DE GRUYTER OPEN

SPATIUM
No. 33, June 2015, pp. 55-61

UDC 712.252(497.11)
711.4(497.11)
Review paper
DOI: 10.2298/SPAT1533055M

GREEN INFRASTRUCTURE PLANNING FOR COOLING URBAN COMMUNITIES: OVERVIEW OF THE CONTEMPORARY APPROACHES WITH SPECIAL REFERENCE TO SERBIAN EXPERIENCES

Igor Marić[1], Institute of Architecture and Urban & Spatial Planning of Serbia, Belgrade, Serbia
Tijana Crnčević, Institute of Architecture and Urban & Spatial Planning of Serbia, Belgrade, Serbia
Jasminka Cvejić, Forestry Faculty University of Belgrade, Belgrade, Serbia

This paper investigates contemporary approaches defined by the policies, programs or standards that favor green infrastructure in urban planning for cooling urban environments with special reference to Serbian experiences.
The research results reveal an increasing emphasis on the multifunctionality of green infrastructure as well the determination to the development of policies, guidelines and standards with the support of the overall community. Further, special importance is given to policies that promote 'cool communities' strategies resulting in the increase of vegetation-covered areas, what has contributed in adapting urban environments to the impacts of climate change.
In addition, this research indicates the important role of local authorities and planners in Serbia in promoting planning policies and programs that take into consideration the role of green infrastructure in terms of improving climatic conditions, quality of life and reducing energy needed for cooling and heating.

Key words: **green infrastructure, cooling urban communities, urban planning, vegetation.**

INTRODUCTION

The planning and realization of urban green infrastructure is one of the passive measures to help reduce the energy needed to provide cooling and heating. On the one hand, urban green infrastructure has special importance in the adaptation of urban environments to climate change, while, on the other hand, it is also a certain, limited contributor to climate change mitigation (Cvejić *et al.*, 2011). Over recent years, in the context of climate change, the multifunctionality of green infrastructure has been growingly taken into account, thus leading to definitions which include "the concept of multifunctionality related to natural resources, adopt a holistic approach to thinking putting the focus on physical interactions between different types of green spaces" (Ibid: 32). The green infrastructure enables preservation, restoration or creation of facilities that utilize natural processes to recycle storm water, conserve energy and purify air in a way that encourages connectivity, supports development and is environmentally and economically sustainable (Hamin and Gurran, 2009).

The European Union (EU) policies documents, such as The Sixth Community Environment Action Programme, the Thematic Strategy on the Urban Environment, the European Landscape Convention, the Leipzig Charter, as well as the Aalborg Charter of European Cities and Towns towards Sustainability (Hudekova, 2011), highlight the importance of open spaces for improving environmental quality. Howevere, the above policies, supported by international, national and regional regulations, are not enough to ensure the establishment of adaptation measures at the local level (Hersperger and Burgi, 2009). Results of the analysis of contemporary practice within green infrastructure planning emphasize that the cooperation of all participants is crucial as the importance of local authorities not only as a driving force for the development of local policies and regulations, but also as an important factor that influences the success of actions and activities aimed at climate change adaptation (Hersperger and Burgi, 2009; Kazmierczak and Carter, 2010).

[1] Bulevar Kralja Aleksandra 73/II, 11000 Belgrade, Serbia
igor@iaus.ac.rs

Over recent years, the activities for harmonization of the legal framework of the Republic of Serbia with the EU acquis have intensified, resulting in the adoption of a set of new environmental laws, as well as the adaptation of the existing planning legislation. In this context, the aim of this paper is to present an overview of the existing legislation, policies and practice worldwide and Serbia related to the planning of green infrastructure in urban environments, aimed at implementing the concept of green infrastructure to mitigate and adapt to climate change and improve not only outdoor but also indoor environmental quality. The research is based on descriptive and analytical methods applied to contemporary theoretical and empirical frameworks that promote green infrastructure in urban environments, as well as on a comparison and synthesis of research results.

