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Cultural Ecosystem Services and Local Identity – A ppGIS Case Study from Budapest Metropolitan Region

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Abstract

Several studies and international conventions highlight the importance of public participation in the process of strategy building. In spite of all these initiatives, public participation methods are not common tools in the practice (especially in Central-Eastern-Europe). In the frames of our research, we applied the ppGIS (Public Participation GIS) method, a special, mostly new tool in Hungary, in order to bridge the gap between the scientific world and local citizens. The method combines community based mapping with GIS techniques. It aims to foster the integration of the public into the process of evaluation, planning, and decision making using GIS technology. Our former research project justified the significance of this method, especially in mapping cultural ecosystem services, since these cases are the most important to local knowledge.

We applied the ppGIS method in micro-region of Vác, situated in Budapest Metropolitan Region. Five cultural ecosystem services were chosen based on former scientific literatures (these are the most commonly used cultural ecosystem services, since these describe the social-cultural background of a place, region): aesthetic value, recreational value, spiritual value, cultural and historic value, and educational value. The survey was carried out between 2017 and 2018 collecting 184 maps. The data was digitized and processed using GIS. The objectives were to define the level of local identity in this peri-urban region, and to analyze the relationship between the frequently used, visited areas and the location of the most important cultural landscape elements for the locals. We had the following research questions:

- Which landscape elements, settlements, regions are marked mostly with local significance? What are the causes for regional disparities?
- Do the commuting or travel routes influence the significance of landscape values for the society?
- Is there any correlation between hiking trails, cycling routes and the location of marked landscape elements?

Our results show that most of the regionally known values are in the administrative and historic center of the micro-region, but some settlement-groups may have their own local identity, as the level of appreciation differs when we analyze the separate watersheds within the micro-region. It turned out that there is a correlation between bike routes and cultural ecosystem services in the region. The hiking routes are crossing the area where the most values were marked by locals outside of town centers or villages. In spite of high road density and the huge number of commuting residents, the most important daily routes did not always influence priorities locally.

Introduction

In the peri-urban, continuously changing areas of big metropolitan regions (e.g. in Budapest Metropolitan Area) there is a great threat to ecosystem services. Major land use conflicts can occur in these landscapes, as opposing interests form their development (interest of investors, municipal, locals). Fast, intensive changes can also cause conflicts (intensive growth of built up areas, loss of natural, semi-natural areas, loss of identity, weakening of cultural ties to specific locations because of the changing composition of the population and the break-up of traditional communities). These processes appeared in Budapest Metropolitan region, where our study area (Micro-region of Vác) is located. In these regions, it is highly important to define and assess these services in order to apply the most effective regional development, nature and landscape protection and sustainable landscape management techniques in order to minimize, avoid conflicts in the landscape. It is especially true for cultural ecosystem services, as these can be the base of local identity, communities and in many cases the local economy (tourism). Local identity is a highly complex phenomenon, it can be defined as the ties, binding and relations of citizens to their hometown and the depth of their knowledge about the history of the region and cultural heritage.

