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## GREEN INFRASTRUCTURE IN THE CONTEXT OF RURAL SPACE RESTORATION AND DESIGN

ATTILA TÓTH AND L'UBICA FERIANCOVÁ

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### Abstract

This paper focuses on green infrastructure (GI) for restoration and design of rural settlements in Slovakia. We explain our planning and design approaches with a case study developed for the rural settlement *Tvrdošovce*, situated in the south-western region of Slovakia, in the *Danube Lowland*. Our case study is a complex landscape architectural project conducted at three planning levels and scales based on administrative and territorial units of different areas. At the first level, there is a GI concept for the micro-region *Cergát-Váh* (area: 195.70 km<sup>2</sup>, 15,545 inhabitants), the second planning level consists of a more detailed concept concerning the cadastral area of the village *Tvrdošovce* (area: 55.56 km<sup>2</sup>, 5,301 inhabitants) with the intention to create a visual and functional linkage between settlement and landscape. At the third planning level, we deal with public space design at a fine scale relating to the central part of the village *Tvrdošovce* (0.09 km<sup>2</sup> within the overall urban area of the village that covers around 3 km<sup>2</sup>). The area in focus is the present village centre and the linear historic open space situated in the central part of the village. Our design follows the surrounding landscape and uses principles and rules of rural space design. It is a qualitative contribution to the rural community and its micro-region.

Key words:

Green ways, green infrastructure,  
linear historic open space,  
micro-region, planning levels,  
rural settlement



## Introduction

The development of the Slovak countryside during the 20<sup>th</sup> century brought a lot of noticeable changes, which left behind a modified village and visible footprints on its urban structure, aesthetic values, social life and local identity. These changes negatively impacted the image of contemporary rural settlements and are related to the previous political and social structure of the socialistic planning economy model, e.g. introducing an urban architecture, which was foreign to this rural context, see figure 1.



However, these interventions are not only an attribute of the last century but are also part of ongoing development. In order to improve the image of Slovak villages, it is necessary to define the current deficiencies and find sustainable development solutions. From the urbanism and architecture point of view, the most common obstacles are oversized transport structures or ‘Routine-catalogue’ architecture, which did not, and still does not, have much to do with the rural character and local identity of the settlement. This phenomenon is related to the core concept of socialistic urbanism and architecture as tools for the realisation of a centralised planning system. One of the goals was to match life quality of the countryside with urban living standards. To fulfil this goal, a modernistic ‘catalogue’ for housing units and uniform public buildings (e.g. schools, service and community centers) was developed. In the second half of the 20<sup>th</sup> century, there was a boom in construction of new transportation structures as well as a focus on improving such existing structures by sealing new asphalt and concrete surfaces. However, according to contemporary norms for traffic, this design is significantly oversized, meaning that more open spaces are covered by impermeable surfaces than is really needed. Today’s traffic engineers pay more consideration to cars than people and, therefore, streets are dominated by cars rather than pedestrians (Šarafín, 2006).

**Figure 1**  
The photos show the typology of urban architecture introduced to Slovak rural settlements during the socialistic regime. This architectural morphology was applied not only to public buildings (on the left) but also to private family houses (on the right).

The rural character of the Slovak countryside has been significantly disrupted and still awaits renewal. The image of the street as a common and convenient public space for village inhabitants has noticeably changed. As Štěpánková and Kristiánová (2012, p. 180) state, «In most cases the use of streetscapes is reduced only to the transportation function and there is an absence of public spaces represented by accompanying greenery or parking possibilities». Every house has its own front garden sheltered by a high fence, which caused the extinction of authentic Slovak village characteristics, such as the doorway with a shaded bench under a spreading tree. Thereby, the street has lost a very important semi-public space function, which represented a soft transition from public streetscape to private courtyards. Similarly, the rural architecture today faces a significant pressure from the individualistic approach, which is typical for the era of globalisation and market economy. It does not comply with logic and sustainable aesthetics of urban planning principles such as the building and street line or the general architectural characteristics of the specific region, e.g. materials, roof inclination or facade.

In order to find adequate planning solutions for rural spaces, it is crucial to identify deficiencies of rural space from a landscape architecture and planning point of view. In the open agricultural land, the most common problem is connected to consequences of the agricultural collectivisation, which aims at receiving greater profits from collectively owned land. The process of collectivisation in agriculture was typical for Eastern European socialistic systems. It consisted of uniting small pieces of land into larger blocks that allowed for more intensive industrialised farming. This was a profitable solution in terms of economy, but at the same time, it brought with it a range of negative environmental impacts such as intensive drainage of landscapes, deforestation, removing vegetation along roads, watercourses, shelter belts or field baulks. The agricultural landscape lost its inherent diversity and natural permeability. All these interventions caused an ecological destabilisation of the landscape, which now needs to undergo rehabilitation. Sacral elements, which have been a traditional and integral part of the open land and field roads of Slovak villages, have been neglected and long forgotten. Many of them have even disappeared. The villagers gradually lost their attachment to the landscape – they do not know the field roads, the meadow vegetation and the local fauna anymore. They do not go for walks along the brook, to the meadows or into the woods. The contact and the linkage between settlement and landscape, as well as between man and nature, have considerably faded. Disruptive elements were introduced to the built up areas of the villages, often with good intentions. One example of this is the introduction of coniferous woody plants to rural settlements situated in southern regions of Slovakia surrounded by bottomland vegetation and agricultural landscape (eg. *Thuja occidentalis*, *Platyclusus orientalis*, *Picea abies*, *Picea pungens*, *Pinus nigra*, *Pinus sylvestris* and other species). The front gardens and public spaces in these villages have been, and still are, 'decorated' with introduced woody plants like thuja, as well as by autochthonous (native, domestic), however, for concrete regions, nonspecific woody plants like juniper, spruce, fir or pine. This trend is in line with the current tendency of using a global pool of plants from international nurseries (Ignatieva, 2011).



Historic village centres were the most significant public open spaces from a cultural, historical and social point of view. In the 20<sup>th</sup> century, these spaces often turned into overcrowded parks with a lot of conifers or uniform and strict alleys, which have taken away the cultural and historical value and identity, and the main function of these spaces has been lost – to be a spacious and clear green village square.

