SEEFOR SOUTH-EAST EUROPEAN FORESTRY
OPEN ACCESS
ISSN 1847-6481
eISSN 1849-0891
Original scientific paper

Social and Policy Aspects of Climate Change Adaptation in Urban Forests of Belgrade

Ivana Živojinović [1]✉, Bernhard Wolfslehner [1], Jelena Tomićević-Dubljević [2]

[1] The European Forest Institute Central-East and South-East European Regional Office (EFICEEC-EFISEE), c/o University of Natural Resources and Life Sciences, Vienna, Feistmantelstr. 4, A-1180 Vienna, Austria
[2] University of Belgrade, Faculty of Forestry, Department of Landscape Architecture and Horticulture, Kneza Višeslava 1, RS-11000 Belgrade, Serbia

✉ Corresponding author: e-mail: ivana.zivojinovic@efi.int

Citation:
ŽIVOJINOVIĆ I, WOLFSLEHNER B, TOMIĆEVIĆ-DUBLJEVIĆ J 2015 Social and Policy Aspects of Climate Change Adaptation in Urban Forests of Belgrade. *South-east Eur for* 6 (2): 219-235. DOI: http://dx.doi.org/10.15177/seefor.15-20

Received: 22 Jul 2015; Accepted: 30 Sep 2015; Published online: 15 Oct 2015

Abstract

Background and Purpose: Climate change has an impact on economic and natural systems as well as human health. These impacts are particularly visible in urbanised areas. Urban forests, which are one of the main natural features of the cities, are threatened by climate change. Generally, the role of forests in combating climate change is widely recognised and its significance is recognised also in urban areas. However, appropriate responses to climate change are usually lacking in their management. Climate change adaptation in relation to urban forests has been studied less often in comparison to climate change mitigation. Adaptive capacity of forests to climate change consists of adaptive capacity of forests as an ecological system and adaptive capacity of related socio-economic factors. The latter determines the capacity of a system and its actors to implement planned actions. This paper studies social and policy aspects of adaptation processes in urban forests of Belgrade.
Materials and Methods: For the purpose of this study content analysis of urban forest policy and management documents was applied. Furthermore, in-depth interviews with urban forest managers and Q-methodology surveys with urban forestry stakeholders were conducted. Triangulation of these data is used to assure validity of results.
Results: The results show weak integration of climate change issues in urban forest policy and management documents, as well as weak responses by managers. A comprehensive and systematic approach to this challenge does not exist. Three perspectives towards climate change are distinguished: (I) 'sceptics' - do not perceive climate change as a challenge, (II) 'general-awareness perspective' - aware of climate change issues but without concrete concerns toward urban forests, (III) 'management-oriented perspective' - highlights specific challenges related to urban forest management. Awareness of urban forest managers and stakeholders towards climate change adaptation is characterized by assumptions and uncertainties, which are the result of poor knowledge, lack of data of local impacts and weak communication.

Conclusions: The results indicate the need for building urban forestry institutional and human capacities for creating effective climate change adaptation responses, which will lead to better understanding of challenges posed by climate change and ability to make the trade-offs between possible decisions.

Keywords: awareness, urban forest management, climate communication, adaptation measures, institutional and human capacity, Serbia

INTRODUCTION

In the last century the global urban population has increased rapidly from 746 million in 1950 to over 3.9 billion in 2014 [1]. In Europe, 73% of the population lives in urban areas [1]. Population growth, together with technological development and increased consumption levels, has increased the pressure on urban centres, its natural resources and ecological systems [2]. Climate change is a major challenge today's society needs to cope with, especially as it has been proven that human activities have been the dominant cause of it [3]. The Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC) has confirmed the important role of cities in the development and delivery of climate change responses, as cities are in many ways affected by climate change and are a focal point of vulnerability, as their functioning relies on complex infrastructures [3, 4]. Urban forests are part of a green infrastructure which is one element that can contribute to climate change adaptation in cities [5]. However, the role of cities [3] and its green infrastructure is still marginally studied in relation to variety of issues related to climate change. So far mitigation actions have been supported by a wide range of policies in various sectors [6], while adaptation has only become prominent lately.

'Urban forests' in this paper implies all forests and other tree-based green areas (e.g. parks, tree alleys) that are situated within the administrative border of a city [7, 8]. Urban forests contribute to mitigating climate change in many ways: by controlling greenhouse gases (GHGs) emissions, the shading effect on buildings (reduces energy use and carbon emissions), by regulating the urban microclimate (reducing albedo, providing shade and cover) and the hydrological regime of cities [9-11]. At the same time, urban forests are becoming highly threatened by climate change [4]. Assessing the vulnerability of urban forestry systems is essential for adaptation processes and their long-term sustainable development [5]. Adaptation mainly is a matter of local importance [12, 13] and promotes the implementation of measures which are useful in the present, and at the same time reduce the risk of unacceptable losses in the future [13, 14]. FAO [15] sees adaptive forest management as an essential for addressing arising challenges and reducing forest vulnerability. In adaptive management various measures can be included: selection of drought-tolerant or pest-resistant species, use of stock from a range of provenances, assisting natural regeneration of functional species, and measures targeted to individual requirements of single species [15-17]. All of these measures need to be adapted to site specific forest conditions [15].

Adaptive capacity of urban forests comprises adaptive capacity of forests as ecological systems and adaptive capacity of socio-economic factors of urban forestry. Adaptive capacity of socio-economic factors determines the capability of systems and its actors to implement planned actions. "Adaptive organizations that incorporate organizational learning enhance social capital through internal and external linkages, partnerships, and networks, and make room for innovation and multi-directional information flow" are needed nowadays [7, p6]. Effective urban forest management with

 © CFRI http://www.seefor.eu

regard to climate change must be responsive to a wide variety of economic, social, political and environmental circumstances [13]. Thus, effective communication on climate change is very important [18]. Developing a dialogue within and out of the urban forest management community is essential, and will increase the range of possible actions [13]. It is recognised that climate change ultimately requires a national response, and that much more attention must be given to how decisions are made [19] and how decision-makers value expected risks and benefits [20]. Planning for climate adaptation requires comparison of decision options, and these should be based on relevant scientific results which are effectively communicated and perceived [20]. Perception is recognised as an active process of understanding, through which people construct their own version of reality [19] and therefore influences decisions.