The study area is the micro-region of Vác, in the agglomeration zone of Budapest (Figure 1). The micro-region consists of 18 settlements, 362 km^2, with of 67 781 population. There are great spatial differences in the area, Vác, the center of the micro-region has outstanding conditions and, furthermore, the areas along the Danube and in the vicinity of Budapest are developed, but there are smaller villages and more significant natural values in the East. Because of its location and diversity (agglomeration zone of Budapest), the study area is an interesting example of peri-urban areas under pressure and subject to various conflicts.
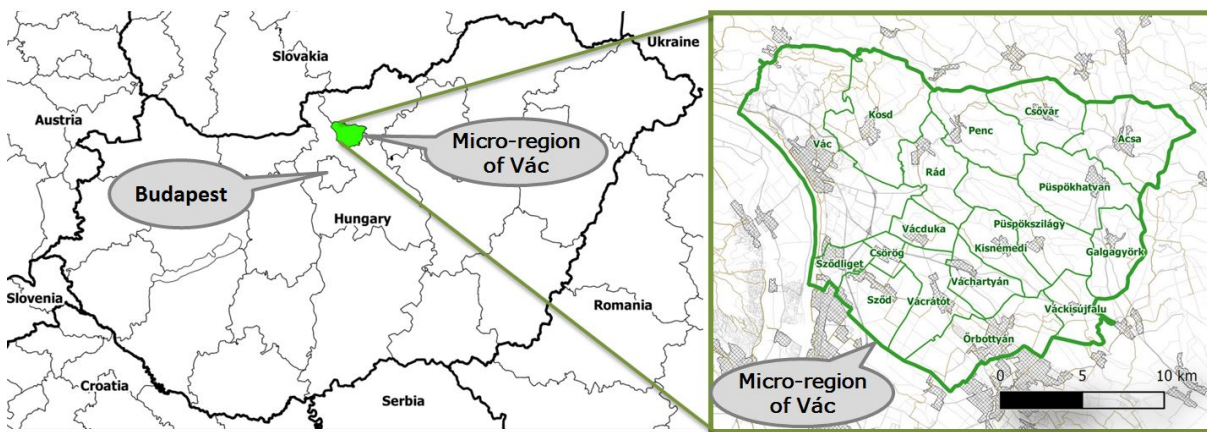
Figure 1. Location of the study area

Background and Literature Review

Nowadays, there has been a growing focus in the international literature on public participation and ecosystem services. In 2001 the UN Millennium Ecosystem Assessment program was the most comprehensive research in the field of ecosystem services (MEA 2005). The most frequently used ecosystem services are: provisioning, regulation, supporting, and cultural services (de Groot 2006, Costanza et al. 1997).

Several studies and research projects highlighted the significance of cultural services (Constanza et al. 1997, TEEB 2010). Researchers have distinguished types of cultural ecosystem services (Brown 2004, Alessa et al. 2008) such as: aesthetic value, educational value, recreational value, spiritual value, historic value, therapeutic value and cultural heritage value.

Recently, several reviews were elaborated about the assessment methods of ecosystem services (Andrew et al. 2015, Englund et al. 2017). The results of the former research programs show two possibilities for defining and assessing cultural ecosystem services. One is the assessment based on statistic data and GIS databases and the other means the involvement of local communities. Other researchers (Fagerholm et al. 2012, Vejre et al. 2010, Willemen et al. 2010) highlight the importance of the former method as the locals are the "experts" of their environment and, furthermore, the landscape includes tangible and intangible values which represent a living memory for them. Through the involvement of local communities the conflicts can be avoided more effectively than following plans elaborated by external experts and planners. The involvement of local stakeholders is especially possible on regional and local level. This spatial level is where locals use the services, goods of the landscape and influence their environment (Fagerholm et al. 2012). The local and regional level is where spatial data is needed the most and data at these levels is mostly available.

We have applied a special method for community based assessment and involvement of local communities. The so called, pGIS or ppGIS method (Public Participation GIS), combines community based mapping with GIS techniques (Tulloch 2008, Brown 2012, Brown and Pullar 2012). PpGIS was used in several research fields such as regional environmental planning, natural resources management (Dunn 2007), planning and management of protected areas (Clement and Cheng 2011), and management of urban parks (Brown 2004). The widespread application is due to the fact that this method makes possible the integration of wide range of spatial data. In case of environmental planning, landscape planning and data collection, cover the following attributes: landscape values, special places, development preferences, perception of environmental impacts, climate change hazards, quality of urban parks and open spaces, recreational resources, state of the landscape and ecosystem services. Brown (2012) defined the most important questions to be answered for an effective survey: who is doing the mapping, what, where and how are we mapping. The most important advantage of this method is that it makes possible to explore such potentials, cultural assets which are hidden for external experts as these are mostly not protected (e.g. folk architecture), or there is no homogeneous database available (quiet, secluded places appropriate for spiritual replenishment), or places remarkable just with their surrounding (castles on higher ground, sacred places) (Valánszki and Filepné Kovács 2018).