The open space of the village centre did represent, in the context of historical development, a particularly central space where the economic, social and cultural village life was concentrated. Around this space the village gradually grew and, therefore, represents the most valuable historical legacy concerning the organic development of urban structures. It is the main attribute of village identity.

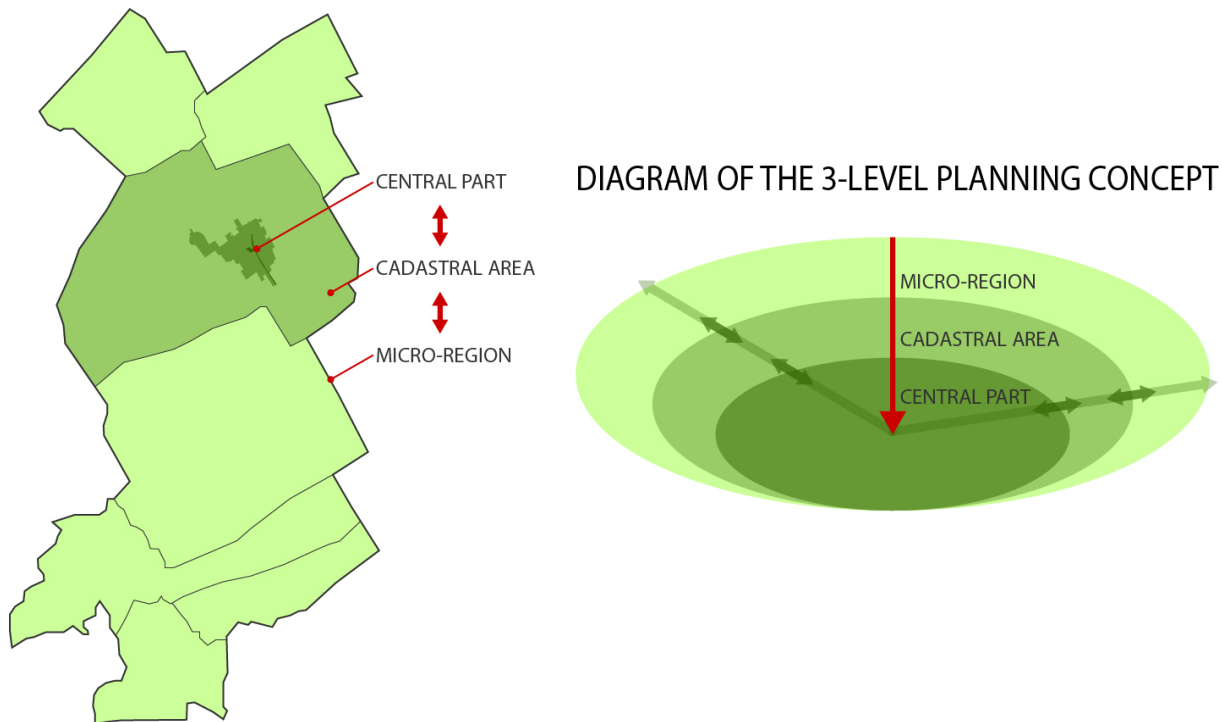
In different cultural settings (eg. in German-speaking countries), rural settlements are interlinked with a common infrastructure including transport, ecological, urban, landscape, social and economic layers. In Austria, a great importance is given to solving village reconstruction in a micro-regional context (Retzer Land, 2013). A further example of such a concept is the fellowship of six rural towns that decided to join into one administrative unit – Nettetal in Germany (Optendrenk, 2013). Within cadastral areas of the member municipalities of the micro-region Retzer Land (Austria) or the town fellowship Nettetal (Germany), there are concepts dedicated to interlinking settlements and landscapes and creating a functionally and visually coherent and harmonious whole, including both, open land and built-up areas. To fulfil all these requirements, there is a landscape planning strategy – *green infrastructure (GI)* – that is being implemented in several countries in Europe and around the world. It is also included in the Europe 2020 strategy (European Commission, 2013) and in terms of the services and benefits provided by GI, it can be regarded as a valuable and constructive approach, which may also be applied to the restoration of the Slovak countryside.

This paper is dedicated to explaining the importance of the GI concept for village restoration and rural development in Slovakia. We present our results from a case study conducted in the rural settlement *Tvrdošovce* situated in the *Danube Lowland*. For this settlement, a GI concept was developed at micro-regional and cadastral level. At the local level, a complex landscape architectural design has been developed for the central part of the village dealing with a linear open space of the historic streetscape. This urban structure represents a significant cultural heritage with important historical legacy. In our design, we deal with these issues in order to create a valuable contemporary open space for the inhabitants.

Our research question is how contemporary GI planning principles can be adapted in order to constructively contribute to restoration and design of rural spaces with specific urban and landscape structures.

## Description of the case study

The main focus of this case study is the landscape architectural development of the rural settlement *Tvrdošovce* and its GI at three planning levels, see figure 2.



At the micro-regional level, we developed a GI concept for the micro-region *Cergát-Váh* (a geographically delimited area with common natural, demographic, historic, cultural and other features; an interest association of 7 rural settlements, including the village *Tvrdošovce*). Its aims are a) to support sustainable development of the micro-region as a coherent whole, b) to stimulate local economy, c) to develop agri tourism and to strengthen ecological stability of the area. Thereby, a complex micro-regional GI can be built and public awareness of the landscape can be raised.

The second intermediate planning level is represented by the cadastral area of the village *Tvrdošovce* (the administrative territory of the municipality, including the built-up urban area and the open agricultural land). For this settlement, a more detailed GI concept has been developed. The principal goals of this concept are a) to create a visual and functional linkage between settlement and landscape and convert it into a continuous and harmonious whole, b) to raise the visual and perceived value of the settlement and landscape image; to make the open land accessible for the inhabitants and visitors, c) to improve the local green infrastructure and to increase the ecological stability of the area.

