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## **Greenways as Linear Components of Green Infrastructure in Rural Agricultural Landscapes of South-Western Slovakia**

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### **Introduction**

Greenways are important linking elements of green infrastructure systems in rural cultural landscapes. Their significance markedly increases in agricultural landscapes, since green networks and systems are very often limited to linear structures in this particular type of landscape. Greenways can therefore be crucial green infrastructure components in intensively farmed arable-land matrixes. The uniqueness of the presented research consists in the focus on sustainability and resilience benefits provided by greenways in agricultural landscapes. Greenways and green infrastructure improve the overall environmental resilience of farmed landscapes towards climate change and extreme environmental events, such as long lasting drought and erosion of fertile topsoil by strong wind or rainstorms. Moreover, it facilitates and enhances wildlife migration in the landscape and increases the overall landscape and species biodiversity. All these positive environmental benefits lead to more sustainable agricultural landscapes. Additionally, greenways, thanks to their linear spatial structure, surface compactness and multifunctionality, do not threaten the food system resilience of the landscape.

### **Literature Review**

Rural regions face continuous changes, which significantly impact their landscape structures and green infrastructure (Tóth, 2015). Green infrastructure systems improve the ecological resilience and sustainability of rural landscapes and help mitigating the effects of changing climate (Benedict, McMahon, 2006). Therefore, it is crucial to sustain and enhance the natural capital of rural settlements and landscapes (Filepné Kovács, Nagy, Kollányi, 2011; Filepné Kovács et al. 2014). Green infrastructure elements and systems provide us with the possibility to implement nature based solutions for stormwater management and flood control; soil, air and water purification; noise and heat reduction and many other benefits, including the social ones, such as landscape perception, recreation and wellbeing (Fábos, Ryan, 2004; Ahern, 2007). In terms of landscape planning, it is necessary to consider greenways being integrated linear components of a holistic network represented by the rural green infrastructure (Tóth, 2015), which is designed by landscape architecture.

## **Goals and objectives**

The paper elaborates on the contemporary issue of green infrastructure in the context of rural cultural landscapes, it introduces the most important outcomes of the recently finished doctoral research on Green Infrastructure of the Rural Settlement and its Surrounding Landscape (Tóth, 2015), conducted on the case study of Tvrdošovce, one of the largest rural settlements in Slovakia. The main research question of the doctoral thesis is: “What are the features and values of green infrastructure in the rural landscape, how has the rural green infrastructure historically developed and structurally changed since the 18th century and what are the main functions and services provided by green infrastructure in the contemporary rural cultural landscape?”

