Proceedings of the Fábos Conference on Landscape and Greenway Planning

Volume 5
Number 2 *Landscapes and Greenways of Resilience*

Article 6

2016

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Introduction

Landscape values and landscape potential are the base of rural development. Long-term and balanced utilization of these is possible through sustainable landscape management. The Hungarian rural regions have very diverse characteristics, that is why properly targeted and specified programs, strategies are needed to develop them in an appropriate way.

Several planners, researchers and authors emphasized that the first step of sustainable landscape management is landscape-function analysis (De Groot et al., 2010; Herman et al., 2014). Before clustering and typification of rural regions based on the levels of the different landscape functions, it is very important to explore the potential relationships, regularities among these functions.

Literature Review

In regional and rural development policy the development is defined by socio-economic indicators, and less attention is paid on utilization of landscape values, features. However, in Hungary the National Rural Strategy (2012-2020) identifies protection and sustainable use of landscape and natural values as key elements of rural policy (National Rural Strategy, 2012).

The focus of several research related to ecosystem services and landscape functions concentrate on measuring, clustering and mapping of services/functions (Fischer et al., 2009, De Groot et al., 2010). Following the same line, Herman et. al. (2014) expressed, that the analyses of the spatial distribution of landscape functions is essential to make appropriate landscape planning and landscape management decisions. Despite of the intensive and far-reaching researches, evaluations and mappings in this field, some think the landscape function conception has not yet build into the landscape planning and management practice properly (Norgaard, 2010).

Identification, measurement and mapping of landscape functions are mainly possible with different landscape indicators. According to Willemen et al. (2010) these indicators are the bases of spatial identification of landscape functions. Several sources can be used for indicators: land cover (e.g. CORINE), or other economic, social and ecological databases (Haines-Young et al., 2006; Filepné Kovács, 2013).

The number of landscape indicators is endless; however, there are some collections of indicators. One of the most significant collections is the work of Cassatella and Peano (Eds.) (2011). In their system the indicators were divided into five groups: ecological, historical and cultural, economic, land use, and perceptional. We can find other significant collections, some of which focus on the evaluation of rural landscapes (Piorr, 2003), agro-environment (Landsis et al., 20002), or urban landscapes. In Hungary Kollányi (2004) made a collection of those landscape indicators, which are applicable in the Hungarian context. In this research, we developed and selected our indicators based on the practice of formerly introduced systems, collections.

Goals and objectives

The goal of the research is to identify relationships between landscape values and a special kind of socio-economic development in case of the Hungarian rural regions. Regarding to our goal the following questions were defined:

1. Which are the most suitable landscape indicators to identify landscape values, potential on micro-regional level?
2. How these landscape indicators can be clustered? How can this landscape indicator-system be set up?
3. Is there any, relationship between landscape values and the socio-economic development? If yes, what kind of relationship it is? What kind of regularity can be identified in the rural regions of Hungary?

Methods

In Hungary various development strategies and programs are elaborated for administrative regions. 137 Hungarian micro-regions (so-called "járás", that means a region within a walkable distance) were involved in the research. These are the rural micro-regions according to the most common Hungarian rural threshold (based on population density below 120 persons/km^2). Since the relationship between landscape features and socio-economic development was analysed, a complex socio-economic development indicator was involved as the benchmark of this analysis, which was developed in 2007 (67/2007. (VI.28.) Government Regulation).

The elaborated landscape indicators of the first part of our research meant the base of the evaluation, categorization of the rural micro-regions as well as the base of the comparison between the landscape values and the socio-economic development. For the developed indicator system we used several sources and former researches (see Literature Review). The objective was to involve as many landscape-related indicators as possible from several fields; however, we did not strive to elaborate completely new indicators. Thanks to the scale of

the evaluation, our opportunities were limited by the existing and available data source, the level of information detail and the spatial homogeneity of data. Some elements of the final indicator kit overlap each other (e.g. international and national protected areas overlap each other), however, this does not reduce the efficiency of the system thanks to the relativity of the developed evaluation system. Furthermore, the complexity of the indicators results that several important parameters do not even appear in the name of indicators, nevertheless they are included indirectly in the system (e.g. the various forms of water are included in several indicators).