GREEN INFRASTRUCTURE PLANNING FOR COOLING URBAN ENVIRONMENTS: OVERVIEW OF POLICIES, PROGRAMS AND STANDARDS

Along with the positive impact of open spaces and vegetation on environmental conditions, that have always been known and recognized, the fundamental, mystic or religious values associated with the nature have existed in the folklore culture. Traditionally, nature has been considered through its use-value, and the relationship with nature was functional, mystic or religious. In Serbia, there were votive inscriptions carved in trees marked a spiritual space instead of a church, while "folk planners were looking for suitable sites near agricultural land and water for organizing their holdings ..." (Marić, 2006:48). Traditional respect for the nature and its spiritual meaning have an increasing importance in planning of green infrastructures. Contemporary urban planning and design also aim to protect the existing values of the natural environment by adapting to local environmental conditions and climate. The use of vegetation in urban planning as a passive measure is based on main principles and established criteria for bioclimatic urban planning and design for the distribution of vegetation which are, amongst other things, aimed to reduce heat transfer losses and improve natural ventilation. With climate change, the multifunctionality of urban green spaces is becoming increasingly important (Gill *et al*., 2007), i.e. its significance in terms of energy efficiency and microclimate is emphasized. In addition to the functions and effects of urban green spaces such as air purification, protection against dust, smoke and soot, increase in relative humidity, and the positive effects on human health, etc., the research conducted in recent years has been directed towards the quantification of the effects of green spaces in terms of energy savings and the improvement of microclimatic conditions. Research by Ca *et al.* (1998) shows the impact of green spaces on energy saving in hot climates by establishing that the cooling effects of a park can extend up to 0.5km^2, and during one hour, from 1 to 2 pm, 4000kWh of electricity can be saved and, at the same time, air quality improved, while the anthropogenic heat released to the air can be reduced: this results in savings of 650 U.S. dollars in only one hour in the summer period. Further, it has been projected that, to plant an urban tree to shade a building and cool a community, is equivalent to three forest trees in terms of CO_2 emissions (Rosenfeld *et al*., 1998). As planted roofs are used as a passive cooling technique it was estimated that installation of a rooftop garden on a five-story commercial building results in savings of 1-15% in annual energy consumption, 17-19% in the space cooling load and 17-79% in the peak space load (Wong *et al*., 2003).

Standards for planning of green infrastructure in the Republic of Serbia to date were based on the minimum size of green space expressed as a square meter per city dweller. However, deterioration of environmental quality, the impacts of climate change and the results of research on the effects of green spaces on temperature have led to the development of new standards, similar to the related international standards, for planning and design of local green spaces. The Biotope Area Factor (BAF) (Kazmierczak and Carter, 2010), used in Berlin to establish the proportion of green space required in a development area has influenced planning policies in several countries. The BAF expresses the ratio of the ecologically effective surface to the total area (or plot) covered by the development. All potential green spaces, such as courtyards, roofs and walls are included in the BAF. However, different types of green space are weighted differently in relation to evapotranspiring qualities, permeability, possibility to store rain water, relationship to soil functioning and provision of habitat for plants and animals. Thus, surfaces covered by vegetation have the highest weighting factor - 1.0, while partially sealed surfaces have the lowest weighting factor - 0.3. The BAF covers all forms of urban land use, and it sets out minimum ecological standards for structural changes and new development. One of the important advantages of the BAF regulation is that it provides flexibility in the process of planning as developers can decide on the type of green space to be created. Today, the BAF is recognized as having certain international importance, and it also helped other countries in developing their standards. Thus, in Slovakia, a set of standards has been developed (Ibid.) that are categorized by municipality (population) size. They comprise quantitative standards in relation to the provision and accessibility of open space, as well as standards focusing on the quality of green space. Standards also comprise guidelines for planning open green space, impacts of climate change including flooding in urban areas, high temperatures and inadequate air quality. This set of standards is intended for spatial planners, as well as others who make decisions on spatial development planning, but they are not legally binding.

A review of available professional and scientific literature revealed that in the Republic of Serbia there are no registered activities in the domain of investigation of the effects of green infrastructure in the context of climate change and its quantification. However, the research conducted for the territory of the city of Belgrade, Municipality of Vračar, in which ecological standards and BAF were used has proved that there is the "possibility of improving the functionality of the system by forming new biotopes, and at the same time maintaining urban morphology and purposes of areas ...", thereby indicating that these standards "are becoming increasingly important due to topicality of climate change issues" (Cvejić *et al.*, 2012: 108).