Belgrade is the capital of Serbia and has faced enlargement and an intensive urbanisation process in the last decades, mainly at the expense of green areas [21]. In the last 50 years, an increase in mean annual temperature has been observed in all parts of Belgrade (up to 0.04 °C/yr), as well as for precipitation (up to 1.7 mm/yr) [22], which demonstrate a demand for climate change adaptation strategies in all sectors (including urban forestry) in Belgrade [23]. The protection of existing and the planning of new urban forests, as well as creation of responses to climate change, is identified as need by city administration [24].

This paper focuses primarily on social and policy aspects of adaptation processes in urban forestry in Belgrade. By applying mixed methods research, it aims to understand: (i) current climate change adaptation practices in urban forest management of Belgrade, and (ii) perceptions of various urban forestry stakeholders toward the issue. Following research questions are addressed: 1) to what degree do urban forest management plans integrate climate change adaptation measures?; 2) how do urban forest related policy documents take climate change in consideration?; 3) and what are the perceptions of urban forestry stakeholders regarding climate change adaptation in urban forestry of Belgrade?

METHODS

In this research following methods were applied: content analysis of relevant policy and management documents, in-depth interviews and Q-methodology surveys. Triangulation of the data is used to assure the validity of results, and to control possible weaknesses and biases. For the purpose of this research a case study approach has been implemented [25], with urban forests of the city of Belgrade as a selected case.

Analysis of Documents

Urban forest related policy and management documents (Table 1) are analysed by content analysis [26]. Searched aspects were: (i) the contribution of urban forests to mitigating/adapting to climate change; (ii) the vulnerability of urban forests to climate change; (iii) climate change impacts on urban forests and (iv) climate change adaptation measures considered as important for urban forests management. It is analysed whether these aspects appear directly or indirectly in the documents and how detailed they are presented.

In-Depth Interviews

In-depth interviews were conducted with six urban forestry managers of two main management bodies in Belgrade. Two interviews were conducted with the heads of the management units and other four interviewees were chosen with the snowball technique. The selection criterion was that all were in charge of developing management plans for forests in Belgrade. The interviews were conducted in May 2012, with an average length of 45 minutes. All interviews started with the question whether the managers were

TABLE 1. Aspects related to climate change from analysed urban forest management and policy documents

Name of document	Year of passing	Level	Mitigation aspects	Adaptation aspects	Type of urban forest mentioned	Quotes from documents in relation to mitigation or adaptation to climate change
Law on Forests of the Republic of Serbia	2010	national	+	+/-	+/- (forest in general)	"…potential of the forests must be enhanced for mitigation of climate change…" [39]
Forest Development Strategy of the Republic of Serbia	2006	national	+	+/-	+/- (forest in general)	"Forests have an irreplaceable role in the climate change mitigation … and, in this sense, carbon sequestration. Efforts should be made to increase permanently the forest capacity" [40] "The Government will (…) support the research and analysis of the potential scope and methods of carbon sinks in forests, promote the efficient generation and consumption of bio-energy, pursuant to the UNFCCC and Kyoto Protocol, and thus create the conditions for application for the international funds" [40]
Afforestation Strategy of Belgrade	2011	local	+	+/-	+ (all types of green areas in Belgrade)	Climate change, as one of the main environmental challenges, is described in detail in section 7 of the Strategy [24]
Urban forest management plans (management districts: Kosmaj, Kosutnjak, Bezanijska Kosa, Milicevo brdo)	2006-2009	local	+/-	-	-	Climate change is not directly mentioned in any of the four UFMPs. One of the general aims of forest management is: "forests have important role in improving climatic conditions"
Law on Spatial Planning of the Republic of Serbia	2010	national	+	+	+ (all types of green areas in cities)	Aim is: "to include climate change as a factor for sustainable development and the environment into sectoral strategies, and to develop sustainable system of risk management for climate change in Serbia" [36] Identified operational aims for adaptation to climate change: - "adoption of sectoral plans/programs regarding climate change adaptation measures, by harmonization of sectoral strategies with the EU strategies, White Paper on adapting to climate change and relevant EU directives" [36] - "reduce the risk of climate change by strengthening capacity to adapt in the most vulnerable social groups and sectors of the economy" [36]
Regional Spatial Plan for the Administrative Territory of the City of Belgrade	2004	local	+/-	+/-	+/- (all types of green areas in cities)	Aim is: "to protect nature and landscape in order to affect the protection and improvement of the environment, including microclimate. It is highly important to: preserve natural ecosystems, especially forest in the urban environment (e.g. 'Topčider', 'Košutnjak', 'Avala') and forests along river banks and on islands (e.g. 'The Great War Island', 'Ada Ciganlija', 'Ada Huja'), establish new forest areas and green areas in the city" [37]

© CFRI http://www.seefor.eu

TABLE 1. Aspects related to climate change from analysed urban forest management and policy documents - countinuation