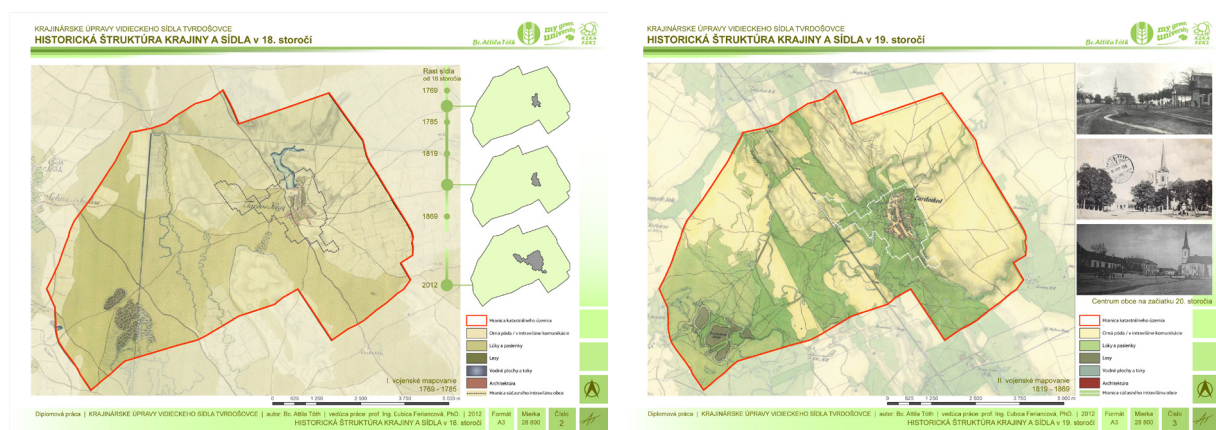
**Figure 2**  
The diagram shows the idea of a coherent and integrated planning approach at three planning levels and scales.



The main goal of the third planning level, which concerns the village centre (the urban core of the village consisting of the historic streetscape – the common, and the present village centre defined by public facilities), is to develop a unified landscape architectural arrangement of the village center including the historic streetscape, which arose in the Middle Ages. The linear open space in the village center is unified by landscape architectural tools in order to convert it into an attractive public space. Our concept emphasises the identity and the rural character of the target area.

## Methodology

One of the first steps in this study process was a detailed analysis of the historic landscape, settlement structures and the spatial development of the village *Tvrdošovce*. The method used for this analysis was a visual interpretation of historic maps of the cadastral area from the 18<sup>th</sup> and 19<sup>th</sup> century (the 1<sup>st</sup> and 2<sup>nd</sup> military mapping) as well as visual interpretation of historic photographs from the end of the 19<sup>th</sup> and the beginning of the 20<sup>th</sup> century, see figure 3.



Compared to figure 4, a significantly higher portion of grasslands in relation to arable land is visible and a considerably denser communication network in the landscape exists. Therefore, it can be stated that the open landscape structures were more balanced, permeable and accessible in historical periods compared to the present.

To develop the landscape architectural design of the central open space of the village, it was necessary to analyse the geographic and natural conditions of the area including spatial, climate, temperature, precipitation, wind, geological, soil, hydrological and potential-natural-vegetation characteristics.

**Figure 3**  
Historic landscape and settlement structures of the village *Tvrdošovce* in the 18<sup>th</sup> and the 19<sup>th</sup> century (Tóth, 2012, pp. 45–46).

To develop a new landscape architectural arrangement for the rural settlement *Tvrdošovce*, we decided to apply planning at three levels. The first level is represented by the micro-region *Cergát-Váh* (this micro-region consists of seven rural settlements including the village *Tvrdošovce*, *authors' note*), the second level is the cadastral area of the village and the third level, the central part of the village consisting of the linear historic core and the present village center.

At the micro-regional and cadastral level, we developed a greenways concept. Greenways stand for natural or designed linear open spaces along anthropogenic or natural corridors for pedestrians, cyclists and other users. They connect the landscape with the urban area and provide society with social, economic and environmental services. For developing this greenways concept, GIS processing and visual interpretation of map data was applied.

The primary structure of this concept is composed of linear elements linking rural settlements of the micro-region and forming a coherent GI. At cadastral level, we used GIS to create landscape planning schemes depicting the landscape in different layers such as water, transport, landscape, urban and green space structure. These schemes were used as a basis to develop a detailed GI concept at cadastral level.

In order to create the public space design of the village center, we applied principles from Slovak, Czech and Austrian authors, who have been continually engaged with long term research into rural space design (Mareček, 2006; Plešl, 2003; Šarafín and Tóth, 2011).

To improve the design, we went on research trips to *Burgenland* and *Lower Austria* (two Austrian regions located in the eastern part of the country). We drew inspiration from public space arrangements of villages located in these regions because their urban structure proved to be very similar to Slovak settlements.

Within the design concept, we worked out a zonation of the designed area, which was divided into four main zones: 1) sport and recreational spaces of the historic streetscape, 2) public spaces of the present village centre, 3) main promenade of the historic streetscape and 4) public spaces of the living street situated in the contact zone between settlement and landscape (Tóth, 2012).

As a starting point for public space design of the village center, we used the inventory of woody plants in the central part of the village *Tvrdošovce*, developed by Tóth (2010). «*Urban greenery and woody plants represent a very important component of public space design as they have historical, social, aesthetic, recreational and perceptual values*» (Supuka, 1998, p. 115). The complex knowledge of woody plants, acquired

during the research from an inventory and assessment of woody plants (Tóth, 2010), made it possible to work out a more ecological public space design concept, which utilizes the spatial potential of the village center.

## Results

The results are presented below using the same structure as the 3-level planning concept.

### Green infrastructure (GI) at the micro-regional planning level

The GI of the micro-region aims at creating a coherent and integrated green system with ecological, spatial, social and economic dimensions, see figure 4. The figure shows the green infrastructure concept at micro-regional level containing primary and secondary greenways structures and areal elements of the green infrastructure. The developed concept contains proposals of how to enhance ecological stability of the area. It supports a sustainable development of rural settlements; improves visual and perceptual values of the countryside; creates a functional and visual linkage between built-up area and open land; provides recreational, educational and cultural functions of green structures and promotes sustainable tourism and non-motorised transport.