In recent years, the development of policies, guidelines and standards worldwide indicates both international and local determination to address problems with the support of the

Table 1. Overview of contemporary urban policies and programs (according to Kazmierczak and Carter, 2010; Jansma and Visser, 2013).

Urban policies

- **Stuttgart (Germany)** – By creating a database on climate, land use and topography ("Climate Booklet for Urban Development Online-Stadtebauliche Klimafibel Online"), requirements for precise planning of different urban spaces have been established, where the "German Building Code", which provides a legal basis for proposed solutions in the Climate Booklet, is a main mechanism for implementation; result – numerous planning and zoning regulations aimed to preserve open spaces and increase the presence of vegetation in densely populated parts;
- **North West England (Great Britain)** – The regional *Climate Change Action Plan* (2007-2009 and then refreshed for the years 2010-2012) in which green infrastructure has an important role in climate change adaptation and mitigation;
- **Almere (Holland)** – Urban plan for the city of *Almere* which envisages integrated housing and urban agriculture is an important innovation in the planning system in Holland.

Urban programs

- **Faenza (Italy)** – The "Bio-neighborhood" incentive program, for which the city of Faenza has received national and international recognitions such as the European Prize for Urban and Regional Planning (Challenges 2009), is an integral part of town planning regulations offering a larger area for the development in return for green space - green roofs, walls and water retention systems, as well as for the creation of continuous public green space;
- **Basel (Switzerland)** – As a result of the implementation of building regulations which require the use of vegetation on roofs, from 2002, when these regulations came into force, until now, a great number of green roofs have been installed, so that today Basel has the highest area of green roofs per capita in the world;
- **Chicago (USA)** – The *Green Permit Program* is a support to strategic commitment to installing green roofs. At the initiative of Chicago's Department of Buildings, an incentive program has been developed which encourages developers to incorporate elements of environmentally conscious design, including green roofs on new buildings.

overall community. There is an increasing emphasis on the multifunctionality of green infrastructure, but also on its social and ecological, as well as economic importance. Special emphasis is given to policies that promote the adoption of 'cool communities' strategies for reroofing and repaving in lighter colors and planting trees which can produce substantial energy savings, both directly and indirectly. An overview of several contemporary international urban policies and programs, presented in Table 1, shows that there are many examples of good practice resulting in the increase of vegetation-covered areas, which has contributed to better environmental quality, as well as to reducing the need for cooling and heating, i.e. to adapting urban environments to the impacts of climate change.

As emphasized by Kazmierczak and Carter, 2010:3, the summarized results of previous studies indicate that "collaboration with external stakeholders and internal, cross-departmental collaboration"have crucially influenced the success "of putting adaptation onto policy agenda", and that the "autonomy of the local authority in developing local policies and regulations was other important factor influencing the potential success of actions aimed at adaptation to climate change". Definitely, the awareness of the adaptation issue is seen as important among the general public and within organizations, as this will influence whether adaptation, as well as the presence of guidance, is perceived as a priority issue at both the national and regional/local levels. Further, the result of *The Green and Blue Space Adaptation for Urban Areas and Eco Towns Projects* (GRaBs) funded under INTERREG IV C Program shows that the existing international and national regulations are seen as additional potential support for the development and use of adaptation responses at the local level. The character of the current regulations at the local level and the possibility for local organizations to revise and innovate them is a major factor which influences development and adaptation strategies while the importance of access to knowledge, data and information, as well as the importance of collaboration and public involvement, have also been pointed out (Ibid.).

REPUBLIC OF SERBIA – GREEN INFRASTRUCTURE AND CLIMATE CHANGE

Legislative and town planning background

The concept of green infrastructure is relatively new in Serbia and this is one of the reasons why green infrastructure is not incorporated in the current legislation (Law on Environmental Protection, Law on Nature Protection, etc.). However, in recent years, it has mainly been mentioned in scientific and professional papers in terms of its role in climate change adaptation and mitigation (Crnčević, 2013; Cvejić *et al*., 2012; Crnčević and Sekulić, 2012; Cvejić *et al*., 2011; Manić *et al.,* 2011, etc.).