Goals and Objectives

In our research, we applied the ppGIS method for defining cultural ecosystem services in the agglomeration zone of Budapest. The objectives were to define the level of local identity in this peri-urban region, and to analyze the relationship between the frequently used, visited areas and the location of the most important cultural landscape elements for the locals. These relationships can help the planners and decision makers to understand better the relationship of the locals to the landscape, and in this way they can help to enhance these experiences and create stronger local communities. Our research questions were:
- Which landscape elements, settlements, regions are marked mostly with local significance? What are the causes for regional disparities?
- Do the commuting or travel routes influence the significance of landscape values for the society?

- Is there any correlation between hiking trails, cycling routes and the location of marked landscape elements?

Methods

For data collection in the frame of ppGIS method there are several methods and techniques. Brown and Pullar (2012) justified that points can be used more effectively than other figures, but higher numbers of samples are needed. Pocewicz et al. (2012) justified that paper-based mapping (using paper maps) results in higher rate of responses and remarkably reduces the mistakes.

Based on all these results, the characteristics of the study area and the research objectives, we defined the method of community based assessment. We used paper maps in order to reach the highest rate of responses, and for the involvement of wide range of social groups (for involving those groups who do not use the internet). The chosen method is appropriate to avoid the potential mistakes because of closer interaction with the interviewed, the unclear issues can be more easily resolved. As a base map we used Google Earth maps which are easily understandable for non-professionals as well. We marked the borders of the study area and the names of the settlements on the map to make it more understandable for the locals.

In all aspects we used three markers. We considered the priority order also important, so we numbered the markers: 1, 2, 3 (number 1. represent the most important goods from the given point of view). The differences in significance are highlighted in the maps by using different shade of the colors. In the frames of the ppGIS method we applied maps of size A3.

We applied those five types of cultural ecosystem services (aesthetic value; recreational; spiritual value; historic value, and educational value) in a simple grouping. The chosen types of services were based on our literature review (these are the most frequently used types of cultural ecosystem services in the scientific literature). We carried out the research program with the involvement of students between September 2017 and April of 2018. We used QGIS program for processing 184 maps and comparison analysis for assessing the results. It is important to emphasize that the results of the ppGIS method are not simple generic maps of object locations but these maps can be considered as specific mental maps reflecting preferences of local people (dot densities and distributions).

For data processing we applied different GIS methods and statistical analysis. We used data bases on land use, road, railway, hiking, cycling trails. We carried out comparison analysis on local level (we used GIS methods for the comparison analysis e.g. buffering, clipping, selection, and "heatmap").

Results

We present our results based on the three research questions. We highlighted two aspects in the analysis of local identity and reputation of local communities. Firstly we evaluated the rate of characteristic landscape elements marked by the locals in their home village. According to the Figure 2. characteristic sub-regions can be distinguished. We registered the strongest identity in the case of Vác, the administrative, cultural and historical center of the micro-region (55% of the marked elements are in the hometown). There are also strong bonds in some Eastern villages (Acsa and Püspökhatvan). The lowest

