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# Green infrastructure in Central, Eastern and South Eastern Europe: A universal solution to current environmental and spatial challenges?

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## **Abstract**

Green infrastructure as a concept has been introduced only lately in the frame of the sustainability and resilience approaches, and as a response to the natural disasters affecting both, urban areas and as well the country side. The analysis of scientific literature has shown that the concept of green infrastructure is most often related to the concepts of sustainability, resilience, smart cities and others. The cases, presented in the articles of this special issue, are showing that the concept of green infrastructure encompasses variety of the topics; that there is diversity in the administrative levels on which the policies and measures concerning green infrastructure can be applied and that the concept allows for a great amount of innovativeness of solutions and cross-sectoral approaches.

**Keywords:** green infrastructure, Central Europe, climate change, governance, planning, public health

## **Background of the special issue**

This special issue of the Urbani izziv journal is dedicated to the 2015 annual Spa-ce.net conference with the title ‘Green infrastructure in Central, Eastern and South Eastern Europe: A universal solution to current environmental and spatial challenges?’ Spa-ce.net is a network of spatial research and planning in Central, Eastern and South-Eastern Europe. The conference took place in Ljubljana at the University of Ljubljana, Biotechnical Faculty from September 27<sup>th</sup> to 29<sup>th</sup> 2015. The conference contributions in the frame of green infrastructure (shorter GI) addressed three subtopics: connection between the green infrastructure and the climate change, the green infrastructure and public health, and most of them the governance aspect of providing the GI. Altogether, around 50 researchers from nine countries participated in the conference and 20 of them (with/without co-authors) submitted an abstract. The few selected were further elaborated into the double peer-reviewed articles presented in this issue.

Contributions to the special issue are based either on projects, e.g. EU FP7 TURAS – Urban Resilience and Sustainability or EU COST project “Urban Allotment Gardens” (examination of the national case studies and different gardening cultures), studies performed in the frame of PhD researches/national research programmes or present reflections of the authors on the topic. Articles encompass different dimensions of GI: a more comprehensive, umbrella overlook focusing on the role and provision of GI on the level of the whole metropolitan area or city to the individual, micro scale case studies that concern only one element of the GI like community garden projects. Besides covering individual aspects of the

GI, the cross-over with other sectors is considered, for example with the transport and agriculture sectors. Apart from the strategic/governance issues technical solutions are presented such as designing of the parking lots that include green elements.

### **Introduction**

Central and Eastern European countries need to face several challenges in the field of spatial planning including the climate change impacts like increase in warm temperature extremes, decrease in summer precipitation, increase in water temperature, increasing risk of forest fire and decrease in economic values of forests (European Commission, shorter EC, 2013b), floods and natural disasters that especially impact densely populated areas. Study of the Croatian town of Dubrovnik (Hrdalo et al., 2016) suggests that the rapid development of built areas has worsened the situation, because flooding (which can be considered the worst climate change problem) has been more frequent over the last few years. This can be attributed to the loss of many absorptive surfaces (green surface) in the process of intensive construction. On one side increased centralisation of the countries together with the intensive urbanisation and high density of population bring congestions, air pollution, soil depletion and consumption, on the other, concentration of population also enables more efficient use of other resources, e.g. for the heating, water consumption etc. is utilised accordingly. Example of Poznan, described in the article of Gadziński (2016), shows what is happening in a big Central European cities which in the last 15 years focused on construction in this particular case the transport infrastructure to enable the suburban development and have neglected provision of other viable urban elements including the green areas.

Additionally, majority of the formerly heavy industrialised Central European cities possess plenty of unused degraded areas for valorisation of which resources and solutions are not always at disposal. For more efficient management of these areas some countries have prepared registers to promptly inform potential investors, adopted some legislative solutions and provide financial support. However, many of these areas stay unused and are left to further decay. In such a state they can present an opportunity for the GI establishment, as the authors Cvejić et al. (2016) show with the case of urban agriculture, this use can be of a temporary or permanent nature.