Name of document	Year of passing	Level	Mitigation aspects	Adaptation aspects	Type of urban forest mentioned	Quotes from documents in relation to mitigation or adaptation to climate change
Master Plan of Belgrade 2021	2003	local	+/-	+/-	+/- (green infrastructure)	"Unlike many other urban sectors, which are regulated by various financial and construction measures, a system of public greenery, although it represents the climatic infrastructure, is not supported by any financial or legal mechanisms. In this regard, Belgrade will have to make a series of regulations to ensure the improvement of this system" [38]
National Sustainable Development Strategy of the Republic of Serbia	2008	national	+	+	+/-	The main problems that are identified are: "absence of a national inventory of GHGs emissions; the lack of strategic documents related to climate change; inconsistent legislation, relating to emissions, with the regulations of EU". Therefore, the main aims are: - harmonization of national regulations in the field of climate change and ozone depletion with EU regulations; - adaptation of existing institutions in relation to the needs for active implementation of climate protection policy and fulfilment of obligations under international agreements; - adaptation of business entities in the energy, industry, transport, agriculture and forestry, utility and housing business policy of climate protection and compliance with international agreements; - developing an action plan for adaptation to the climate change of all economic sectors; - the design, development and implementation of an adequate health response system on the effects of global climate change [41]
Development Strategy of the city of Belgrade	2011	local	+/-	+/-	-	Climate change have been indirectly mentioned throughout the document [42]
Tourism Development Strategy of Belgrade	2008	local	+	+/-	+/- (green infrastructure)	One of the key challenges for sustainable tourism, are: "reducing the impact of tourist transport on climate change and pollution" [43] and …"protection and valorisation of natural and cultural heritage…", where "…impacts of climate change on natural heritage, and the lack of adequate resources (human and financial) for the protection and preservation of heritage" are identified [43] Quote related to climate change and green areas: "Climate change imposes an obligation to improve the microclimate conditions, by conservation of the existing and establishment of new green infrastructure (alleys and green areas) along all pedestrian paths and cycling routs, wherever possible in the existing urban setting. This problem is almost completely neglected in the past two decades of development" [43]

+ directly addressed; +/- indirectly addressed; - missing

© CFRI http://www.seefor.eu

confronted with climate change in their work, and how important this issue was to them. The next question raised issues of communication and policy-making and led into specific details of climate change adaptation of urban forests. In the end, main challenges for adaptation processes in urban forests were stressed.

Q-Methodology

The aim of the Q-methodology is to analyse subjectivity in a statistically interpretable form [27]. In this research, the Q-methodology surveys were used to extract stakeholders' individual perceptions [28] of climate change adaptation in urban forests of Belgrade, and to differentiate which aspects of adaptation processes are seen as the most important.

They were addressed to a variety of urban forestry stakeholders (urban forest managers, employees in ministries, research organisations, NGOs, etc.), including those targeted in the in-depth interviews. In total 23 respondents from 14 organizations were interviewed (five at local, eight at national and two at regional level). 20 of the Q-surveys were conducted face to face in June 2012, with an average length of 50 minutes. Three additional Q-surveys were completed through an on-line application of the Q-methodology by using Q-Assessor.

The application of the Q-methodology implied formulating statements about climate change adaptation in urban forests based on the in-depth interviews and literature review. After the test phase, a concourse of 48 statements was created. The Q-surveys consisted of respondents sorting 48 statements, based on their subjective point of view, along a scale of +4 (strongly agree) to -4 (strongly disagree) using provided score sheets. The results of these 23 Q-sorts were then analysed using PQMethod 2.33 factor analysis software (available at: http://schmolck.userweb.mwn.de/qmethod/). As a result shared perspectives are identified and described. Each Q-survey was complemented by a brief follow-up interview, revealing why respondents have agreed/disagreed the most with certain statements [29].

Case Study Description

Research Area: Urban Forests of the City of Belgrade

Belgrade is the biggest city in the Republic of Serbia by area (3,222 km^2) [30] and population (1.66 million) [31]. In the period from 1948–2002 the total population of Belgrade has increased by 2.5 times [30, 32], which was followed by significant enlargement of the city [18]. Urbanization has had a major impact on the green areas, many forests had to be cut-down and very little has been done to prevent this situation [33, 34].

Belgrade has in total 35,980.00 ha of forests in the administrative area. The Public Enterprise (PE) 'Serbia Forests' manages 32,322.70 ha of forests, while the Public Utility Company (PUC) 'Greenery Belgrade' manages 610.75 ha of forests and 2,900 ha of other green areas. These two management organizations are the most important at the city level. Other forests are managed by other organizations (water management companies, military, agricultural organizations, churches) according to 10-year management plan approved by the Ministry [33]. Urban forests of Belgrade are mostly small in size, fragmented and scattered [24]. Deciduous tree species prevail (96.2%) [33]. General assessment of the forests in Belgrade shows unfavorable conditions of forests, and the main management goals identified are the conversion of coppice forests into high forests, timely and adequate maintenance of artificially established stands, increasing the share of autochthonous species, and responding to upcoming challenges (e.g. climate change) [24].

Background Information on Climate Change Policy in Serbia

The assessment of climate change for Serbia by a regional climate model shows that annual temperature is expected to rise from 0.8-1.1°C (according to A1B scenario) to 3.4-3.8°C (A2 scenario) per decade [23]. Precipitation is projected to decrease by 1% each decade, which will be followed by a decrease in the number of days with snow cover [35].

 © CFRI http://www.seefor.eu

In 2001 Serbia became Party to the United Nations Framework Convention on Climate Change (UNFCCC), and in 2008 it ratified the Kyoto Protocol [23], thus focusing mainly on mitigation activities. So far, no climate change adaptation strategy has been developed at any level.

The Ministry of Agriculture and Environmental Protection is a national coordination body for the realisation of the UNFCCC convention. In collaboration with other ministries and governmental bodies (e.g. Republic Hydrometeorological Service, EU Integration Office), Serbia formed a working group for fulfilling obligations ratified by the UNFCCC. The Initial National Communication (INC) to UNFCCC represents one output of this working group and is the first state-of-the-art report in the field of climate change at national level [23].

The development of the INC indicated several obstacles for the effective identification and implementation of climate change adaptation measures. The main problems identified were: (i) a lack of systematic data collection and databases, (ii) a deficient structure of the sector and (iii) a lack of financial and technological capacities. The main goal of the state therefore is to build new and strengthen existing capacities of experts who are involved in (sectoral) policy-making in relation to climate change and the development of the National Action Plan for Adaptation [23].

RESULTS

Climate Change Adaptation Aspects in Urban Forest Policy Documents

Urban forest management in Belgrade is influenced by various national and local policy documents. Content analysis of these policy documents demonstrated week integration of climate change aspects. Climate change mitigation aspects are more prominent compared to adaptation (Table 1).