values of identity can be found in the small neighboring villages around the regional center (just 20% of the marked elements are in the home village). There are also low values in the centrally located settlements.
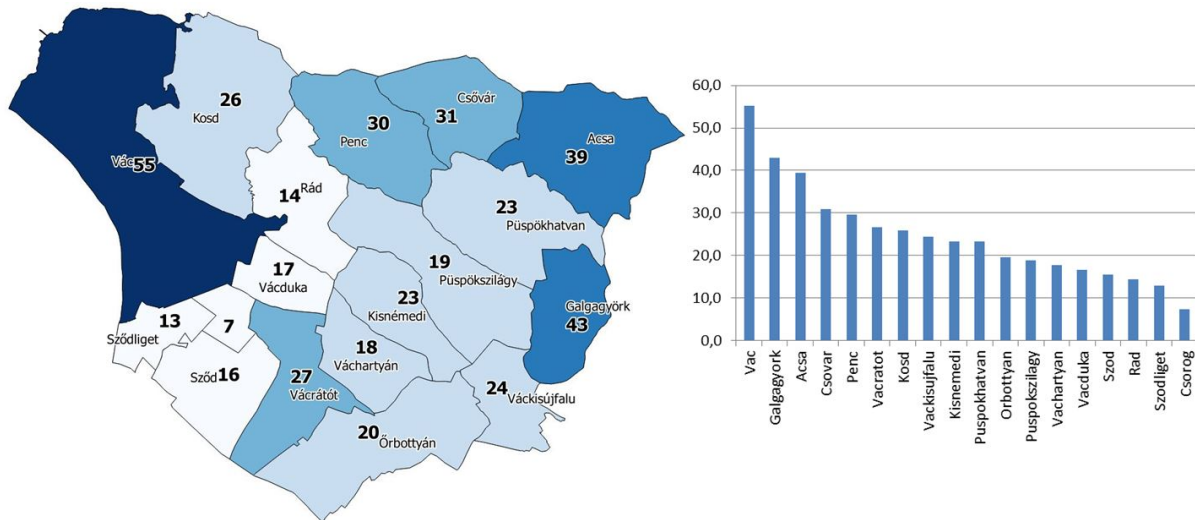

Figure 2. Level of local identity in the settlements (%)

In the second phase we analyzed the recognition and significance of the settlements in the region based on the rate of marked characteristic landscape elements by population of other settlements. The Figure 3 shows the remarkably high values of Vácrátót thanks to the nationwide famous arboretum. The arboretum is also highly appreciated by the locals. It is a really unexpected outcome of the research that the values of Vác are quite low compared to the other centrally situated settlements.
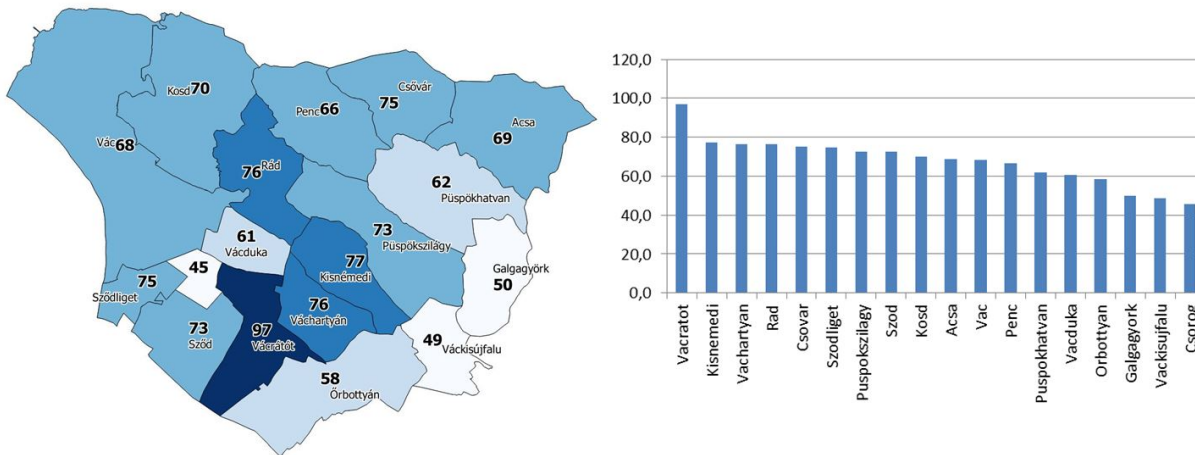

Figure 3. Regional significance of the settlements (%)

Comparing the results, we can see low level of relation between local identity and regional significance, so we can find high level of local identity and high level of regional significance in different settlements. The differences of the two types of results were unexpected, since the center of the region (Vác) and the periphery have different landscape characteristics (as it was presented in the Introduction chapter).