### **Definition of green infrastructure**

Green infrastructure as a concept has been introduced only lately in the frame of the sustainability and resilience approaches, and as a response to the natural disasters affecting both, urban areas and as well the country side. There are several definitions of what GI means with the basic diversification on whether they talk only about the urban infrastructure containing all the green areas in the city (parks, forests, water ways etc.) or as well the green infrastructure as the concept applied in the open space, e.g. the natural parks wider forest areas and the green areas in the countryside in general. The later version of the concept has been utilised for example in Austria. In articles of the special issue you will come across different definitions. For example, most commonly mentioned definition is the one of the European Commission in which **GREEN INFRASTRUCTURE** is ‘*a network of green spaces, habitats and ecosystems within a defined geographic areas, which can range in size from an entire country to a neighbourhood and encompass wild, semi-wild and developed environments (from wetlands to urban parks)*’ (EC, 2013a). Mell (2012) defines it as either an investment in green space or as an infrastructure with sustainable objectives. Benedict and McMahon (2006) support more functional definition: GI is ‘*the ecological framework needed for environmental, social and economic sustainability*’; a conservation approach focused on “actions in concert with land development, growth management and built infrastructure planning” ; while we can also come across more structural definitions like GI as a system of

hubs (large areas of natural vegetation such as protected areas, national and private forests, parks) and links (linear features such as smaller protected areas, river and stream corridors, linear woody buffers). According to the structure of GI, different authors mention different physical elements of GI that can be gathered into the following list: public parks, public green spaces, greenways, green corridors, roofs, walls, permeable vegetated surfaces, avenues and streets, urban forest, golf courses, community gardens, wetlands, bio filters and rain gardens (Byrne and Yang, 2009; Douglas 2011; Foster et al., 2011; Gill et al., 2007; Klemm et al., 2015; Jim et al., 2015).

Seen from above, a common feature of all definitions is the aspect of connectedness and networks that implies we should think beyond single elements from the list and besides ecological and environmental dimension consider also social and economic benefits (Mell, 2012.; Mathews et al., 2015; Kanbites & Owen, 2006; Tzoulas et al., 2007; Wright, 2011). For more information on definitions, introduction to the article of Hrdalo et al. (2016) summarizes them including Wright (2011) who notes that different disciplines have attached different environmental, political, social and economic meanings to the concept, with little agreement as to how it should be defined and interpreted.

Furthermore, in the context of definition one needs to be aware of similar terms, like “**green systems**”, used in Slovenian Spatial Development Strategy of the Republic of Slovenia (2004) which represents individual parts of open space in a town or a settlement differing in function, structure, and the degree of naturalness and of which components are parks, childrens’ playgrounds, school gardens, squares, vegetation and greenery along the streets, roads, water streams, and in residential areas, suburban meadows, suburban and urban forests and the like. Green systems manifest in different forms like a concept of green wedges and their interconnection, crucial connections and green corridors and the network of parks (Šuklje Erjavec, 2015).

### **Similar concepts**

The analysis of scientific literature has shown that the concept of green infrastructure is most often related to the concepts of sustainability, resilience, smart cities and others. Scopus hits for GI for the last 10 years indicate concept has been hitting it off in the last five years (from 2013 on) when both the frequency and the citations of articles have increased. The prevailing keywords of the most quoted articles on GI include sustainable development, energy efficiency, energy utilization, urban planning, sustainability, climate change, green space and storms. The journals of listed articles are predominantly environmentally and landscape oriented: Journal of Environmental Planning and Management, Environmental Management, Landscape and Urban Planning, and Urban Forestry and Urban Greening. The most quoted articles focus on finding solutions for better provision of public health in the cities, adapting the cities to climate change, discussing the eco-system services and assessments. These topics also resonate in the conference contributions.