ArcGIS 10 and Microsoft Excel 2007 programs were used during the test and run of the indicators. The spatial analysis were carried out with the GIS software (e.g. cutting, length and area measurements, selections), while Excel was used to summarize and analyse the preliminary results. During the next step the standardisation of parameters was necessary, since they had been varying in totally different scales.

Table 1. Applied landscape indicators in the research

Indicator groups	Indicators
Environment–Biodiversity	1. Biological activity; 2. Biodiversity; 3. Environmental integrity; 4. Forestry potential
Nature protection	1. Ecological network area; 2. Internationally protected areas; 3. Nationally protected areas; 4. Other protected areas
Historical–Cultural	1. Number of cultural heritage; 2. Historical significance
Visual–Perceptional	1.Landscape scenic value; 2. Naturalness; 3. Relief energy; 4. Visual diversity
Agriculture	1. Agricultural potential; 2. Soil
Tourism	1. Recreational potential; 2. Tourist flow

To evaluate the level of landscape functions, 18 complex landscape indicators were developed. The indicator-system was set up based on the literature reviews and professional consultations. In this system the indicators were grouped into 6 groups (Table 1).

After the GIS-based evaluation various statistical methods were carried out to identify the relationship between landscape features and socio-economic development. SPSS and R statistical programs were used to identify the correlations and the level of them. During the correlation analysis the objectives are to detect the relationships between the indicators, and to identify the intensity of the relations. Therefore, in the general statistic the correlation means that two or more parameters are not independent. Despite of the

formers, with this method it is not possible to justify cause and effect relationship, only the existence of the connection. We completed the analysis with significance testing, with which the correlations were justified (Fidy and Makarag, 2005).

Results

With the comparison analysis of the landscape and the socio-economic indicators our objective was to identify whether there is any relation between the landscape features and the socio-economic development. In the first phase all of the rural micro-regions of Hungary were involved into the research, while during the second phase two special Hungarian rural region-types were separately analysed (e.g. farmstead-type and small village-type micro-regions). In this part of the research the tourist flow was excluded, since it is already included in the complex socio-economic indicator, so with their correlation we cannot justify any new relationship.

The correlation analysis was carried out with 137 rural micro-regions. The reasons of the correlations, received during the statistical analysis, were identified according our professional judgement. Figure 1 shows the summary of the correlation analysis.

The strongest relationship (significant correlation) was identified in the case of the recreational potential. We determined that the existences of the touristic primer infrastructure (e.g. bike paths, hiking trails), as well as the other favorable recreational potential (e.g. wine regions) facilitate tourism profitability, and that is why they contribute to the development of certain micro-regions (the direction of the correlation is positive, that is why the values of the recreational potential and the values of the socio-economic indicator move in the same direction).

Similarly, significant (positive) correlation can be detected between the number of the cultural heritage and the socio-economic development. If the analysis have covered the urban regions of the country, this relation would be obvious, since in the bigger towns or cities the numbers of the cultural heritage are usually higher. Nevertheless, in the research we dealt only with the rural areas, it means, the bigger cities or urban areas were excluded from the sample area. Therefore, with the correlation between the economic development and natural heritage our research justified, that in general, those micro-regions are more developed economically, which have significant cultural traditions and values. Consequently, the micro-regions, which are nowadays more developed, were in better position in the past as well, so our results show “historical determinism”.