Figure 4  
Greenways concept for the micro-region Cergát-Váh (Tóth, 2012, p. 44).



Enhancing ecological stability is mainly achieved by increasing the portion of non-forest woody vegetation in the landscape. A higher portion of non-forest woody vegetation would improve the existing landscape structures impacted by agricultural collectivisation. We propose to enhance the portion of woody vegetation in the landscape, mainly by establishing new linear vegetation structures along field routes and watercourses. This approach would not only provide aesthetic benefits (unifying the common image of the rural settlement and landscape) but also environmental benefits, such as increasing biodiversity and structuring the landscape through bio-corridors for wildlife in a currently impermeable landscape. These migration corridors are missing in the present agricultural landscape of Slovakia. Besides the mentioned ecological benefits, an increase in non-forest woody vegetation would also eliminate one of the largest problems of Slovak agricultural landscapes, soil erosion. Vegetation structures next to watercourses would lower the eutrophication of these water resources. There is also a NATURA 2000 area *Panské lúky* (SKUEV0095; area: 77.79 ha) within the cadastral area, which functions as a protective landscape tool at policy level and aims at protecting the GI and increasing ecological stability of the area. Our greenways concept is based on results from long term research done by Ahern (2004) into greenways planning and implementation. He determines greenways as an efficient planning tool for the protection of maximal amounts of natural resources through minimal land consumption (hypothesis of coexistence). Greenways support biological and physical functions of the landscape and, therefore, they are important for the sustainable development of a spatial unit.

The main dimensions and functions of the green infrastructure at micro-regional, cadastral area and built-up area level are summarized in table 1.



**Table 1**  
Overview of principles and functions of greenways, green networks and green infrastructures (Feriancová and Tóth, 2012, p. 46).

Ecological Dimension	Urban and Spatial Dimension	Social Dimension	Economic Dimension
Bio-corridors, bio-centres, interactive elements and natural systems	Aesthetic, design and cognitive function; visual-landscape-forming, compositional and spatial significance; urban-space-forming element	Recreational function	Agriculture and forestry function
Importance for nature conservation, environmental and landscape protection			
Promotion of sustainable land use, development and way of life; linking of greater natural areas, existing and planned green spaces	Connection and transport function	Educational function	Positive impact on local economy
	Linking inner-urban areas, connecting the urban area with the surrounding landscape	Cultural function	Positive impact on sustainable tourism
Strengthening of ecological stability of the area	Inclusion of major source and destination points and public facilities	Participation in design and maintenance of the green network	Positive impact on mobility
Urban ecology and urban climate function	Multifunctional ways for non-motorized users	Safe and attractive routes to school	

The main elements of the primary greenways structure are the river *Váh*, as the longest river in Slovakia, it is of supra regional importance and impacts several regions, and the canal *Cergát* (regional importance). Within the cadastral area of *Tvrdošovce*, the village brook is the main linking element between settlement and landscape. The secondary structure of the micro-regional GI consists of field roads connecting settlements with each other and with recreational spaces in the open land. They make the agricultural landscape accessible and represent a cultural and historical legacy in the form of physical and social linkages between settlements. This historical heritage has to be protected, improved and appropriately used. The vision for *Cergát-Váh* is to become a micro-region of countryside tourism and agri tourism by using the proposed GI system to offer recreational use of the agricultural landscape. The role of municipal self-governments is to find their position and tasks within the vision of the micro-region and to work out a common strategy for further sustainable development.

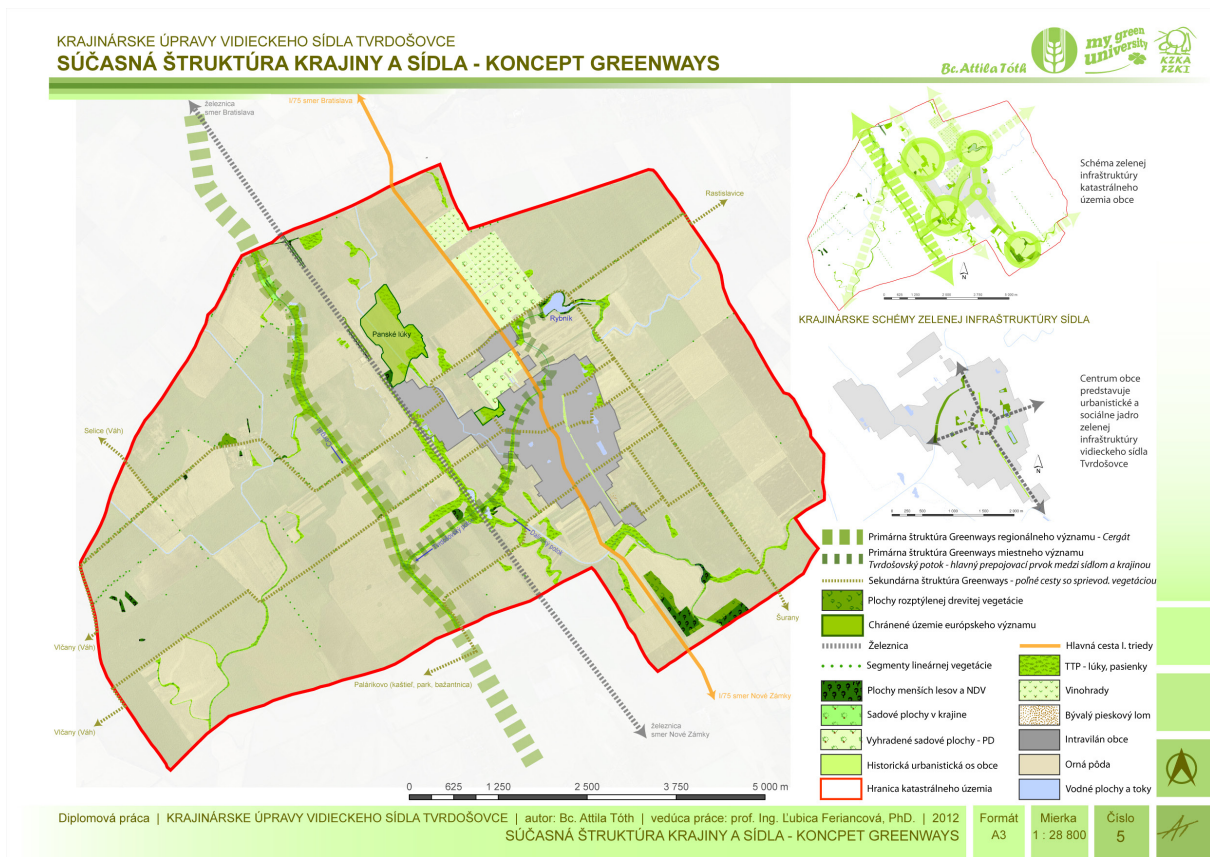
## Green infrastructure (GI) at the cadastral area planning level