The previous spa-ce.net conference (Bratislava, 2014) and experiences from the transnational projects, e.g. ReSource, have shown that Central European countries show certain resistance to the introduction of these new concepts – GI and related resilience. This might root in the capacity of the spatial planning epistemic communities and certain scepticism towards everything that is “eco”, environmental etc. More into detail, a survey performed in Slovenia in 2014 (Marot, 2014) has shown that for the concept of **resilience** we find contradictory understanding among researchers and practitioners: some think that the concept is no novelty, but rather just an adaptation of the ecological concept or description of already existing processes. Only to the few of them, the concept actually represents a novelty. Therefore majority agrees it can be compared to the concepts of sustainability, vulnerability and resilience. Besides conceptualisation the common problem is also the translation of the

new (buzz) words, usually introduced by the Western scientific communities, into the Slavic and other non-German languages. It can already happen that the epistemic community gets stuck in this dilemma and never or only slowly proceeds to the actual utilisation of the concepts in practice.

In comparison to GI and resilience, it could be summarized that sustainability now as a concept has been widely accepted and utilized in all countries with integration of the economic, social and physical characteristics of the system to be planned, e.g. urban system. Next, **vulnerability and adaptive capacity** present more elaborated approaches telling on ‘whether the system has the ability to adjust to or resist the perturbation, moderate potential damage, take advantage of opportunities and cope with the consequences of the residual transformations’ (Manuel-Navarrete et al., 2007). Inspection of the European climate adaptation platform shows results that do not necessarily resembles the actual state in the countries. The measurements of the achievements is done through the existing on-line links and not the actual documents or implemented measures, so for example for Slovenia we get the information that both the national adaptation strategy and action plan “exist” already but in reality they do not. What is reported on the platform is the website of the responsible ministry that tells about the progress of the preparation of these two documents but not the actual documents. Additionally, the platform shows very well performing Central European countries, apart from the existence of the adaptation platform which is still missing in the Baltic countries, Romania, Bulgaria, Hungary, Italy, Croatia, Slovakia and Slovenia. More focused research in Slovenia on the adaptive capacity shows that in reality the adaptive capacity of Slovenia is not sufficient due to the lack of institutional organization, educated staff, ground studies, e.g. regional climate change scenarios, low administrative capacity and low awareness (esp. compared to mitigation) (Kajfež Bogataj et al., 2014).

Green infrastructure can also present an important ingredient of a **smart city**, a concept that Vienna as a Central European city has mastered to the detail. The narrow definition talks about cities that provide services for inhabitants who benefit from the communication technology, while the wider concept demands the efficient use of energy sources and innovative technology to save energy and costs and thus improve the quality of the life. The concept presents a general guideline and a marketing strategy with the emphasis that one city is smart only when it enables all elements of the development, including the economy, environment, transport, human capital and living. Different authors mention different topics: Buro Happold (2013) talks about governance and growth, environment and natural resources, society and urban development and infrastructure while De Angelis et al (2013) concern with six elements that should be present in each smart city: economy, people, environment, governance, living and mobility. In both cases we can recognize GI as the one connecting environment and living, and at the same time introducing also the governance component. Among the long-term goals of the City of Vienna one finds the decrease of the emissions (CO<sub>2</sub>, green house gases), raising awareness of responsible use of sources (energy, water) and active role of citizens. Comprehensiveness and complexity are also recognisable in the seven principles Biggs, Schlueter and Schon (2015) defined for fostering resilient (city regions): 1. promote diversity; 2. manage connectivity, 3. manage control variables, 4. foster urban complex system thinking; 5. encourage learning practices and knowledge-building, 6. encourage participation and partnership and 7. deal with multi-level governance.