Of all analysed documents, the Spatial Plan of the Republic of Serbia (2010) is the most advanced in terms of the integration of climate change issues. A specific chapter focuses on climate change effects in various sectors (e.g. forestry, nature protection) and identifies main problems:

- "Climate data and information used in the planning are developed with application of standard methods and guidelines based on stationarity of climate;
- Low awareness of the need to include climate change as a factor of sustainable development into sectoral strategies, particularly sectors vulnerable to climate change (agriculture, water management, forestry, energy, tourism, health, construction, transportation);
- Lack of adequate support for the implementation of multidisciplinary research programs on climate change, vulnerability and adaptation options;
- Lack of a special state program for solving problems of climate change;
- Limited funds for capacity building (institutional and individual), education, training" [36].

According to the latest Spatial Plan (2010), existing lower level urban planning documents (e.g. Regional Spatial Plan for the Administrative Territory of the City of Belgrade [37] and Master Plan of Belgrade [38]) still require adjustments related to climate change.

The analysed forestry-related policy documents (e.g. Law on Forests [39], Forest Development Strategy [40] and Afforestation Strategy of Belgrade [24]) have generally been harmonised with various international regulations, including climate change regulations. However, content analysis revealed that climate change issues are weakly integrated and mainly appear as general and indirect statements throughout the documents. The Afforestation Strategy of Belgrade (2011) has been the most advanced, primarily by integrating climate change mitigation aspects [24], while the Forest Development Strategy (2006) only briefly introduces these aspects.

Other documents (National Sustainable Development Strategy [41], Development

Strategy of Belgrade [42] and Tourism Development Strategy of Belgrade [43]) recognise climate change as a future challenge and call for development of thoughtful approaches. The National Sustainable Development Strategy identifies the main problems in this regard (Table 1).

Climate Change Adaptation Aspects in Urban Forest Management Plans

Four analysed urban forest management plans (UFMPs) were developed for different forest areas (municipalities) and urban forest types (urban and peri-urban forests), managed by PE "Serbia Forests" or PUC "Greenery Belgrade". In all four UFMPs climate change mitigation and adaptation aspects were not directly covered and related terms were not used[1]. Implications could only be found in the description of general aims of forest management, such as "forests have an important role in improving climatic conditions" or "forests have positive impacts on the environment". Parts of the UFMPs describing climate conditions in Belgrade are abundant with information of all climate parameters (e.g. annual average air temperature, minimal/maximal annual temperature/precipitation), but future impacts of climate change are not mentioned (Table 1).

Urban Forest Stakeholders' Perception towards Climate Change Adaptation

The results obtained by the in-depth interviews and Q-methodology offer insights into the current state of urban forest management and policy regarding climate change. We therefore interlink the findings from both sources of information, as they complement and explain each other (detailed findings from each method are presented in Table 2 and 3).

The application of the Q-methodology in this study revealed three shared perspectives regarding climate change adaptation in urban forests, which are named: 'sceptics', 'management-oriented perspective' and 'general-awareness perspective' [29].

'Sceptics' do no perceive climate change as a challenge. They hold the opinion that climate variations are normal and that there is a lack of data and evidence on existing change at the local level. This perspective reveals a very low level of awareness and communication regarding climate change, both inside and between various urban forestry organisations. Moreover, sceptics are of an opinion that urban forests will naturally adjust to future climate variability. They perceive other problems as more important (e.g. economic crises, governance issues, lack of information and technical assistance). However, it can be said that this perception is not so rigid, as more scientific evidence regarding climate change impact and information would be needed for this group to change opinion (follow-up interviews).

The two other perspectives are aware of challenges posed by climate change, and both selected statements regarding importance of education, public awareness, individual and collective actions in tackling climate change as important. However, they are also revealing different standpoints.

The 'management-oriented perspective' is aware of concrete needs related to improvement of urban forest management in the light of climate change (e.g. introduction of monitoring and modeling tools, obtaining more funds for research, improving legislation). The in-depth interviews revealed that urban forests vulnerability to climate change was noticed in the last ten years in practice (Table 3), but was not addressed in management plans. Vulnerabilities are seen through: (i) lower physiological state of trees due to frequent droughts/water stress, (ii) more frequent weather accidents, (iii) changes

[1] we use following terms in Serbian: *klimatske promene* (climate change), *ublažavanje klimatskih promena* (climate change mitigation), *prilagođavanje klimatskim promenama* (climate change adaptation), *osetljivost/ranjivost na klimatske promene* (vulnerability to climate change), *uticaj klimatskih promena* (impact of climate change)

 © CFRI http://www.seefor.eu

TABLE 2. List of statements used in Q-methodology with normalized factor scores for each statement and perspective [29]

No.	Statement	Sceptics	Management-oriented perspective	General-awareness perspective
		Normalized factor scores		
1	Introducing monitoring system and modelling tools for forest management will be of great importance for adaptation to climate change.	1	**4**	2
2	The establishment and development of a dialogue about climate change adaptation among various actors is highly important for management of urban forests.	-2	3	0
3	Scientific knowledge about adaptation of urban forests to climate change would help in the adaptation process.	**4**	1	**4**
4	Public institutional money is needed to deal with the adaptation of urban forests to climate change.	0	2	1
5	The protection of biodiversity and forest habitats will depend on how well we adapt forests to climate change.	-1	1	1
6	Adaptation of urban forests to climate change is important for preserving forests for future generations.	2	3	2
7	Management of urban forests should adapt to more frequent natural disasters that are consequences of climate change.	**-4**	-1	1
8	Public awareness about climate change is already high; there is no need for more educational programs and trainings.	-2	**-4**	-3
9	Climate change adaptation actions in urban forests are costly; it does not make sense to invest in them.	3	**-4**	**-4**
10	Selection of climate-resilient species in urban forests management is needed for urban forests adaptation to climate change.	-2	0	2
11	Popularization of climate change topic can be done through greater involvement of experts.	2	1	1
12	Taking into account adaptation to climate change in urban planning will help the process of adaptation.	-1	3	3
13	Lack of interest of urban forestry actors toward climate change will not influence adaptation process.	0	-2	-2
14	We should aim at planting as many species as possible in order to make forests resilient to climate change.	-3	-1	0
15	Climate change adaptation actions in urban forests are not needed because forests will naturally adjust to future climate variability.	**4**	-2	-3
16	Education of employees in urban forestry in climate change is needed for adaptation process.	-2	1	2
17	Employees in forestry are informed about climate change only through informal sources (e.g. internet, newspapers).	-1	-2	-1
18	Actions aimed at reduction of impacts of climate change are expensive for companies and enterprises.	1	-2	-2
19	Forest management enterprises and agencies should make main decisions in adaptation of urban forests to climate change.	1	0	**-4**
20	Stronger political leadership would be of great importance in initiating climate change adaptation actions.	**-4**	2	2
21	Local authorities should play a crucial role in developing climate change adaptation strategies in various sectors.	-3	0	-1