Landscape planning at the cadastral level resulted in a more detailed GI concept, which deepens the micro-regional concept and makes it more thorough. The principal function of this concept is to link the settlement and landscape visually and functionally and, thereby, create a coherent and visually unified whole, see figure 5.

The green infrastructure at cadastral area level (figure 5) depicts present landscape and settlement structures where structural changes are clearly visible compared to historical sources. The concept contains primary and secondary greenway structures as interlinking elements as well as more ecologically significant components such as protected areas, smaller woods, orchards, grasslands, etc.

The GI concept has been developed by adapting landscape planning schemes. Its main focus is the historic village center, which consists of a linear open space of the wide historic streetscape of significant cultural, historical and social value. It is one of the most important landmarks of the village and, therefore, became a space of particular interest for public space design. This linear open space in the historic village center, together with other public green spaces, creates the GI within the built-up

Figure 5  
Current landscape and settlement structures – Greenways concept (Tóth, 2012, p. 48).



area. Linkages between spatial elements of the GI are provided by linear greenway elements, which are represented within the built-up area by streets and their accompanying green elements.

A considerable amount of small lakes within the built-up area represents a historical legacy of the settlements' hydrological system. These lakes have a great potential to improve microclimate and to provide attractive open spaces (lakesides) for sport and recreational use for inhabitants and visitors.

Elements of the village GI, which have great local significance, are the historic streetscape and the village brook, which also has regional significance. The village brook functions as the main linking element between settlement and landscape, as it flows through the built-up area and continues to the open land. Architectural improvements along the brook are proposed in order to convert it into a natural 'green promenade' for the village.

### Green infrastructure (GI) and public space design at the central part planning level

The existing public space design of the historic streetscape suggests a visual and functional integration of the linear open space with the present village center. The open space improvements can then convert the central public space into a continuous, harmonious whole, see figure 6.

Within the landscape architectural concept we developed a unified public space design for the central streetscape and the present village center. The additional photos show the urban environment of the village center in order to understand the spatial and perceptual characteristics of the designed area.

The proposed changes have a clear compositional structure, typical and suitable for rural spaces. The predominant vegetation elements are represented by lawns with solitary and group plantings of high deciduous trees – limes (*Tilia cordata*, *Tilia platyphyllos*), oaks (*Quercus robur*), maples (*Acer platanoides*, *Acer campestre*) and ashes (*Fraxinus excelsior*) as fundamental trees supplemented by birches (*Betula pendula*), willows (*Salix alba*; *Salix alba* 'Tristis'), cherry trees (*Prunus avium*), apple trees (*Malus domestica*, *Malus sylvestris*) and pear trees (*Pyrus communis*, *Pyrus pyraster*). A significant portion of the vegetation elements are woody plants and consist of existing healthy tree plantings, which have a higher landscape architectural value and are in accordance with the compositional aim of the design (particularly in the case of common ash, common birch, small-leaved lime and Norway maple, based on the woody plants inventory developed in 2010 by Tóth). Cherry trees are the most visually unifying elements of the historic village center. They make up a conceptual 'ribbon', meande-



ring through the whole linear space. The idea of a stylised common orchard is based on the historic function of this space, which has always been a common ‘property’ of villagers. Continuous grass surfaces with solitary and group plantings of high trees provide a more efficient use of the spatial potential of linear green space. As Kuczman (2008, p. 34) states, «vegetation elements can decrease the visual impact of negative elements of a streetscape and thereby they are able to improve the visual quality of a streetscape and the settlement as a whole». These spatial improvements return historic and social value to the space and raise its perceived quality.

According to the predominant function and use, we divided the designed area into four main zones. North of the church, there are wider areas of the historic streetscape aimed at sport and recreation. Here, the open space of the historic streetscape is at its widest, in some parts up to 40 meters. The provision of lawns in combination with the calm character of the living streetscape, determine its potential for becoming a sport and recreational public space right in the village center. It is designed to have continuous lawns in the middle of the streetscape, which are framed by tree groupings and solitary trees. This attractive and calm public space has potential to become a safe playground for children, a place to sit- or lie-down on the grass or in the shade of a spreading tree.

Figure 6  
Landscape architectural concept for the central part of village Tvrdosovce (Tóth, 2012, p. 49).



The historic streetscape will as well attract young and elderly residents to enjoy sitting-down on a bench, have a picnic on the grass or to engage in sport activities. In the southern part of this zone, there will be an open air gallery displaying carvings from local woodcarvers. These wood carvings will attract visitors to step onto the 'green carpet' of the streetscape and to look at the open air gallery surrounded by greenery.

The next zone is located in the southern part of the streetscape where the built-up area borders directly on the agricultural open land. Attractive views to the landscape exist here, and its compositional elements significantly impact on the perception of this space. The distance between this section and the village center provides a calm living streetscape. It also contains common spacious front gardens, which belong to the inhabitants and adorn the whole streetscape. The adjacent open land attracts walkers and provides the possibility to observe the natural expressions of beauty of the agricultural landscape, its variety and diversity. Future prospects to construct a thermal recreational complex at the thermal well on the south-eastern boundary of the built-up area, create a future image of this part of the central village streetscape. It would create an extension to the current village promenade, from the historic square up to the planned thermal recreational facility.