The successfulness of the Central European cities in providing the green infrastructure can also be measured through the **green city index** (Siemens, 2009) which rates the environmental performance of 30 leading EU cities by taking into account 30 individual indicators for each of them. Indicators cover a wide range of environmental areas – environmental governance, water consumption, waste management, greenhouse emissions. On the measurement scale the Central European cities rate in the last third of 30 EU cities

compared in this way. One can declare clear Nordic cities domination except for the Vienna of the Central European towns. The index also shows a strong correlation between wealth and a high overall ranking of the index – 9 out of 10 best ranked cities have GDP per capita of more than 31.000 EUR which is under the average country GDP of Eastern Europe. From the underperforming cities Vilnius performs the best on the 13<sup>th</sup> place and if followed by Riga in 15<sup>th</sup> place. The low standing of the other cities is according to the survey due to the low wealth, the legacy of history – decades of environmental neglect during communist period – mass housing, heavy industry in the past; while some of the positive examples include innovative ideas regarding specific environmental initiatives like the green capital concept applied in some of the cities, in 2016 in Ljubljana as well. Other pressing issues like unemployment and economic growth, illegal settlements and lower participative engagement of society additionally hinder the performance of these cities.

### **The governance aspect**

Examples that focus on green infrastructure as the planning - governance topic include Croatian, German, Polish, Serbian and Slovenian cases. At the conference the contributions under governance topic were divided into the four sections: GI and policy, GI – urban agriculture and conservation, GI – sustainability and cities and GI – perception and participation. These cases are more of a general nature, for example introduction of the resilience concept into Ljubljana strategic spatial planning, or concrete for a selected sector, e.g. agriculture or transport. Interventions also distinguish in whether they talk about a strategic framework and solutions in the form of legislation or regulation, e.g. the plans, or an exact small scale projects are described and elaborated. Both groups of examples as the authors are showing demand engagement from different actors including local communities, neighbourhoods, NGO's and local population.

Urban interventions can be valorised under different concepts, e.g. resilience being one. Concept of resilience is widely discussed in the article by **Schiappacasse and Müller (2015)** who reveal institutional challenges of planning the GI as a source of urban and regional resilience. This umbrella article connects the elements and principles of the urban resilience to the GI initiatives and their institutional frameworks. Functions and features of GI are described and various institutional challenges for the provision of GI are brought forward: multifunctional framework, mismatch between theory and practice, knowledge transfer, lack of formal planning status, common management area, genuine participation and financial constraints.

**Vieira Mejia et al. (2015)** dug into the past and present the GI in the context of German landscape planning. They present have the predecessors of GI including axes and boulevards, parks systems, garden cities and greenways including the coverage of their functions. In the frame of three principles of GI: multifunctionality, multi-scale and connectivity they try to connect the GI to the landscape planning tradition and practice in Germany. Importance of the GI for the multifunctionality is argued through ecosystem services (provisioning, regulating, supporting and cultural services), multiscale by exposing different spatial units of the GI (metropolitan region or city, districts or neighbourhoods, individual sites) and connectivity through the links GI should guarantee through green belts, greenways, conservation corridors and landscape linkages. Authors conclude that GI has much in common with its predecessors and landscape planning, however, it presents a more complex concept and should provide a wider range of benefits for human well-being and health as its predecessors did.

The Ljubljana case study of the inner-city neighbourhood of Tabor, described by **Pichler-Milanovič and Foški (2015)** is a good example of the collaborative planning and community participation activities (both top-down and bottom-up) towards developing GI. Resilience strategies and the urban revitalisation of derelict and/or underdeveloped urban sites with a

sustainable, participative approach take mainly two forms: horizontal, bringing together “place-based” policies in an area, and vertical, bringing together different levels of governance. In their opinion, the vital ingredients of resilience strategy are lively partnerships, which bring in civil society organisations and individuals, and embrace various tiers of government, as well as territorial governance. Such approach is especially valid in times of austerity when these projects can fill in for the bigger, state and city financed projects for which the financing is currently lacking. In these cases important factors of providing the GI are capacity, knowledge, networks between people and places, and attitudes. Investigation of these elements proved that in Ljubljana concept of GI is not sufficiently integrated in urban resilience strategy and several institutional and social obstacles exist. Implementation of the resilience and GI is for now strongly linked to the individual revitalisation projects like: traffic calming, upgrading of the Ljubljana embankments with communal infrastructure, new urban park(s), bridges, pedestrian areas, retrofitting of the buildings. This means that resiliency planning correlates the physical assets of place, such as scale and distribution of urban institutions, services, amenities, projects and other stakeholders with social networks and the territorial capital of a specific urban neighbourhood.