Planning the multifunctional green infrastructure does not have an explicit legal basis at any level of planning. The section of the Law on Planning and Construction (2014) which refers to urban plans implies the obligation to take into account "general directions and corridors for transportation, energy, water supply, utility and other infrastructures" (Art. 24, paragraph 3), while the section "Rules on Urban Planning and Design" sets out the obligation to create "requirements for urban planning and other requirements for planning and construction of structures in public use and network of transport and other infrastructures." (Art. 30, paragraph 2). The green infrastructure can also be subsumed into "other infrastructures". The Law also encompasses the issue of energy efficiency specifying that a "structure...must be designed, built, used and maintained in a way that ensures prescribed energy efficiency features" (Art. 4), which also supports the multifunctional green infrastructure planning. Therefore, it can be concluded that, although green infrastructure planning is not explicitly prescribed by law, the Law provides a minimal framework for its planning, which is, on the other hand, also related to the adequate interpretation of these articles in the Law.

However, the concept of public green areas is also incorporated in Serbian legislation. The Law on Environmental Protection (2004), in its Art.20 sets out the obligation according to which "public green areas in

settlements and places covered by spatial and urban plans shall be made and maintained in a way which shall enable preservation and development of natural and man-made values". This Law further stipulates that "general conditions of protection, the way of making, maintaining and renewing the destroyed public green areas, as well as data about the public green areas, shall be regulated by special law". An attempt to adopt a special law which would derive from this provision of the Law on Environmental Protection was not successful[2]. Currently local authorities prescribe requirements and ways of compensation for destroying green space. This provides the possibility for local authorities to take initiatives such as the Decision of the City of Belgrade for green roofs from 2011. This Decision is certainly a step forward in terms of the initiative of local authorities, but the question of its influence still remains because, according to the current legal framework, these types of green space, as well as green walls and green parking lots, are not included in the total amount of greenery. On the other hand, it should be mentioned that this Decision has not been implemented yet.

Important elements of green infrastructure, such as forests, are regulated by a special law –the Law on Forests (2010), while nature protection is regulated by the Law on Nature Protection (2010). Unfortunately, neither of these laws have special provisions which would ensure their use in the context of multifunctional green infrastructure planning and the reduction of energy needs, while the importance of vegetation is not emphasized either in this context or in relation to climate change. However, it should be mentioned that the Law on Nature Protection, Art. 38, prescribes the obligation to establish ecological networks which are an essential element of green infrastructure at the wider regional and national levels.

On the other hand, the basis for planning at the national level provides a certain level of support to urban green infrastructure planning and development. Thus, the adopted Spatial Plan of the Republic of Serbia (SPRS) promotes the improvement/preservation of image and structure of urban landscape, amongst other things, also through the "preservation, improvement and sustainable use of open green spaces and elements of nature in cities, as well as creation of green and public open space networks which connect natural and cultural values of settlements, peri-urban areas and rural landscape" (Law on the Spatial Plan of the Republic of Serbia, 2010:139).

The study entitled "Belgrade Afforestation Strategy" (2011) encompasses the administrative area of the City of Belgrade and deals with climate change impacts and effects of afforestation on energy saving. This document indicates that saving only 10% of energy would save 7,100,000 Euros per year, taking into consideration annual electricity consumption of 7,555kWh per household and the projected price of 5.5 Euro cents per kWh. Taking into account the importance of greenery in saving energy, the Strategy promotes a set of principles outlining:

- The creation of windbreaks which prevent penetration of cold winds (southeastern wind), but allow the penetration of fresh summer breeze;
- Increase in the total vegetated area; and
- Planting trees on the eastern and western sides of solid structures and avoiding planting trees on their northern sides.

It should be stressed that it is particularly suitable to plant deciduous trees on the south side of buildings as during the summer this practice protects buildings from overheating, and in winter when the sun is low it can more easily enter buildings (Pucar *et al.*, 1994).

Public participation in urban planning is not sufficiently supported by the Law on Planning and Construction which, except the obligation of presenting the planning document for public insight (articles 50 and 51), „does not oblige the developer of the Plan to cooperate with the local community and population living in its vicinity" (Petovar, Jokić, 2011:10). The decision on cooperation is left to the discretion of planners, or it is carried out if required by the promoter. Furthermore, there is also the "lack of experience and knowledge about techniques and methods, as well as insufficiently developed mechanisms and procedures for public participation in the decision-making process" (Orlović *et al.*, 2013:51).