In terms of public space design, these two zones situated in the central part of the streetscape are of utmost importance.

The current center is defined by existing community facilities (*church, kindergartens, florist shops, chemist's, pizzeria, café, confectioner's, community guest house, community cultural centre with amphitheatre, municipal authority, firehouse, restaurant with bar, service centre, supermarket and bakery*), which are concentrated around the central part of the settlement, the midpoint of the village, which is marked by the main urban and architectural landmark – the church. Existing and proposed open spaces are the target for proposed public space design and consist of: 1) the historic square around the church with a gathering space at the oldest artesian well, 2) the surroundings of the community cultural center, 3) a new square in the courtyard of the municipal authority.

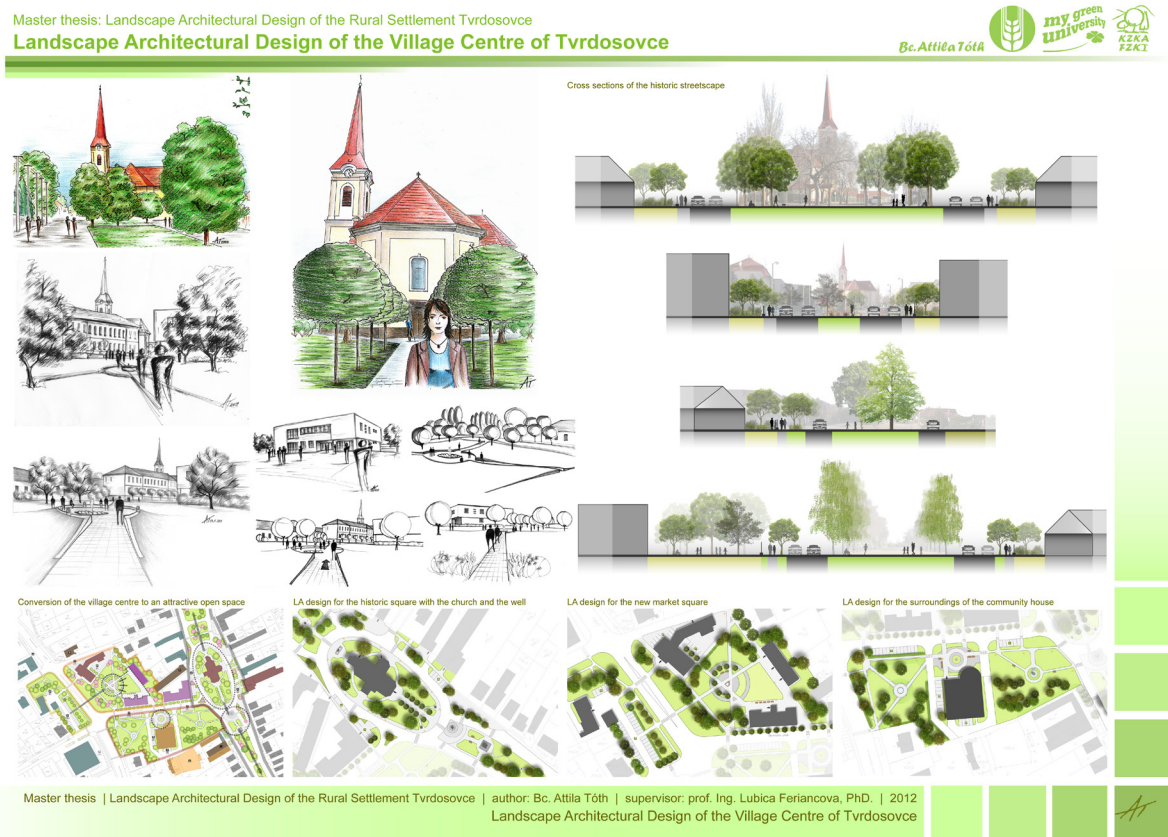
The main promenade in the historic center is formed by the streetscape leading from the church up to the primary school. It is used all year round as a gathering space in the central part of the village and also serves as a public space for inhabitants and visitors. During the school year, this area becomes the main route to school, therefore, the majority of users are children from the ages 6 to 15. The streetscape provides a true promenade-function during St. Stephan's days, at the end of August, when traffic is diverted and the whole street is used as a promenade, directing people from the historic square and the church along the market stands to the seasonally used car park in front of the thermal swim-

ming pool. In this green space, in front of the primary school, there is an amusement park with merry-go-rounds and a market fair. Another unifying element of the promenade composition is situated besides cherry trees, a stylised brook that meanders through the entire promenade. Of particular value to the locals are the existing horse chestnuts (*Aesculus hippocastanum* L.) planted around a baroque sacral sculpture and the common birches (*Betula pendula* Ehrh.) in front of the primary school. The importance given to these elements has warranted their inclusion into the design concept (Tóth, 2012).

In summary, it can be said that the design focuses on the present village center and the main promenade of the historic streetscape. It solves issues of parking (static traffic) in the village center by providing three larger car parks at the service center, the supermarket and the cultural center, as well as several smaller car parks near public facilities. Main elements of the present village centre are the historic square, the new square with a market place and the surroundings of the community center, see figure 7.

Cross sections of the streetscape on the right show the spatial dimensions of the designed streetscape as well as the relation to their framing urban structures. Plans on the bottom of the figure show selected

Figure 7  
Landscape architectural design of the village center of Tvrdosovce (Tóth, 2012, pp. 50–62).



public spaces of the village center – the historic square with the church, the multifunctional market square and the open space improvements at the community center. Provided are some additional sketches and drawings, which underline the intention of the designed public space improvements.

The spatial flexibility of the new market square is provided by a lawn adjacent to the central paved surface. This solution enables, if needed, a spatial extension to the square. The landscaping of the new square creates an attractive and cosy space for users. Soft terrain modelling brings pleasant dynamics to the small park to the left of the community center and provides attractive surroundings for sitting-down around a fountain. By removing the car park in front of the community centre, a gathering space with green surfaces and benches adds adequate social function to this space. The historic village square is improved by removing the fence around the church garden and, thus, makes an attractive public garden accessible. A path with gathering spaces loops around the church and serves during religious holidays for processions. The landscaping of the church garden is designed in two vertical dimensions. The higher dimension is composed of deciduous trees framing the views to the church, while the lower dimension, of ‘human scale’, comprises an alley, which lines the path leading to the main entrance. The core of the restored historic village square is a gathering space arranged around the reconstructed artesian well. The historic monument at the gathering space will become an integral part of the public space by removing an existing fence, similar to opening the church garden.