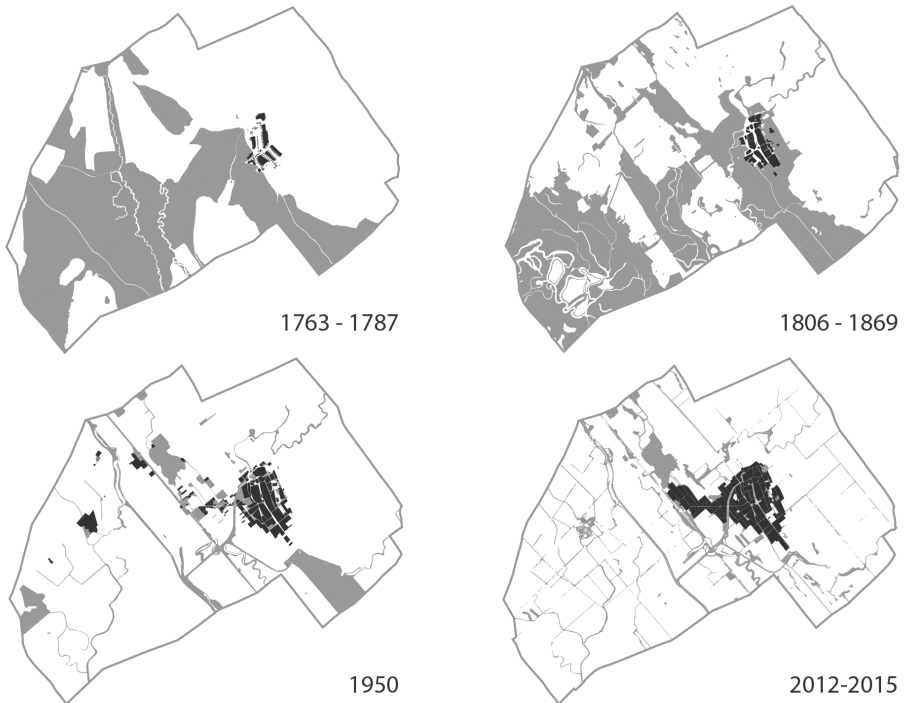
## **Methods**

The applied methodology consists of comprehensive digital, spatial and field research. The results and findings consist of three main parts: 1) historic development, spatial and structural transformations of the settlement and landscape since the 18th century, 2) elements, features and values of the cultural landscape with a linkage to greenways and green infrastructure elements, 3) vegetation structure, non-forest woody vegetation elements in the landscape and green spaces in the intra-urban area of the settlement, with a focus on their species composition and diversity. Green infrastructure in the studied open land is mostly represented by linear corridors, which cross the municipal boundaries and continue to the wider countryside, while permanent grasslands belong to the most significant constituents of the rural green infrastructure, *see figure 1*.

## **Results**

Based on the evaluation and interpretation of the research outcomes, particular measures and proposals have been developed for rural cultural landscape planning. The main conclusion of this paper is a prospective plan on green infrastructure connectivity enhancement and spatial integrity improvement in the rural agricultural landscape, *see figure 2*. It aims at improvement of the landscape structure through enhancement of green infrastructure, while maintaining productivity of agricultural land. Its contribution consists in developing viable landscape structures integrating both, enhancement of green infrastructure and maintenance of productive agricultural land, so that multiple benefits can be achieved. The planning model proposes a resilient agricultural system in a sustainable balance with green infrastructure, in the spirit of the EU Green Infrastructure Strategy, the EU Biodiversity Strategy to 2020 and the Common Agricultural Policy. The plan respects the agricultural legacy of the

site, the productivity and significant fertility of the land. The proposed improvements contribute to the green space system in the landscape, yet in a very sensitive way towards arable farming structures. Although, the most important spatial information has been derived from the current landscape structure analysis, historic landscape structures have also provided a range of important spatial and structural information, knowledge and inspiration for planning.



**Figure 1. Spatial and structural transformations of permanent grasslands in the study area since the 18th century (Tóth, 2015)**



**Figure 2. Prospective plan on green infrastructure connectivity and spatial integrity improvement.** *Pale-grey areas represent existing green infrastructure, dark-grey areas represent prospective linkages between existing discontinuous green infrastructure elements (Tóth, 2015)*

## **Discussion**

The results, partly depicted in *figure 1*, confirm the statement by Kurz, Machatschek and Iglhauser (2011), who define the existence and decline of the landscape through its intensification and extensification, while in the study area, the tendency of intensification can be clearly identified, *see figure 1*. In accordance with Supuka et al. (2013), intensification of agriculture, increase in the built-up areas, decrease in the share of permanent grasslands and natural meanders of watercourses and wetlands has been identified and documented. According to Salašová (2012), grasslands (meadows and pastures) are the most valuable components of non-forest landscapes, but their areal share constantly decreases. Therefore, the prospective plan, proposed in *figure 2*, recommends

an increase in the areal share of grassland structures, greenways and green infrastructure in general. The proposed improvements of the existing green infrastructure also tackle the issue of revitalisation of water networks and their accompanying vegetation, floodplains, wetlands and marshlands, which according to Halaj (2010) will be crucial for climate change mitigation. The presented research findings have a potential to be integrated into other professional and research fields dealing with rural planning, for instance into land consolidation databases (Muchová, Leitmanová, Petrovič, 2016) or to the territorial and spatial planning documentation at the local level. Moreover, they have the potential to enhance the status of landscape planning and protection in Slovakia and its integration into the spatial planning practice as suggested by Filepné Kovács et al. (2013). An example of implementation can be found in the Hungarian region of Hanság, where a greenway system has been elaborated that enhances traditional landscape elements, such as woodlands and grasslands (Filepné Kovács, Egyed, 2011). In Slovakia and Czech Republic, the elaborated planning approach bases on the traditional landscape planning concepts of Landscape Ecological Planning and the Territorial System of Ecological Stability and can be integrated into the spatial planning documentation (Tóth, 2015). Sustainable landscape management approaches in Austria and landscape restoration initiatives in the Czech Republic can be considered positive examples of implementation of similar concepts, where linear corridors play a crucial role of multifunctional components in the green infrastructure of the landscape. The presented research findings, proposals and measures are being continuously implemented at the local level through the Committee for Environment, Flood Control, Agriculture and Land Management at the Municipal Authority Tvrdošovce, where the author of this study acts as member and specialist adviser since 2013. The implementation is financed mainly from local budget and realised by voluntary work of locals.