In the second phase we analyzed the relation between the marked characteristic landscape elements and cycling and hiking trails. The Figure 4. shows the location of cycling roads (green), the National Blue Hiking Trail (blue) and other trails (yellow). Along these routes we elaborated buffer zones (250m; 500m; 1000m; 1500m). The second picture (Figure 4) shows that there is proportionally higher number of marked elements along these routes than in the remote areas. There is the densest network of marked elements in the closest buffer zone (250 m zone). The cycling routes have the most significant influence for the ratio of marked landscape elements. As an unexpected result, the National Blue Trail had lower significance, even lower than other hiking trails.
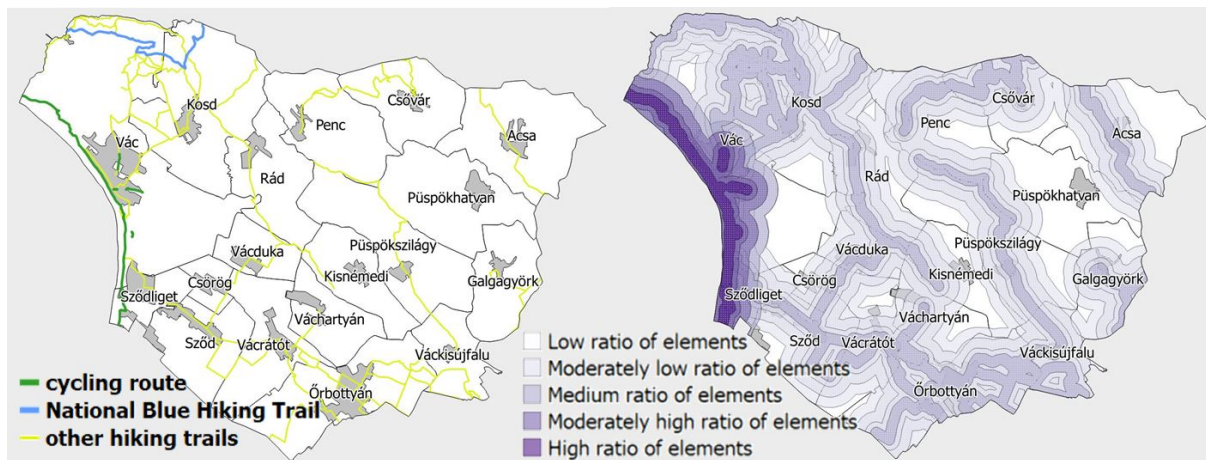

Figure 4. Relation of marked landscape elements and hiking and cycling trails

In the second phase we analyzed the significance of the marked landscape elements (1;2;3) and compared them with the buffer zones of the hiking and cycling trails. The Figure 5. shows a remarkably higher significance of the National Blue Hiking Trail and the strong influence of cycling routes.
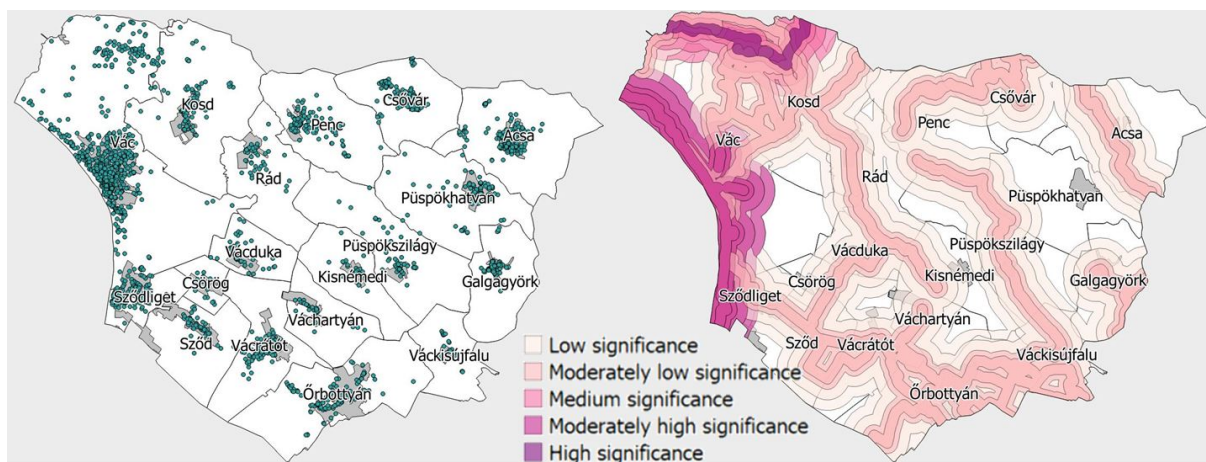