A stylised meandering brook adorns the main promenade and ‘returns’ to the village center in the form of a gravel brook bed lined by grasses and perennials. The stylised brook contains dynamic water elements such as drinking fountains and water playing elements for children. Thus, water returns to the public space of the historic streetscape in a way that corresponds to current user requirements, enhancing the rural character of the public space. The green strip, which frames the two roads, will once again become an attractive public space, a living streetscape. The stylised brook will not end at the lawn, but will continue through the parking area in a meandering line of darker pavement. Thereby, the green and the hard surfaces will be linked visually and thematically, which will contribute considerably to the perception of the streetscape as being a unified and coherent linear space. The paved surface of the parking area will add a subtlety. The green space in front of the primary school will serve during the school year as a playground-meadow and will extend the functionality of the open space of the primary school and promote interaction between the users of public and semi-public spaces. Preference is given to solitary and point plantings over linear vegetation elements. These can create long narrow spaces with a dominant linearity more effectively compared to uniform linear vegetation elements. They

make the composition of narrow spaces softer, cleaner and more transparent, as they enhance the visual linkage between the architectural objects along both sides of the linear open space. The sacral sculpture in front of the primary school deserves special attention. The architectural and spiritual value of this element is emphasised by old horse chestnuts, which are the oldest trees in the historic streetscape and certainly belong to the overall image of the sacral element. In the Slovak countryside, sacral elements (sculptures or crucifixes) were always accompanied by vegetation elements – mostly deciduous trees (lime trees, oaks, horse chestnuts, etc.). This cultural and historical heritage has to be maintained and protected and deserves to be restored in the future. To make this significant sacral element more attractive, the design proposes to remove the fence, thereby achieving a visual link to the public open space of the streetscape (Tóth, 2012).

## Discussion

The result of our work is the proposed landscape architectural design of the rural settlement *Tvrdošovce* at a micro-regional, cadastral and central part (fine scale design) level. The application of greenways and GI planning strategies in the process of rural settlement restoration provides a better integration of *Tvrdošovce* with the micro-region *Cergát-Váh*. It also incorporates new progressive experiences informed by Western and Nordic countries. It works in accordance with the Europe 2020 strategy that promotes research into GI and its implementation (European Commission, 2013). The network of greenways has not only a positive impact on the countryside restoration process, but at the same time, it renews the faded relationship and linkage between ‘*settlement-landscape*’ and ‘*man-nature*’. These issues are also discussed by Murphy and Mourek (2010) who state that greenways promote rural development, active tourism, local employment and improve relationships between inhabitants. This is one of the reasons for applying the greenways and GI strategy to re-design the rural settlement *Tvrdošovce*. These concepts can potentially intensify the cooperation between settlements of the micro-region, which currently is stagnating. Our design is a contribution at urban (e.g. re-connection of urban areas in the countryside), landscape (e.g. creation of a coherent rural landscape image integrating urban areas), ecological (e.g. enhancing the biodiversity and ecological stability of the landscape; creation of wildlife corridors), social (e.g. renewal of the linkage between man and landscape) and economic level (e.g. supporting local and micro-regional economics by agri tourism and other supplementary economic activities). A significant short-coming of current master plans of these settlements, is the fact that they do not plan the development of the village in micro-regional context. This fact prompted the development of a design at three planning levels. The developed greenways concept at cadastral level has to be understood as a thematic and content extension of the *Territorial System of Ecological Stability* de-



veloped within the master plan of the village *Tvrdošovce*. This statement is based on results of a long-term study done by Ahern (2004) who, among others, states that greenways represent an effective method to protect nature and landscape through occupying a relatively small area for multiple functions at the same time (ecological, urban, landscape creation, social, economic and other functions). Therefore, greenways are an effective and proven landscape planning tool, which should be applied to the process of Slovak village restoration, thus enhancing rural settlements and their micro-regional associations. The proposed planning approach has potential to solve issues of the Slovak countryside described by Štěpánková and Kristiánová (2012, p. 180) who state that, «*the most significant manifestation of suburbanisation in rural settlements is an extensive growing of built-up area into open land*». Most of the current projects and strategic rural development plans in Slovakia are developed only at local level. However, common trends of rural space design, e.g. in German speaking countries, prove that integrated planning approaches in rural space design, within the context of micro-regions, constitute a much higher improvement potential for the designed settlement. The results of a long-term cooperation between villages of micro-region *Retzer Land* in *Lower Austria* show that coordinated planning and design approaches of rural spaces within micro-regional context provide a significantly more dynamic development (Retzer Land, 2013). As Ahern (2004) explains, local plans have to always be solved in the context of greater territorial units in order to promote cooperation between individual settlements and their sustainable development in the fields of rural tourism, land use and local economy, which is in accordance with our 3-level planning approach. The importance of linkages in the landscape is also supported by research results from Jongman (2004) who focuses primarily on ecological corridors and networks. Thus, greenways and green networks can be regarded suitable for the Slovak countryside within a historic context. The interpretation of historic maps concludes that the amount of linkages between different settlements of the rural countryside of the 18<sup>th</sup> and 19<sup>th</sup> century was significantly higher and more complex than nowadays. A greenways concept provides a progressive strategy for renewal of rural communities and, thus, can also be considered an effective tool to build positive relationships between current villagers and their landscape. This is also proven by Hellmund and Smith (2006) who state that appropriately designed greenways can, besides obvious recreational use, create also social linkages between neighbourhoods and communities. These can increase civil interaction and, at the same time, extend and improve a sense of community. This attribute of greenways described by Hellmund and Smith validates the suitability of the GI planning strategy to solve present issues of the Slovak countryside. According to Mareček (2006), one of the greatest deficiencies of restoration projects for rural public spaces is that, only partial improvements are offered without an overall concept for public open spaces of a settlement and without attention to its historic context. Our integrated plan-

ning approach responds to this deficiency by offering a self-government approach of the village, a complex and unified design of the linear historic village core and creating the current village center to become a coherent whole. It responds to deficiencies of the project «*Revitalisation of the central zone of village Tvrdosovce (2010/2011)*», which focused only on a transportation concept and neglected a more complex urban and landscape architectural solution and also failed to connect design with the cultural and historical heritage of the village center. The mentioned revitalisation project did not utilize the spatial potential of the central part of the village and furthermore, the landscaping included in this project did not respect the basic compositional principles and rules of rural space design.