Revitalisation of the urban neighbourhoods can include also a project of urban agriculture such as an example of **Cvejić et al. (2015)**. Urban agriculture is a tool for including people in site planning and management since it requires presence of users on site. The proper facilitation process should consider two dimensions: multiple level operation engaging users, municipality and general public and gradual inclusion of users in site governance. Urban agriculture takes many forms – from vertical framing and rooftop garden to community farms and gardens. From the governance point of view it is differently integrated into policies and can present either a temporary (a year or two) or a longer period solution (for example 100 years) for the vacant sites. It is not necessarily planned or legal therefore consideration of different actors: academic and research institutions, private firms, governments, public and local authorities, the public at large and non-governmental organisations is crucial since urban farming raises a conflict between the food production and planning and the definition of the appropriate land use type. Currently different solutions are applied: zoning by law, combination with other land use functions (nature conservation, recreation), use of vacant public or private sites in transition (temporary use of space) or incorporation of food production spaces within new social housing projects. The case of “The Beyond the Construction Site” (BSC) from the city of Ljubljana proves that solutions do not necessarily need to be official (top-down) but can also function well in the case of bottom-up initiatives. However, case study confirmed that bottom-up initiatives need firm facilitation process; scientific knowledge should be combined with the local skills. UA has shown to be a powerful tool for socially inclusive UGI planning - including citizens in site planning and management since it requires the presence of users on site.

In a way, urban agriculture and other projects of community gardens across Europe mean reinventing the wheel since first allotment gardens according to the overview of authors **Lorbek and Martinsen (2015)** date back to mid- and late nineteenth century. The role of these allotment gardens corresponds to modern needs, although the reasons for greening are different. Similarity can be found in establishing the fruit and vegetable gardens for a self-grown food and healthy outdoor activities during leisure time, while there is the contrast in counterbalancing the overcrowded expanding industrial cities. Cities nowadays are no longer crowded because of the industry but rather because of the necessary commuting infrastructure, using the maximum floor space index for the new developments. Their functions have today changed with the emphasis on their environmental function, including the impact on the micro climate conditions, rainwater management, biodiversity and participatory urban planning practice. The difference between the allotments in different

Central European countries is in whether they are legally protected (only in Austria, Germany, the UK and Slovakia) and regulated. One of the regulated characteristics is whether they allow the overnight stay: while in Germany this is the common practice, in Slovenia it is not.

It is not sufficient to only make the green infrastructure available, the research interest is as well in observing its use. This was done by the author **Golobič Marušić (2015)** who observed use of three public spaces in Ljubljana with the focus on their social dimension. Use of behaviour mapping (repeated observation on different days, at different times and under different weather conditions) showed that occupancy patterns have some spatial logic and that in development and planning it is essential to pay more attention to the spatiality of uses, compatibility of uses in place and comprehensive usage-spatial relationships to produce well used and people friendly places. Such approach is important to provide layouts that meet inhabitants' needs in practice, for the interpretation of the (healthy) life styles and diversifying between the needs of different age groups and gender.

