of suburban area of Wrocław, based on the combination of best evaluated methods we can conclude that the presented method can be used to carry out such landscape analyzes, which include the conflict areas. Presented landscape valorization identifies the main areas that should be protected because of its high natural values, aesthetic and landscape, and these that should be restored, as well as areas where it is recommended to locate new residential buildings or services, especially in suburban areas where is a pressure as a consequence of urban growth, population pressure and changing agricultural methods and policies (Antrop, 2004: 9-26).

Using multiple sources of information about the landscape, such as photographic data, cartographic data, analisys of historical land cover changes and field studies facilitates the understanding and interpretation of the landscape (Ode et al., 2010: 24-31). Thanks to this landscape valorization becomes more objective.

Method proposed by the authors can be used as a tool to identify and space management especially in the case of rapidly changing and dynamic suburban areas. The method can be used as part of studies within the scope of audits landscape. However, it is obvious that proposed method does not capture all the landscape values, but thanks to the amount of available data sources, clear evaluation criteria and simplicity of execution it can be easily replicated by any planner or designer. It should be remembered that the evaluation depends on the observer, and therefore it is not possible to completely eliminate subjective factors (Arriaza et al., 2004: 115-125). However, in the future, method proposed by the authors can include analysis of other data that improve and objectifies method of landscape valorization.

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Zarządzanie strefą podmiejską przy użyciu metod oceny i waloryzacji krajobrazu

Streszczenie

Strefa podmiejska jest obszarem niezwykle konfliktowym, na którym dochodzi do bardzo dynamicznych zmian. Z roku na rok tereny podmiejskie stają się coraz bardziej popularne. Gwałtowny wzrost gęstości zaludnienia oraz rosnące saldo migracji z miast na tereny wiejskie powodują zmianę charakteru tych obszarów pod względem przestrzennym, estetycznym i społecznym. Dlatego też bardzo ważnym zadaniem jest zarządzanie strefą podmiejską i odpowiednie planowanie dotyczące ochrony jak i kształtowania jej krajobrazu. Narzędziem, które można do tego celu wykorzystać jest waloryzacja krajobrazu. Metod waloryzacji jest bardzo dużo, dlatego też należy stosować je w sposób umiejętny, wybierając elementy najważniejsze oraz odrzucając te, które mogą niekorzystnie wpływać na ocenianą przestrzeń, zachowując jednocześnie podejście jak najbardziej obiektywne.