The aim of the landscape architectural design described in this paper is to rectify the deficiencies of the mentioned revitalisation project. Thereby, it contributes to a qualitative improvement of the central part of the village by creating an attractive public space for inhabitants. The significance of the village center for community life is also emphasised by Šarafín and Tóth (2011, p. 17) who state that one of the priorities of rural development has to be seen in the improvement of the village appearance. This includes raising the attractiveness of public spaces for inhabitants and visitors because they represent the center of community life. Design tools are used that are in line with Mareček (2006) and other experts' findings on rural space design suitable for historic village centers, which, in summary, are the use of solitary trees and groups of high-stem deciduous trees and the maintenance of continuous central open spaces in the form of lawns.

## Conclusions

This paper brings forward two points of discussion: a) the importance of interlinking settlements and landscapes into a coherent whole, and b) understanding rural villages as being part of the cultural landscape. The micro-regional greenways concept developed at the first planning level represents a complex green infrastructure with ecological, urban, landscaping, social and economic dimensions. The designed GI system consists of primary and secondary structures. The primary structures are represented by bio-corridors of supra-regional, regional or local importance within the *Territorial System of Ecological Stability (TSES)*. The secondary structures respond to historical legacy of how rural settlements were linked in the past. These linkages are renewed in a way, which corresponds to current cultural, social and demographical conditions of the Slovak countryside. Our greenways concept at micro-regional level contributes to a sustainable development of the micro-region to become a coherent whole. The micro-regional GI presents a tool with the potential to strengthen the ecological stability of the area and to contribute to the master plans of the villages by providing thematic and content improvement of *TSES* concepts.

The greenways system supports development of rural tourism within the micro-region, primarily in the form of agri tourism. The concept emphasises attractions and offers sport and recreation possibilities to visitors. This concept also describes the potential for further development of municipalities. Greenways make the agricultural landscape accessible for users by providing cycle trails, pedestrian recreational routes and routes, which enable an experience of the agricultural landscape, its vegetation, diversity, aesthetic value and wild life. Making the landscape accessible will attract inhabitants to visit valuable places outside the boundaries of the built-up area, in the open land. Inhabitants will become acquainted with the surrounding landscape and will begin to take ownership of it and finally, protect it.

The main purpose of primary and secondary greenway structures at cadastral level is to link settlement and landscape visually and functionally. The greenways concept at cadastral level creates a unified and harmonious image of the settlement and landscape. In our case study, the main linking element between the built-up area and the open land, is the village brook. This brook is the primary driver of a conceptual landscape architectural design, which aims at creating a natural 'green' promenade for the village. The secondary greenways structures connect the settlement with the surrounding landscape and neighbour municipalities. Thereby, the historical heritage of linkages in the landscape will be renewed and the landscape will become accessible. The developed concept significantly contributes to ecology, tourism, settlement and landscape image, local economy and recreation opportunities for inhabitants and visitors.

At the third planning level, we developed a landscape architectural design for the central part of the village, which comprises a complex and unified solution for the whole central space consisting of the linear historic streetscape and the current village center. The design solution uses principles and rules of rural space design and also responds to the historical development of this significant space. The goal is to maintain and enhance the identity as well as the cultural and historical heritage of the site. Landscape architectural and urban design tools are used to unify the historic streetscape and the central space of the village. This study focuses on converting the village center into an attractive contemporary public space for the municipality.

Our results can contribute to the sustainable development of the micro-region *Cergát-Váh* and the rural community *Tvrdošovce*.

The greenways concept can be used as a basis for developing a common sustainable development plan and strategy for the micro-region. At the cadastral level, it represents relevant thematic and content improvement of the master plan and thereby contributes to a sustainable development of the settlement.

The landscape architectural design presented here may be regarded an important methodical basis for the self-government of the municipality in order to develop a new compositional arrangement of the village center, which will respond to the cultural and historical legacy, while also responding to current needs of inhabitants.

We further propose to generate detailed greenways concepts for the other municipalities of the micro-region as well. These should be based on thorough analysis of settlement and landscape structures. After a detailed analysis of historic structures, we propose to develop urban design projects for the public spaces of these communities.

A good contribution to the cadastral area of the village *Tvrdošovce*, could be the development of partial landscape design projects for landscape areas that have recreational potential. The village GI could be improved through further design projects for other public green spaces.

The public space interventions proposed at the third planning level are being gradually implemented, mostly by self-initiative and voluntary work of the community and is also supported by the local government through participative planning and social inclusion. The concept has also functioned as a strong negotiation tool acting against development pressures of a major supermarket chain, which had plans to take charge of one of the open spaces in the village center. The local government will utilise the design developed at the third planning level, to apply for the *Green Village* grant announced by the national *Village Renewal Programme* (2014). At higher planning levels, some further negotiations are needed to advocate the implementation of the GI strategy and its integration into local and regional planning policy.

The planning approach presented in this case study points to possible ways of planning and designing rural areas in Slovakia and other European countries. The 3-level planning concept may be regarded an integrated way of designing rural communities and landscapes by focusing on linkages and interactions between settlements and landscapes at different scales. Linking rural communities within greater territorial or administrative units, like micro-regions, encourages better cooperation and networking, which is crucial for their economic, environmental and social viability and competitiveness in the regional context. Therefore, we propose that the presented approach should be further verified through more case studies in different contexts in order to confirm its relevance for GI planning in the context of rural space restoration and design.



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