## **Conclusion**

As argued in the preceding paragraphs, green infrastructure, including greenways has become the phenomenon of the present time and the strategy of sustainable rural development. It will help planners, designers and decision makers making viable rural landscapes and resilient environments in the context of changing climate and food resilience challenges. The presented research findings have the potential to enhance the environmental aspects in the rural planning practice in Slovakia. They can be integrated into the territorial planning documentation as a thematic enrichment of territorial systems of ecological stability, which focus only on the ecological aspects of the local green infrastructure. The implementation of the linear green corridors presented in this paper could be facilitated mainly at the local and micro-

regional level, with a local governmental support. This new conception of green infrastructure and greenways can build upon the rich tradition of Landscape Ecological Planning (LANDEP) and Territorial System of Ecological Stability (TSES or ÚSES) in Slovakia.

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### **References**

- Ahern, J. (2007). Green infrastructure for cities: the spatial dimension. In P. Brown (Ed.) *Cities of the Future: Towards Integrated Sustainable Water and Landscape Management* (pp. 267–283). London: IWA Publishing.
- Benedict, M.A., & McMahon, E.T. (2006). *Green infrastructure – linking landscapes and communities*. Washington: Island Press, 299 p., ISBN 1-559-63558-4.0.
- Fábos, J.Gy., & Ryan, R.L. (2004). International greenway planning: an introduction. *Landscape and Urban Planning*, 68(2-3), 43-146.
- Filepné Kovács, K., & Egyed, A. (2011). Reviving of natural networks in Hungary. *Journal of Landscape Ecology*, 9(1), 73-85.
- Filepné Kovács, K., Nagy, G.G., & Kollányi, L. (2011). Evaluation of rural landscape functions based on domestic case study. *Applied Ecology and Environmental Research*, 10(1), 17-30.
- Filepné Kovács, K., Valánszki, I., Sallay, A., & Jombach, S. (2013). Integration of landscape planning and protection in the spatial planning practices of European countries. *Journal of Landscape Ecology*, 11(2), 279-290.
- Filepné Kovács, K., Valánszki, I., Jombach, S., Csemez, A., & Sallay, Á. (2014). Rural regions with different landscape functions: Comparison analysis of two pilot regions in Hungary, *Applied Ecology and Environmental Research*, 12(4), 867-886.
- Halaj, P. (2010). Riečne systémy a ich funkcie. *Životné prostredie*, 44(3), 149-152.
- Kurz, P., Machatschek, M., & Iglhauser, B. (2011). *Hecken: Geschichte und Ökologie; Anlage, Erhaltung & Nutzung*. 2. Auflage. Graz; Stuttgart: Leopold Stocker Verlag. 440 s. ISBN 978-3-7020-1315-8.

- Muchová, Z., Leitmanová, M., & Petrovič, F. (2016). Possibilities of optimal land use as a consequence of lessons learned from land consolidation projects (Slovakia). *Ecological Engineering*, 90, 294-306.
- Salašová, A. (2012). Ochrana krajinného rázu a rozvoj valašské dědiny. *Životné prostredie*, 46(4), 186-192.
- Supuka, J., Šinka, K., Pucherová, Z., Verešová, M., Feriancová, L., Bihuňová, M., & Kuczman, G. (2013). *Landscape Structure and Biodiversity of Woody Plants in the Agricultural Landscape*. Brno: Mendel University in Brno. 187 p. ISBN 978-80-7375-905-6.
- Tóth, A. (2015). *Green Infrastructure of the Rural Settlement and its Surrounding Landscape*. PhD Thesis. Slovak University of Agriculture in Nitra. 120 A3 p.