TABLE 2. List of statements used in Q-methodology with normalized factor scores for each statement and perspective [29] - continuation

No.	Statement	Sceptics	Management-oriented perspective	General-awareness perspective
		Normalized factor scores		
22	More funds from national funds should be secured for doing research on climate change adaptation.	1	**4**	**4**
23	Companies and enterprises need to consider climate change in all their activities (corporate responsibility).	2	2	**4**
24	We need legislation that addresses climate change adaptation in urban areas.	-1	**4**	0
25	There are many other problems in the city than climate change adaptation which should be solved.	3	-1	1
26	Natural forests are best suited to adaption for climate change.	2	0	-2
27	It is already too late to do anything, as any action to adapt urban forests to climate change will take a long time to produce an effect.	0	-3	**-4**
28	Everybody has to contribute to tackling climate change through individual actions.	2	1	2
29	Water supply will be endangered if nothing is done about adaptation of urban forests to climate change.	-2	0	0
30	Failure to address climate change is the fault of political leaders.	-2	0	0
31	As effect of climate change we have more trees that are drying now in urban forests.	-1	1	1
32	Climate variation is normal, so we cannot say that there is global climate change.	**4**	-1	-3
33	In future invasive species will become a big problem due to climate change.	-3	3	-1
34	Adapting forests to climate change should be done because of sustainable development of the city.	0	-2	-3
35	There is not enough information to say definitely that climate change exists.	2	-2	-2
36	Climate change adaptation in urban forests will not help in regulation of city microclimate.	-1	-3	-2
37	Urban scale and local adaptations are not important part of national and international policy agenda of climate change.	0	-3	-2
38	Only when negative effects of climate change become evident, it will be acted in finding a resolution.	0	0	0
39	Non-native (alochtone) species in urban forests are not negatively influenced as a consequence of climate change.	-1	-1	-1
40	Media is insufficiently covering climate change.	0	1	1
41	Urban forest management has other priorities then climate change adaptation.	3	-1	-1
42	When schools/universities include climate change in their curriculum, young generations will know what to do in the end.	1	2	3
43	Climate change adaptation in urban forests is an urgent issue that requires an immediate change of forest management.	**-4**	0	0
44	Climate change adaptation policy for urban forests should be top-down mandated.	1	2	3

 © CFRI

TABLE 2. List of statements used in Q-methodology with normalized factor scores for each statement and perspective [29] - continuation

No.	Statement	Sceptics	Management-oriented perspective	General-awareness perspective
		Normalized factor scores		
45	Adaptation to climate change in urban forest will not contribute to minimizing climate change effects if other sectors in the city (e.g. transport, energetic) are not adapted as well.	2	-1	3
46	The cost and effects of climate change adaptation in urban forests need to be calculated before actions are taken.	1	2	-1
47	The organizations responsible for climate change and other enterprises involved in urban forestry have good communication about climate change.	0	**-4**	-1
48	Enforcement and implementation of international agreements on climate change are more important at the global level rather than separately at the national or local level.	-3	-3	0

in forest structure, (iv) changes in forest increment. In social terms, vulnerability is seen through higher use and changed demands toward forests, while in economic terms vulnerability is expected by increased costs of maintenance and introduction of measures related to climate change. The concept of green infrastructure (e.g. forests, parks, green corridors) is identified as important regarding the climate change by some managers, who are trying to introduce this concept into city planning and thus secure higher visibility and importance of urban forests from other sectors (in-depth interview).

The 'general-awareness perspective' values statements which highlight general challenges to climate change as the most important, such as the need for more scientific evidence, better education, more funds for conducting research and improved cross-sectoral cooperation.

One of the main weaknesses, which was stressed in both in-depth and Q-surveys, is the low level of communication and coordination between urban forestry actors. National level organizations responsible for climate change issues and agencies involved in urban forest management (mainly at local level) do not cooperate. Managers stressed that climate change was not set as an important issue at the management level, that possible existing data and findings are not shared and used in management and that communication around the issue is a matter of individual interest (Table 3).

According to 'general-awareness perspective', climate change adaptation policy for urban forests should be top-down mandated by leading national bodies. However, 'Management-oriented perspective' perceives that management bodies, due to their practical knowledge and experience, should be involved in this process as well.

DISCUSSION

Climate change is a serious challenge for future urban forest management in Belgrade. For the last 50 years climatic changes have already been recognised [22]. Forest resources in Belgrade are facing similar problems as other forest resources in the temperate continental zone due to the climate change [17]. The notion of local risks and negative influences of climate change have been recognized in the everyday practice of forest managers, but are not analysed and tackled in future management plans. This means that many of