Public open spaces (shorter POS) were also the major focus of the authors **Vertelj Nared and Zavodnik Lamovšek (2015)** who took under the lens open spaces in small Slovenian towns, meaning the towns with less than 5,000 inhabitants. In the country of dispersed settlement (around 6,000 settlements in the area of 20,000 km<sup>2</sup>) a special attention should be given to the local planning and guaranteeing the GI also in the limited area and sources available. Public open space was considered as a city's non-built space accessible to the public and recognised as an essential structure to increase city's quality of life. Apart of the environmental value, open spaces have an important social value, encouraging interaction among users, residents' identification with cities, reduce the crime level, offer opportunities for sport and recreation and encourage active and healthy lifestyle. The research has shown that inhabitants of the selected 10 towns mostly use these places while running everyday errands, meeting others or walking. The fourth place takes watching the environment and people, followed by recreation and playing sports. The nature of small towns resembles in the type of green areas used since forest takes the first place (29%), then come domestic open space (27%), waterfront (16%), main city square (15%) and other sport playgrounds in the city (15%). Respondents gave also suggestions about the urban areas that should be in every city: sidewalks (78%), children's playground (73%), park (71%), sport playgrounds (62%) and bicycle paths (60%). The analysed towns diversify in the presence/absence of parks, public children playgrounds and squares reserved for pedestrians. Therefore, authors conclude that special attention in the planning should be directed towards planning and designing POS used daily or for specific user groups. If the local resources are too weak, standards should be introduced by the legislation, guidelines and spatial planning policy documents which would then demand local response.

GI can be perceived and considered by different sectors, including the transport system. **Gadziński (2015)** investigated the impact of local transport system on GI in the Metropolitan Area of Poznan. In his article he assessed the level of negative impact of the road transport sector on the GI, compared the policy on GI with the actual direction of changes in transport system and assessed plans for transport development and their future impact. His major presumption was that construction of the transport corridors under the sponsorship of EU funds, especially common in the Eastern European countries, as one of the most common threats to GI in urban areas, more particularly in the urban fringes. This cross-over field is called road ecology (term established and popularised by Forman in 1998) and means investigation of environmental impacts of the transport network construction such as impacts on biota and habitats, on wildlife population, population fragmentations, deterioration in the quality of the atmosphere/ microclimate and hydrosphere and irreversible changes in landscape. These effects can be divided according to the time period in which they occur:

during construction, in a short or a long term period after the infrastructure is put into use. Although the *EC White Paper on Transport – Roadmap to a Single European Transport Areas – Towards a competitive and resource efficient transport system* (2011) clearly sets goals to increase the public transport, introduce the greener transport etc., the actual data of modal split in Poznan shows minor increase in the use of public transport (from 37% to 43%) from 2000 to 2010; however, in the wider area of the metropolitan area of Poviát Poznan the use has on one side decreased from 25% to 18% and on the other the car use has increased from 51% to 66%. Decrease has been also reported for bicycles and walking (from 24% to 16%). This once more illustrates the decrease of the city population and spread of the suburban one spurred by the construction of city ring roads. Author concludes that transport planning should not go without considering the significant impacts on the green area it might induce, especially the physical impacts such as narrowing, splitting, limiting the size and the shape of the green areas available to the city people.

### **Tackling the climate change**

Climate change was addressed in two sessions and was divided between the policy aspects and the climate change and water subtopic which discussed different technical solutions which are already available or still under development.

Firstly, example of **Hrdalo et al. (2015)** presents an approach of the newest EU members (since 2013) for which European Commission's recommendation to implement green infrastructure has aroused interest in urban and spatial planning institutions. This was the background to the case study review of the town Dubrovnik potential offered by urban green infrastructure to counteract the impacts of climate. In line with many authors the general concept should be adopted in frame of the local specifics and circumstances – natural and cultural conditions taken into account (Bowler et al., 2010; Byrne et.al, 2015; Hrdalo, et al., 2015).