Figure 5. Distribution of weighted scores based on significance and their relationship with hiking and cycling trails

We compared the evaluated five groups of cultural ecosystem services with the hiking trails. There is the strongest relation with the aesthetic services. In the frames of the third research phase we compared the density of marked landscape elements with the buffer zones of motorway, railways and other public roads (250m; 500m; 1000m; 1500m). Our research results show the significant influence of the railway (Figure

6.) and roads (Figure 7.) on the density of marked elements. In the closest buffer zone (250 m) was marked the highest proportion of characteristic landscape elements similarly to the hiking and cycling trails.
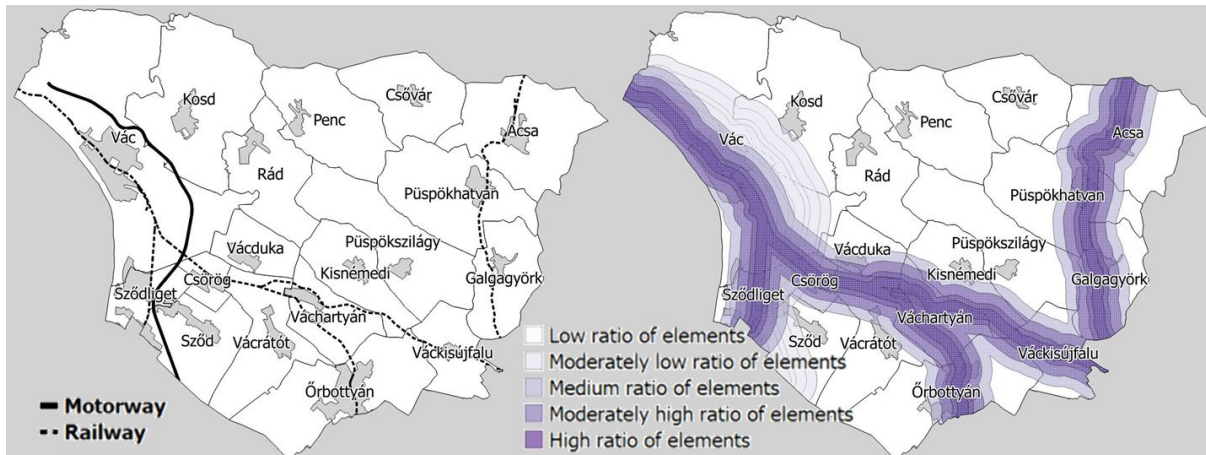

Figure 6. Relation of distribution of marked landscape elements with the motorway and railways

In the case of the motorway we haven't found significant influence (Figure 6.). Similarly the roads of lower significance haven't shown any influence (Figure 7.).
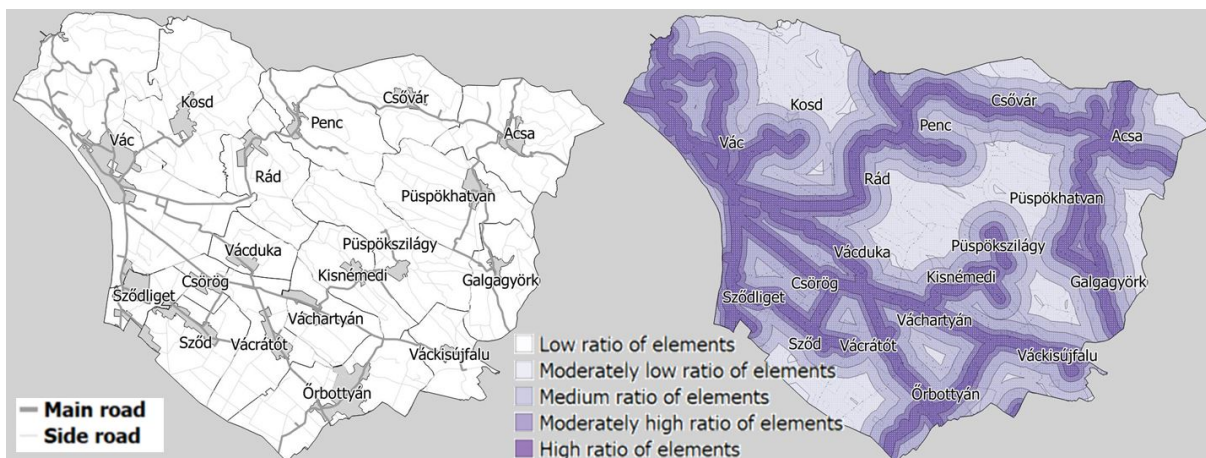