Previous analysis of the legal framework, as well as of the studies and research conducted, indicate that there is a lack of adequate support and legal framework for the planning and realization of multifunctional green infrastructure. On the other hand, current practice in planning indicates that a certain amount of attention has been dedicated to this issue. The Detailed regulation plan for block 23 in the town of Bela Crkva (IAUS, 2011) represents good practice regarding the inclusion of areas under agricultural use into the green infrastructure, while the Master plan of Vrnjačka Banja (IAUS, 2005) provides an example of good practice regarding the protection of forests and their function within the green infrastructure system. Further, published results of the analysis of the current practice in planning also imply that a certain attention has been dedicated to this issue (Manić *et al.,* 2011; Crnčević, Bakić, 2008; Crnčević, Bakić, 2010; Crnčević, Bakić, 2011; Crnčević, 2013), which can be documented by the following good practice example.

City of Belgrade case study

The Master Plan of Belgrade up to 2021

The spatial distribution of vegetation coverage for Master Plan of Belgrade up to 2021 (2003) is green infrastructure and the coverage of planned intervention are concepts and requirements. Quality of life, biological-sanitary-hygienic function in terms of improving climatic conditions, reducing energy needed for cooling and heating are recognized as the core drivers.

The Master Plan of Belgrade (Figure 1) introduced the concept of the *urban green space system,* a system that includes different forms of property ownership, from suburban forests, private forests and shrubs, urban forests, urban gardens, to urban parks and tree avenues.

[2] One of the results of the "Belgrade Green Regulation" project (Urbanistički zavod Beograda, 2014) was a draft law. Although the final draft was later prepared by the Serbian Association of Landscape Architects, it did not strike a responsive chord among lawmakers and has not been adopted thus far.

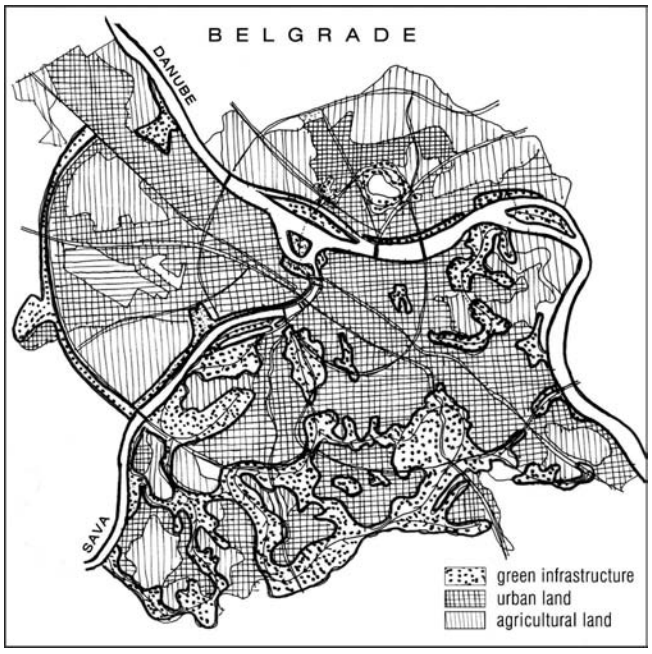

Figure 1. Design of the urban green space system according to the Master Plan of Belgrade up to 2021

The purpose of each space is defined primarily from the standpoint of land cover - greenery, and not in terms of the activities that are carried out in these green spaces (Master Plan of Belgrade up to 2021: 110). The system is defined as *green infrastructure for urban climate adaptation.* The goals for developing the system of urban green space have been set, such as: the preservation of green space inside the city and the forests outside the city within their existing borders; protection of foreland forests and river islands; protection of remnant marshes, ponds and wetlands; connectivity of the existing forests to the greenbelt; realization of a networked green space system using linear connections between the existing and planned green areas; remediation of a wider riparian area of the Sava and Danube rivers and formation of continuous linear greenery along river banks where possible, etc. This system and the concept of urban green infrastructure share many similarities.