TABLE 3. Summary of main aspects revealed through in-depth interviews

Climate change adaptation aspects (related to questions of in-depth interview)	Main aspects identified related to urban forests in Belgrade
Climate change issue in the work of forest managers	– become a topic of discussion in the last few years – not perceived as a strategic aim of urban forest management – managers are concerned with challenges caused by climate change in everyday practices – some managers were involved in the development of national planning and climate change documents by giving expert opinion in regards to urban forests
Importance of climate change in urban forest management	– varies among managers – uncertainty exists due to the lack the data on the local impact – seen as less important challenge than other challenges (e.g. land use conflicts, governance issues, lack of information and technical assistance) – becomes more important because of perceived changes in forest resources, changes in maintenance operation, or in management practices – mitigation measures (e.g. afforestation) have been better understood
Policy and legislation regarding climate change issues	– climate change aspects mainly indirectly covered – managers' knowledge about existing national climate change regulatory framework is based only on individual interest – the lack of legislation is one of the biggest constraints for the integration of climate change adaptation measures in management
Communication about climate change	– the level of communication is very low (inside and between various organizations) is happening on individual level – need for information on financial sources and other opportunities that exist at the national level for tackling climate change – internet and grey literature are mostly used as the source of information
Urban forest contribution to climate change in FMPs	– not specifically described in UFMPs (it is seen as one of the main forest functions) – terminology related to climate change is hardly used – the long-term monitoring data regarding the contribution of urban forest to climate change are missing
Vulnerability of urban forests to climate change	– noticed in the last ten years in Belgrade, but not analysed adequately – database of resulting changes does not exist – in ecological terms the vulnerability of forests is seen through negative effects of drought periods on various tree species, water stress, worse physiological state of trees and more frequent natural disasters – management and maintenance operations have been changed (more frequent irrigation and mowing are needed, planting is done in autumn) – the structure of forests has been changed (coniferous species have been replaced with deciduous; *Fagus silvatica* L. heavily impacted, invasive tree species have become more frequent in urban areas) – change in forest increment due to long dry periods is noticed – all the changes in management and maintenance operations have been made as a consequence of already experienced negative influences (reactive adaptation measures)
Monitoring of climate change impact on urban forests	– monitoring of climate change impact on urban forests has not been done – the necessity for comprehensive monitoring practices was expressed by all managers

© CFRI http://www.seefor.eu

TABLE 3. Summary of main aspects revealed through in-depth interviews - continuation

Climate change adaptation aspects (related to questions of in-depth interview)	Main aspects identified related to urban forests in Belgrade
Climate change adaptation measures in urban forests	– have not been applied as such in urban forest management plans – most urgent and valuable adaptation measures are selection of climate-resilient species, optimizing species mixture, creation of ecological corridors and enhanced forest protection measures – in social and economic terms many actions are identified: adjustment of institutions, inclusion and empowerment of various actors, capacity building of employees in forestry, provision of finances
Constraints to climate change adaptation in urban forests	– lack of political will and legislation, financial resources, knowledge and skills about climate change – inadequate coordination and communication between urban forestry actors – passiveness of employees – absence of foresight planning in urban forest management – management practices applied currently are very old, and new methods and approaches are needed

the currently applied forestry measures are mostly characterized by reactive adaptations [44]. Introducing new measures and tools, as well integrating different tools (species suitability maps, decision support systems) in management, and making them available to a larger community of forest practitioners [45], could improve current urban forestry practice in Belgrade.

Even though, the forest sector in Serbia has been harmonized with international climate change regulations during the last decades, integration of climate change aspects in forest policy and management is still week. Main goal of the Forest Development Strategy (2006) and the Law on Forests (2010) is securing sustainable forest management [39, 40], which provide basis for further improvements and modifications towards the integration of climate change adaptation aspects in urban forest management. The Afforestation Strategy of Belgrade is one example where climate change becomes prominent [24]. Also the significance of urban planning documents for urban forest management has been emphasised. However, frequent changes of the government and legislation in Serbia prevent the adequate implementation of existing ordinances into urban forest management. Such an instable system of passing legislation is directly connected to limited reactions of lower level governments and management. Harmonization of legally binding planning and management documents is necessary for an appropriate planning of activities.

Current urban forest policy and management in Belgrade is traditionally top-down, dominated by decisions made by the national body and characterized by low levels of communication among actors. Hence, there is need for better communication between actors, as well organization of training sessions and outreach activities for forest professionals [45, 46]. Furthermore, the coordination of activities and interaction of various stakeholders at different levels and from different sectors is needed [7, 47]. Stakeholder's awareness of potential risks needs to be raised to set up conditions for well-informed and timely actions. [45]. Bottom-up initiatives by local actors (e.g. managers) addressing specific local risks to climate change could be valuable. Moreover, interactive discussions on measures [46] and the involvement of various experts (e.g. climate experts, decision scientists, social and communications specialists) are important

as this might lead to better communication and agreement on selected measures and evaluation of trade-offs [20].

Even though many urban forestry stakeholders recognize the importance of climate change, their actual response can be characterized as low and passive. This indeed represents one of the major challenges for climate change adaptation. The presence of sceptics among employees in forestry regarding this issue proves that climate change awareness is still not as high as needed. Hence there is an urgent need in Serbia to raise awareness among experts and improve capacities that are needed for adequate responses, as suggested in other European studies [45, 46]. Empowering decision-makers and citizens is an important step, and can be done through formal education programs but also public service announcements [18].

CONCLUSION

This study gives broad overview of current situation related to climate change adaptation in urban forest management and policy, thus it represents the first analysis on this topic in Serbia. It can serve as a basis for more detailed quantitative and qualitative analysis of specific urban forests and problems imposed by climate change, in both ecological and socio-economic terms, as a result of which more practice-oriented recommendation could be drafted.

At the moment, the integration of climate change adaptation measures in urban forest management in Belgrade is a big challenge dependent on decisions of distinct actors who hold different perceptions. These distinctions of opinions indicate existence of complex urban forestry system, where various needs should be harmonized in order to overcome existing and forthcoming challenges. Due to this complexity, adaptive forest management is seen as an adequate approach for urban forest management under climate change. Traditional urban forest management with a narrow sector-specific focus, dominated by decisions of few actors, cannot meet the increasing challenges that urban forests face nowadays. In practical terms, adapting urban forests to climate change should aim at reducing their vulnerability to undesirable effects while preserving a full range of ecosystem services. This mainly involves the reduction of urban forest exposure to risk and increased urban forest resilience to disturbances. Adapting socio-economic aspects of urban forestry system are thus necessary, which assume involving various stakeholders and establishing coordination and interaction at all levels, as well as developing necessary policy and management plans and programmes. Furthermore, urban forestry stakeholder's awareness and knowledge of risks imposed by climate change are necessary prerequisite in order to implement adaptation measures. Strengthening research, communication and fostering discussion around climate change, as well as building a stronger network of urban forestry actors, both at the local and national level, are therefore urgently required.