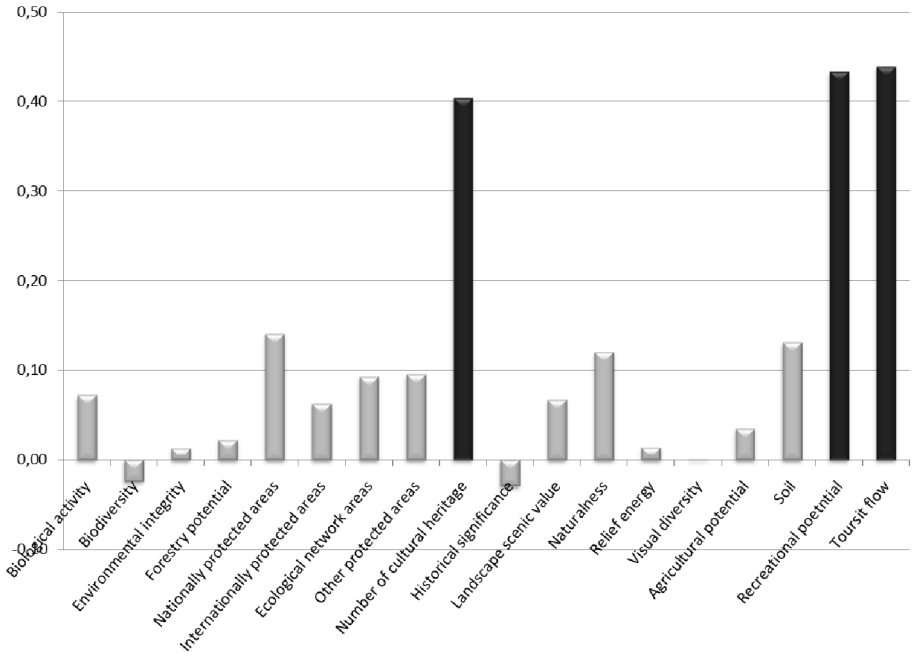

Figure 1. Correlation of landscape indicators with socio-economic indicator (black: landscape indicators with high correlation value)

We could not identify any relationship with the socio-economic development in the case of the following indicator groups: Environment–Biodiversity, Nature protection, Visual–Perceptional, Agriculture. According to the results of the research, we could not justify any relationship between the economic development and the quality of the environment in the rural areas of the country, so in general, the economically less-developed micro-regions do not have better environment quality.

The farmstead-type and small village-type micro-regions were defined based on the National Spatial Plan (2013). In this document 34 farmstead-type and 45 small village-type micro-regions are defined. The correlation analyses were carried out separately in these sample areas as well (Table 2). In the case of the small village-type regions, we received similar results like in the case of the national-wide analysis. In the case of the farmstead-type micro-regions, we could not justify relationship between the socio-economic development and the recreational potential; since the parameters included in this indicator (e.g. bike paths, hiking trails, wine regions) primarily concentrated in the hill countries of Hungary, so in the farmstead-type regions, which located in the plain areas of the country, these relations could not appear.

Table 2. Correlation of the applied landscape indicators with the socio-economic indicator in case of the farmstead-type and the small village-type micro-regions

	Correlation value (absolut value)	
	Farmstead-type regions	Small village-type regions
Biological activity	0,1500	0,2000
Biodiversity	0,0810	0,0860
Environmental integrity	0,1030	0,0980
Forestry potential	0,0650	0,0230
Ecological network areas	0,3430	0,2400
Nationally protected areas	0,2230	0,3510
Internationally protected areas	0,3820	0,0620
Other protected areas	0,0520	0,2000
Number of cultural heritage	**0,4690**	**0,5890**
Historical significance	0,0850	0,0210
Landscape scenic value	0,2520	0,0100
Naturalness	0,3810	0,1960
Relief energy	0,0170	0,1430
Visual diversity	0,0160	0,1720
Agricultural potential	0,2180	0,1970
Soil	0,1430	0,2500
Recreational potential	0,2720	**0,5560**
Tourist flow	0,3010	0,5970

Discussion and Conclusion

In the research 18 complex landscape indicators were used, which were chosen according to the literature review, the former collections of landscape indicators, and the accessible country-scale, homogenized database. In our future research, the number of indicators can be increased. The research was value-based, it means, that the selected indicators measured the landscape values, however, in several cases the evaluation of the restrictive landscape conditions are also necessary.