The Master Plan of Belgrade sets forth minimal norms for planning various urban green spaces adapted to different uses of space, zones, position in the territory of the city and to existing and planned uses. Thus, for example, the percentage of site coverage of greenery according to the site area of 10-20% is envisaged in spaces around residential buildings for existing compact urban blocks in the central zone of the city; 20-30% for existing compact blocks outside the central zone of the city, and 30% in new compact blocks.

Belgrade Green Regulation

The Action Plan for the Protection of the Environment in the Territory of the City of Belgrade and the Master Plan of Belgrade up to 2021 were starting points for creating a project for the preservation and development of green space in the city of Belgrade, the "Belgrade Green Regulation" project. The spatial distribution of vegetation coverage for *Belgrade Green Regulation* (Urbanistički zavod Beograda, 2014) is green infrastructure and the coverage of planned interventions are regulations.

This project defines the concept of Belgrade's green space system taking into account the following principles: connectivity, multifunctionality, accessibility, protection of the character of the landscape, preservation of biodiversity, and improvement of the state of the environment. The spatial realization of conceptual commitments is planned by establishing a system of interconnected green areas. The generative elements of the system are dominants, spots and lines. Dominants include large green areas which are of importance for the city and region and are the main elements of the greenery system. Spots include green areas of local importance, while lines are connecting green spaces (Cvejić and Teofilović, 2010). Planning solutions include the following types of green area:

a) Maintenance of urban green spaces

- *Freestanding:* parks, squares, botanic gardens, cemeteries, park forests, community gardens, river islands, forests;
- *Connecting:* in street regulation, in wetlands;
- *Around buildings:* different types of residential tissue, industrial and commercial buildings, infrastructure facilities, sports facilities, facilities for public use;

b) Naturally regulated green areas

- *Freestanding:* plantations, forest-like habitats, fallows, wetlands;
- *Connecting:* brushwood and forest remnants in wetlands – foreland, brushwood and forest remnants in agricultural land.

The proposed concept of Belgrade's green space system, compared to previous solutions, has placed an emphasis on the importance of green areas near the confluence of two large rivers, the Sava and the Danube, by singling out the "core" of the system and by strong "green connections" along the riparian area. Another important component of the system includes green corridors along the transportation network. Two rings, inner and outer, are a continuation of the main "skeleton" of the system. The rings are connected to numerous green corridors along small urban watercourses, roads and the network of land reclamation canals in the alluvial plains of the Belgrade area.

CONCLUDING REMARKS

The multifunctional nature of green infrastructure that creates positive impacts on human health mitigates climate change and saves energy should be a basis for initiating related policies and setting adequate standards for its inclusion in planning at national, regional and local levels.

In developing green infrastructure planning policies, the initiatives of local authorities particularly stand out, as shown in the examples of Belgrade The new concept of Belgrade's green space system, which is based on ecological approach to landscape design, as well as on the use of European standards and contemporary theory of planning, has come closer to the practices of planning in other European towns and cities. The planning method used, although modified and adapted to available data and level of detail, is not a novelty in European practice, but its use in the example of Belgrade is definitely a verification and

new experience. The contribution of the used method can be seen at the national level. It is definitely a new approach and demonstrates understanding of the importance of the urban green space system. The preparation of detailed argumentation through conducted studies and analyses, which can have an important role in achieving a consensus in the future town planning, can be singled out as a unique contribution. The change in the philosophy of and approach to urban planning which is based on the ecological approach to landscape design is another important contribution. The new concept is an example of taking into account the multifunctional role of urban green space. The reservation of space which is to be excluded from future in Belgrade is also an important contribution considering the specific role of green space and the provision of an integrated urban green space system. Additionally, the improved typology of open green spaces, including completely maintained, but also naturally regulated green spaces, is an important novelty in relation to previous planning practices. Besides the protection of the still-remaining valuable biotopes, the Study on Mapping and Assessment of the Belgrade Biotopes, which was conducted for an urban territory in Serbia for the first time, has also provided very detailed information on the resources available for the creation of new urban green spaces. New knowledge which was derived from this Study is primarily related to the great diversity of habitats and species that survive in an urban landscape such as Belgrade. This represents an important information base for further development of green infrastructure planning with a shift towards green blue infrastructure planning[3] that aims to reintroduce natural water cycles within urban environments.