Acknowledgements

The authors would like to thank all participants that took part in this study. We are grateful to Dr. Götz Kaufmann for special advices regarding the Q-analysis work. We are also thankful to colleagues from the Faculty of Forestry in Belgrade, Dr. Dragan Nonić and Dr. Nenad Petrović, who supported us in the organisation of interviews. We are very grateful to three anonymous reviewers for very valuable and constructive comments.

 © CFRI http://www.seefor.eu

REFERENCES

1. UNITED NATIONS 2014 World Urbanization Prospects: The 2014 Revision, Highlights (ST/ESA/SER.A/352). United Nations, Department of Economic and Social Affairs, Population Division, New York, NY, USA, 28 p. URL: http://esa.un.org/unpd/wup/Highlights/WUP2014-Highlights.pdf (27 August 2015)
2. SATTERTHWAITE D 2011 How urban societies can adapt to resource shortage and climate change. *Philos T R Soc A* 369 (1942): 1762-1783. DOI: http://dx.doi.org/10.1098/rsta.2010.0350
3. IPCC 2014 Climate Change 2014 Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Field CB, Barros VR, Dokken DJ, Mach KJ, Mastrandrea MD, Bilir TE, Chatterjee M, Ebi KL, et. Al. (*eds.*)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1132 p
4. COMMITTEE OF THE REGIONS OF THE EUROPEAN UNION 2010 Adaptation to Climate Change. Policy instruments for adaptation to climate change in big European cities and metropolitan areas. DOI: http://dx.doi.org/10.2863/30880
5. GILL SE, HANDLEY JF, ENNOS AR, PAULEIT S 2007 Adapting cities for climate change: The role of the green infrastructure. *Built Environment* 33 (1): 115-133. DOI: http://dx.doi.org/10.2148/benv.33.1.115
6. UNITED NATIONS ENVIRONMENT PROGRAMME 2015 Climate Change Mitigation. URL: http://www.unep.org/climatechange/mitigation/Home/tabid/104335/Default.aspx (31 August 2015)
7. LAWRENCE A, JOHNSTON M, KONIJNENDIJK CC, VREESE R D 2011 Briefing paper 3: The governance of (peri-) urban forestry in Europe. Workshop on sharing experiences on urban and peri-urban forestry, Brussels, 28 January 2011. URL: http://ec.europa.eu/agriculture/fore/events/28-01-2011/lawrence_en.pdf (26 August 2015)
8. KONIJNENDIJK CC, RICARD R M, KENNEY A, RANDRUP TB 2006 Defining urban forestry - a comparative perspective of North America and Europe. *Urban For Urban Gree* 4 (3-4): 93-103. DOI: http://dx.doi.org/10.1016/j.ufug.2005.11.003
9. WOODALL CW, NOWAK DJ, LIKNES GC, WESTFALL JA 2010 Assessing the potential for urban trees to facilitate forest tree migration in the eastern United States. *Forest Ecol Manag* 259 (8): 1447-1454. DOI: http://dx.doi.org/10.1016/j.foreco.2010.01.018
10. TYRVÄINEN L, PAULEIT S, SEELAND L, DE VRIES S 2005 Benefits and Uses of Urban Forests and Trees. *In*: Konijnendijk CC, Nilsson K, Randrup TB, Schipperijn J (*eds*) Urban Forests and Trees. Springer, Berlin, Heidelberg, New York, USA, pp 81-114
11. NOWAK D 2000 The interaction between urban forests and global climate change. *In*: Abdollahi KK, Ning ZH, Appeaning A (*eds*) Global climate change & the urban forest. Franklin Press Inc., GCRCC, Baton Rouge, LA, USA, pp 31-44
12. ORDÓÑEZ C, DUINKER PN, STEENBERG J 2010 Climate Change Mitigation and Adaptation in Urban Forests: A Framework for Sustainable Urban Forest Management. *In*: Book of Abstracts of the 18th Commonwealth Forestry Conference, Edinburgh. Restoring the Commonwealth's Forests: Tackling Climate Change, Edinburgh, Scotland, UK, 28 June - 2 July 2010. URL: https://treecanada.ca/download_file/view/719/598/595/ (26 August 2015)
13. SPITTLEHOUSE DL, STEWART RB 2003 Adaptation to climate change in forest management. *BC Journal of Ecosystems and Management* 4 (1): 1-11
14. INNES J, JOYCE L A, KELLOMÄKI S, LOUMAN B, OGDEN A, PARROTTA J, THOMPSON I, AYRES M, *et al.* 2009 Management for Adaptation. *In*: Seppälä R, Buck A, Katila P (*eds*) Adaptation of forests and people to climate change - A Global Assessment Report. IUFRO World Series 22, International Union of Forest Research Organizations (IUFRO), Vienna, Austria, pp 135-185
15. FAO 2010 Managing forests for climate change. FAO working with countries to tackle climate change through sustainable forest management. Food and Agriculture Organization of the United Nations, Rome, Italy, 20 p. URL: www.fao.org/docrep/013/i1960e/i1960e00.pdf (27 August 2015)
16. ROLOFF A, KORN S, GILLNER S 2009 The climate-species-matrix to select tree species for urban habitats considering climate change. *Urban For Urban Gree* 8 (4): 295-308. DOI: http://dx.doi.org/10.1016/j.ufug.2009.08.002
17. LINDNER M, MAROSCHEK M, NETHERER S, KREMER A, BARBATI A, GARCIA-GONZALO J, SEIDL R, *et al.* 2010 Climate change impacts, adaptive capacity, and vulnerability of European forest ecosystems. *Forest Ecol Manag* 259 (4): 698-709. . DOI: http://dx.doi.org/10.1016/j.foreco.2009.09.023

18. LEISEROWITZ A, BARSTOW D 2010 Education and communication. *In*: Liverman D *et al.* (*eds*) Chapter 8 Informing an Effective Response to Climate Change. Washington, D.C., America's Climate Choices Report, Panel on Informing Effective Decisions and Actions Related to Climate Change, National Academy of Sciences. URL: http://environment.yale.edu/climate-communication/article/informing-an-effective-response-to-climate-change (31 August 2015)