Besides the soft approaches, two articles are focusing on more technical solutions. One represents testing of the sensitiveness of the GIS method for recognising the value of green areas in the city and the second one assessed the value of the trees for the run off in the urban areas, more precisely on the parking lots. **Deilmann et al. (2015)** were testing GIS approach for identifying the potential critical areas of the city (regard to the heat stress or the accessibility of green spaces) in seven selected German cities. The emphasis was on the automatization of the analysis with the purpose on improving efficiency and environmental quality. The presumption of the authors is that urban density, efficiency and environmental quality are closely interrelated and indeed competing factors. Balancing them for the city means to achieve high quality and an optimal land use while minimising or indeed reducing the exploitation of resources. The article works with “the urban structures” that can be understood as built-up objects such as roads, buildings, as well as interstitial spaces such as public squares, green spaces and bodies of water with their functions for local residents such as housing, places of work, education, relaxation, local services provision. Such structures are closely related to various urban systems such as the volume of traffic in a city, the level of soil sealing, the amount of urban greenery, the consumption of material resources and energy as well as the level of emissions and immissions. They help to achieve particular urban density with a high level of resource efficiency and environmental quality. More to that, the form and spatial distribution of public green spaces and bodies of water, particularly in densely built-up areas are key factors determining the ecological quality and the quality of life for local residents. Parks featuring a good balance of trees, grassy areas, shrubbery, hedges are able to reduce air temperatures in the afternoon and evening in neighbouring areas at a distance of 200 to 300 metres. Paper concentrates on the aspect of environmental quality, in particular the microclimatic impact of green space and bodies of water and their structural



characteristics within cities as well as the possibilities for detecting strengths and weaknesses by a form analysis. It questions the partial assessment arguing that only a complex assessment (compactness, complexity, mobility, pollution and structural diversity) can provide a sufficient info for decision making in the planning process.

**Zabret and Šraj (2015)** brought forward even more focused research on one specific urban element - urban trees and the surface runoff. The later has due to the changed precipitation patterns (floods, changes in river discharges) and due to the intensive urbanisation density (cutting down the trees) changed and is nowadays more intensive. Trees are therefore recognized as an important solution offering several benefits, including the energy and carbon dioxide conservation, air quality, urban hydrology, noise reduction, and ecological benefits. In addition, one needs to mention the aesthetic benefits since they are what people see and most often think about. Among societal impacts one can include raise in the residential property value, attracting more visitors to recreational areas and even help people to recover faster. Although the importance of this urban element is clear, there are still some open questions regarding their use: e.g. which tree is the best to be selected, what are the costs of planting them and what is the actual value of caught rainfall. In the article (testing areas were two parking lots in Ljubljana) it is shown that *Betula Pendula* intercepts 21% and *Pinus nigra* 51% of total rainfall due to their different physical characteristics. The researchers argued in the conclusion that one study can only focus on a limited number of parameters at a time so therefore more studies should be taken. What was proven for sure, is that the runoff on the parking lot under study was reduced by almost 18% through a 35% reduction in the impermeable surface due to tree planting. The costs of such alterations are 30% higher in our case but various other benefits and costs reductions brought by trees can cover this cost in only four years.

## Conclusion

The cases, presented at the conference and in the articles, are showing that the concept of green infrastructure encompasses variety of the topics; that there is diversity in the administrative levels on which the policies and measures concerning GI can be applied and that the concept allows for a great amount of innovativeness of solutions and cross-sectoral approaches. These examples also teach us there is not just one way of approaching the problems of the modern cities and that the focus should be on developing comprehensive solutions that address several problems at the same time, e.g. floods, urban heat island, food self-sufficiency etc. Green infrastructure concept can therefore help the cities to connect different urban resources with the human efforts in order to find effective and sustainable solutions. Whether they concern small-scale solutions, like planting the trees on the parking lots, or the larger scale planning intervention is up to the initiator.

Importance of the GI for the planning can be summarized into four points: 1. integration of different aspect: green areas, social function, environment function and well-being; 2. interconnected network of multifunctional spaces – comprehensiveness, 3. “planning and analytical instrument” and 4. climate change mitigation and adaption measure. However, as we can see in the Central, Eastern and South-eastern Europe there are several hurdles which limit implementation of the new concepts and approaches. Firstly, the historical background and the planning culture of these countries, related administrative frameworks, small epistemic communities and values, e.g. slower adoption of the ecological awareness and ad hoc and slower transfer of good practice cases. Secondly, the stands belated introduction of the collaborative planning into the countries, an important process which facilitates the GI initiatives. From the GI-governance related discussion it can be concluded that urban or strategic planning should and will maintain its primary role in enhancing social well-being

and public health, however providing and managing the green infrastructure should become its important part.

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