It should be emphasized that, although the issue of climate change is not always adequately addressed in the legal framework, the importance and role of green infrastructure is clearly recognized worldwide and, as well, in Serbia. It is thus fair to conclude that local authorities and planners have an important role in promoting planning policies and programs that take into account the role of green infrastructure with the aim to improve living conditions and the quality of life, as well as for cooling urban communities and reducing energy needs.

Acknowledgments

This work is a result of research conducted within the research projectcs "Spatial, ecological, energy and social aspects of developing settlements and climate change – mutual impacts" (TR 36035) and "The investigation of climate change and its impacts on the environment – monitoring impacts, climate change adaptation and mitigation" (43 007) which were financed within the program Technological development by the Ministry of Education, Science and Technological Development of the Republic of Serbia from 2011 to 2015.

[3] Green and blue infrastructure is defined as "an interconnected network of protected land and water that supports native species, maintains natural ecological processes, prevents flooding, and sustains air and water resources, and contributes to the health and quality of life of local communities" (Plus Integreat Knowledge, 2012:32).

REFERENCES

Belgrade Afforestation Strategy. Official Gazette of the Republic of Serbia, No.20/11.

Ca, V.T., Asaeda, T., Abu, E.M. (1998) Reductions in air conditioning energy caused by a nearby park, *Energy and Buildings* 29, pp. 83-92.

Cvejić, J., Bobić, A., Teofilović, A., Tutundžić, A., Radulović, S. (2012) Adaptacija kompaktnog grada na klimatske promene: primena ekološkog modela u Beogradu. In: Đokić, V., Lazović, Z. (Eds.), *Uticaj klimatskih promena na planiranje i projektovanje, razvijanje optimalnih modela*, Arhitektonski fakultet, Beograd, pp. 83-109.

Cvejić, J., Bobić, A., Tutundžić, A., Radulović, S. (2011) Adaptacija gradova na klimatske promene – uloga zelene infrastrukture. In: Zlatanović-Tomašević, V., Gajić, R., Kaić, F. (Eds.), *Budućnost razvoja naselja u svetlu klimatskih promena,* Društvo urbanista Beograda, pp. 27-44.

Cvejić j., Teofilović A. (2010) Concept of Green Spaces System –Belgrade Case Study, *Proceedings of Fabos Conference on Landscape and Greenway Planning 2010 Budapest,* July 8-11, Hungary, pp. 171-178.

Crnčević, T., Bakić, O. (2008) The system of green surfaces in spas with special reference to the case studies: Vrnjačka, Kanjiža and Pribojska spa; *SPATIUM,* No. 17/18, pp. 92-97

Crnčević, T., Bakić, O. (2010) Zelene površine banjskih naselja – prilog uspostavljanju I razvoju informacione osnove u GIS okruženju, in *Održivi razvoj banjskih I turističkih naselja u Srbiji,* Posebna izdanja 64, Beograd: IAUS, pp. 59-74.

Crnčević, T, Bakić, O. (2011) The system of green spaces in spatial and urban planning in Serbia with special reference to the General Regulation Plan of the city of Knjaževac, 1st *International Conference "Ecology of urban areas 2011", Proceedings*, University of Novi Sad, Technical Faculty "Mihajlo Pupin" Zrenjanin, Republic of Serbia in cooperation with Politechnica University Timisoara, Romania, pp. 456-453.

Crnčević, T. (2013) Planiranje i zaštita prirode, prirodnih vrednosti i predela u kontekstu klimatskih promena u Republici Srbiji – prilog razvoju metodološkog okvira, *Posebna izdanja, 72,* Beograd: IAUS.

Crnčević, T., Sekulić, M. (2012) Zeleni krovovi u kontekstu klimatskih promena – pregled novijih iskustava, *Arhitektura i urbanizam*, 36, pp. 57-67.

Gill, S.E., Handley, J.F., Ennos, A.R., Pauleit, S. (2007) Adapting Cities for Climate Change: The role of the Green infrastructure, Built Environment, 33, no.1, pp. 115-133, http://www.fs.fed.us/ccrc/topics/urban-forests/docs/Gill_Adapting_Cities.pdf, accessed: 18th Sep 2013.