In this research the general rules and relationships between the landscape features and the socio-economic development were explored. Researches in the future should focus on the clustering of the micro-regions based on the similar landscape features, values. These further works can be operated as guides for the preparation of the landscape management programs, strategies.

Any relationships were found only in 2 cases of the 18 employed landscape indicators, it means, that the connection between the landscape values and the socio-economic development is very weak in the Hungarian rural areas. Based on these, we can conclude, that the current rural development programs,

strategies have not reached their objectives, since they do not deal in an appropriate manner with the landscape features, they are not area-specific and they do not utilize the landscape values properly. To reach a more effective rural development, better specified landscape management programs are needed, which build on the landscape values. It is necessary to integrate these landscape management programs into the rural development system.

References

Cassatella, C., Peano, A. (Eds.) (2011). *Landscape indicators – Assessing and Monitoring Landscape Quality*. Springer Dordrecht Heidelberg London New York

de Groot, R. S., Alkemade, R., Braat, L., Hein, L. és Willemen, L. (2010). Challenges in integrating the concept of ecosystem services and values in landscape planning management and decision making. *Ecological Complexity* 7, 260–272. DOI: http://doi.org/10.1016/j.ecocom.2009.10.006

Fidy, J., Makara G. (2005). *Biostatisztika (Biostatistic)*. InforMed 2002 Kft.

Filepné Kovács, K. (2013). Tájhasználati szempontok vidéki térségek versenyképességének értelmezéséhez (*Land use considerations related to the competitiveness of rural areas)*. Phd dissertation, Corvinus University of Budapest

Fisher, B., Turner, R. K., Morling, P. (2009). Defining and classifying ecosystem services for decision making. *Ecol. Econ.* 68, 643–653. DOI: http://doi.org/10.3410/f.1145051.602178

Haines-Young, R., Watkins, C., Wale, C., Murdock, A. (2006). Modelling natural capital: the case of landscape restoration on the South Downs, England. *Landscape and Urban Planning* 75, 244–264. DOI: http://doi.org/10.1016/j.landurbplan.2005.02.012

Hermann, A., Kuttner, M., Hainz-Renetzeder, C., Konkoly-Gyuró, É., Tirászi, Á., Brandenburg, C., Allex, B., Ziener, K., Wrbka, T. (2014). Assessment framework for landscape services in European cultural landscapes: An Austrian Hungarian case study. *Ecological Indicators* 37 (A), 229–240. DOI: http://doi.org/10.1016/j.ecolind.2013.01.019

Kollányi, L. (2004). *Táji indikátorok alkalmazási lehetősége a környezetállapot értékeléséhez (Landscape indicator opportunities for the evaluation of the environment condition)*. CUB, Department of Landscape Planning and Regional Development, Budapest

LANDSIS g.e.i.e. (2002). *Proposal on agri-environmental indicators PAIS*. Project summary

Office for National Economic Planning (2013). *Országos Fejlesztési Koncepció és Országos Területfejlesztési Koncepció (National*

Development Conception and National Regional Development Conception).

Norgaard, R. B. (2010). Ecosystem services: from eye-opening metaphor to complexity blinder. *Ecol. Econ.* 69, 1219–1227. DOI: http://doi.org/10.1016/j.ecolecon.2009.11.009

Piorr, H. P. (2003). Environmental policy, agri-environmental indicators and landscape indicators. *Agricultural Ecosystem Environment* 98, 17–33. DOI: http://doi.org/10.1016/S0167-8809(03)00069-0

Ministry for Rural Development (2012). *Nemzeti Vidékstratégia 2012–2020 (National Rural Strategy).*

Willemen, L., Hein, L., Mensvoort, M. E. F., Verburg, P. H. (2010). Space for people, plants, and livestock? Quantifying interactions among multiple landscape functions in a Dutch rural region. *Ecological Indicators* 10, 62–73. DOI: http://doi.org/10.1016/j.ecolind.2009.02.015

311/2007. (XI. 17.) Government Regulation