Figure 7. Distribution of marked landscape elements with the public roads

We carried out a comparison analysis of the 5 evaluated cultural ecosystem services and significance of marked elements (1;2;3) with the road system as well but we got the same outputs.

Discussion and Conclusion

Based on our research results we have the following conclusion:
- the highest level of local identity can be found in the most significant, traditional, central settlements
- the lowest level of local identity can be found in the neighboring settlements around the regional center
- the regional significance and recognition of settlements is the strongest in case of Vácrátót (nationwide famous arboretum), and the centrally located settlements have values above the average
- the values of local identity and regional significance differ in the settlements

- along the hiking and cycling trails we can find higher ratio (per area) of marked elements compared to the remote areas, this influence is especially strong directly along the routes (250m zone)
- along the cycling routes we can see remarkably denser network of marked elements than along the hiking trails
- along the railway and major public roads, the density of marked elements is higher compared to the remote (similarly to the hiking trails the influence is the strongest in the direct buffer zone)
- the motorways and minor roads didn't have significant influence on the marked landscape elements

The settlements with strong local identity have mostly central role in the region, so these high values are not just because of the significant historic and traditional role but also because of the fact that people living in these settlements usually do not know about the others (they do not commute from their hometown). In contrast there is no strong local identity in the villages around Vác because people spend the major part of their life in the central settlement (work, recreation, school).

The regional significance, recognition can be higher in case of the centrally located settlements because people travel through these settlements daily, so more not local people got to know them. We can justify that along the hiking trails more landscape elements were marked because these areas are well known. Because the cycling route was designed along the most important landscape elements (Danube riverbank, downtown of Vác) we cannot completely justify this relation. The higher density of marked landscape elements along the major roads and the railway is since people use these routes for everyday commuting, so people are mostly familiar with these areas. In contrast, the minor roads are used less frequently, so areas along these are less known. The outcome of the research about the significance of motorways justify that people using the motorway have less contact with the landscape, are less aware of the neighboring environment compared to those who use minor roads. Furthermore, the motorway bypass the most important cultural values.

Overall, it can be stated, that this method is appropriate to explore such assets as well which would be hidden from external experts, using only desk-work, and it revealed the significance of these assets for local people. Our experiences show that the application of ppGIS method can enhance the patriotism, identity of local people above the scientific results. This effect is highly important in the case of future development because the locals will accept projects based on the existing values, furthermore the potential conflicts can be minimized.

In the first phase of our research, with the contribution of students, we carried out a detailed survey of cultural and natural heritage (which meant data collection without field trips). In our future research projects, we plan a comparison analysis of this data collection with the results of ppGIS method analyzing the optimal involvement of local communities. In order to clarify and generalize the results of the research, we consider it desirable in the future to increase the number of collected maps, and carry out studies on additional areas of similar and different character.

We consider our research method applicable not just in Hungary but also for European peri-urban areas of similar characteristics. Especially these results can serve as a base for regional development and management plans (e.g. transportation system planning, hiking and biking trails design, where and what kinds of landscape experiences should be improved).

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