Hamin, E.M., Gurran, N. (2009) Urban form and climate change: Balancing adaptation and mitigation in the U.S. and Australia, *Habitat International,* 33, pp. 238-245.

Hersperger, A. M., M. Bürgi (2009) Going beyond landscape change description: quantifying the importance of driving forces of landscape change in a Central Europe case study, *Land Use Policy,* 26, pp. 640-648.

Hudekova, Z. (2011) Assessing vulnerability to climate change and adapting through green infrastructure, GRABs Expert Paper 7, http://www.grabs-eu.org/downloads/EP7%20FINAL.pdf, accessed: 11th Jan 2014.

Jansma, J.E., Visser, A.J. (2011) Agromere: Integrating urban agriculture in the development of the city Almere; Urban

Agriculture Magazine, 25, http://www.ruaf.org/sites/default/files/UAM%2025-Agromere%2028-31.pdf, accessed: 11th Nov 2013.

Kazmierczak, A., Carter, J. (2010) Adaptation to climate change using green and blue infrastructure, A database of case studies, http://www.grabs-eu.org/membersArea/files/Database_Final_no_hyperlinks.pdf, accessed: 11th Nov 2014.

Marić, I. (2006) Tradicionalno graditeljstvo Pomoravlja i savremena arhitektura, *Posebna izdanja,* No. 46, Beograd: Institut za arhitekturu i urbanizam Srbije.

Manić, B., Crnčević, T., Niković, A. (2011) Uloga zelenih površina u prostornoj i funkcionlanoj koncepciji Bloka 23 u Beloj Crkvi, *Arhitektura i urbanizam*, 33, pp. 67-74.

Orlović, L.., V., Crnčević, T., Milijić, S. (2013) Tourism development in Serbia – on the way to sustainability and European integration, *SPATIUM*, No. 30, pp. 47-53.

Petovar, K., Jokić, V. (2011) The right of servitude between public interest and undisturbed use of private property, *SPATIUM*, No. 26, pp. 7-13.

Pucar, M., Pajević, M., Jovanović-Popović, M. (1994) *Bioklimatsko planiranje i projektovanje - urbanistički parametri,* Zavet, Beograd.

Plus Integreat Knowledge (2012) Planning committee members learning and development program Leeds & Bradford Series module 2: Green and Blue infrastructure, http://www.more.lgyh.gov.uk/wp-content/uploads/2012/03/Green-Blue-Infrastructure-Planning-Series-Handout-.pdf, accessed: 15th Mar 2014.

Rosenfeld, A.H., Akbari, H., Romm, J.J., Pomerantz, M. (1998) Cool communities: strategies for heat island mitigation and smog reduction, *Energy and Buildings,* 28, pp. 51-62.

Urbanistički zavod Beograda, Generalni Plan Beograda 2021 (Master Plan of Belgrade to 2021), http://www.urbel.com/cms_images/gup1.jpg, accessed: 15th Jan 2015.

Urbanistički zavod Beograda, Zelena regulativa Beograda (Belgrade green regulation), http://www.urbel.com/default.aspx?ID=uzb_ZelenaReg3&LN=S, accessed: 15th Jan 2014.

Master Plan of Belgrade to 2021 (Generalni plan Beograda 2021), Official Gazette of the town of Belgrade, No. 27/03.

Law on Environmental Protection, Official Gazette of the Republic of Serbia, No.135/04.

Law on Forests, Official Gazette of the Republic of Serbia, No. 30/2010.

Law on Nature Protection, Official Gazette of the Republic of Serbia, No. 36/2009, 88/2010.

Law on Planning and Construction, Official Gazette of the Republic of Serbia No. 72/09, 81/09, 64/10, 24/11,121/12, 42/13,50/13,98/13,132/14,145/14.

Law on the Spatial Plan of the Republic of Serbia, Official Gazette of the Republic of Serbia, No. 88/2010.

Wong, N.H., Cheong, D.K.W, Yan, H., Soh, J., Ong, C.L., Sia, A. (2002) The effects of rooftop garden on energy consumption of a commercial building in Singapore, *Energy and Buildings* , 35, pp. 353-364.

Received March 2015; accepted in revised form April 2015