19. WORLD ECONOMIC FORUM 2013 Global Risk 2013. Eight Edition. World Economic Forum, Geneva, Switzerland, 78 p. URL: http://www.weforum.org/reports/global-risks-2013-eighth-edition (27 August 2015)

20. PIDGEON N, FISCHHOFF B 2011 The role of social and decision sciences in communicating uncertain climate risks. Perspective. *Nature Climate Change* (1): 35-41. DOI: http://dx.doi.org/10.1038/nclimate1080

21. STUPAR A 2004 (Re)creating the Urban Identity: The Belgrade Metropolitan Region at the Crossroads of the European Integration Flows. 40th ISoCaRP Congress, Geneva, Switzerland. URL: http://www.isocarp.net/Data/case_studies/433.pdf (27 August 2015)

22. GUDURIĆ I 2013 The perception of decision-makers to climate change adaptation in urban and peri-urban forests of Belgrade. MSc thesis, University of Natural Resources and Life Sciences (BOKU), Vienna, Austria. 163 p. URL: https://zidapps.boku.ac.at/abstracts/download.php?dataset_id=10285&property_id=107 (21 February 2015)

23. INC 2010 Initial National Communication of the Republic of Serbia under the United Nations Framework Convention on Climate Change. The Ministry of Environment and Spatial Planning, Belgrade, Serbia. URL: http://unfccc.int/resource/docs/natc/srbnc1.pdf (27 August 2015)

24. RATKNIĆ M, VESELINOVIĆ M, RAKONJAC LJ 2009 Afforestation Strategy of Belgrade (*in Serbian*). Institut za Šumarstvo Beograd i Grad Beograd, Sekretarijat za Zaštitu Životne Sredine, 276 p

25. YIN RK 1994 Case study research: design and methods. 2nd edition. Sage Publications, Thousand Oaks, CA, USA,, 282 p

26. BABBIE E 2010 The Practice of Social Research. Twelfth Edition. Centage Learning, Belmont, CA, USA, 624 p

27. BARRY J, PROOPS JLR 1999 Seeking sustainability discourses with Q methodology. *Ecol Econ* 28 (3): 337-345. DOI: http://dx.doi.org/10.1016/S0921-8009(98)00053-6

28. BROWN SR 1980 Political Subjectivity: Applications of Q Methodology in Political Science. Yale University Press, New Haven, CT, USA, 355 p

29. ŽIVOJINOVIĆ I, WOLFSLEHNER B 2015 Perceptions of Urban Forestry Stakeholders about Climate Change Adaptation – A Q-Method Application in Serbia. *Urban For Urban Gree* 14 (4): 1079-1087. DOI: http://dx.doi.org/10.1016/j.ufug.2015.10.007

30. VOJKOVIĆ G, MILETIĆ R, MILJANOVIĆ D 2010 Recent Demographic-Economic Processes in the Belgrade Agglomeration. *Bulletin of the Serbian Geographical Society* 90 (1): 215-235. DOI: http://dx.doi.org/10.2298/gsgd1001215v

31. CENSUS ATLAS 2014 Census of Population 2011, Households and Dwellings in the Republic of Serbia. Statistical Office of the Republic of Serbia, Belgrade, Serbia, 125 p. URL: http://pod2.stat.gov.rs/ObjavljenePublikacije/Popis2011/Popisni%20atlas%202011.pdf (26 August 2015)

32. HIRT S 2009 Belgrade, Serbia. *Cities* 26 (5): 293-303. DOI: http://dx.doi.org/10.1016/j.cities.2009.04.001

33. GUDURIĆ I, TOMIĆEVIĆ J, KONIJNENDIJK CC 2011 A comparative perspective of urban forestry in Belgrade, Serbia and Freiburg, Germany. *Urban For Urban Gree* 10 (4): 335-342. DOI: http://dx.doi.org/10.1016/j.ufug.2011.08.002

34. STOJOVIĆ D 2011 Belgrade perspective of sustainable development and climate change (*in Serbian*). Planeta print, Belgrade, Serbia, 202 p

35. HIDMET 2011 Republic Hydrometeorological Service of Serbia. URL: http://www.hidmet.gov.rs/ciril/ipcc/info_ipcc.php (26 August 2015)

36. THE MINISTRY OF SPATIAL PLANNING, CIVIL ENGINEERING AND ECOLOGY 2010 The Law of Spatial Plan of the Republic of Serbia 2010-2020 (*in Serbian*). *Official Gazette* 88/10, Belgrade, Serbia. URL: http://195.222.96.93//media/zakoni/Zakon_o_prostornom_planu_RS-cir.pdf (26 August 2015)

37. THE MINISTRY OF SPATIAL PLANNING, CIVIL ENGINEERING AND ECOLOGY 2004 Regional Spatial Plan for the Administrative Territory of the City of Belgrade (*in Serbian*). *Official Gazette* 10/04, Belgrade, Serbia. URL: http://www.urbel.com/urbel_novi/default.aspx?ID=uzb_ProstorniPlanovi&LN=SRL (26 August 2015)

 © CFRI

38. THE MINISTRY OF SPATIAL PLANNING, CIVIL ENGINEERING AND ECOLOGY 2003 Master Plan of Belgrade 2021 (*in Serbian*). *Official Gazette* 27/03, Belgrade, Serbia. URL: http://www.urbel.com/urbel_novi/default.aspx?ID=uzb_Beograd2021&LN=SRL (26 August 2015)

39. THE MINISTRY OF AGRICULTURE, FORESTRY AND WATERS 2010 Law on Forests of Republic of Serbia (*in Serbian*). *Official Gazette* 30/10, Belgrade, Serbia. URL: http://www.srbijasume.rs/pdf/zakon_sume.pdf (26 August 2015)

40. THE MINISTRY OF AGRICULTURE, FORESTRY AND WATERS 2006 Forestry Development Strategy of the Republic of Serbia (*in Serbian*). The Ministry of Agriculture, Forestry and Water Management (MAFW), Directorate of Forests, Belgrade, Serbia, 30 p. URL: http://www.fao.org/forestry/16159-0f033f89b9da00ac3d5a3c81cda247f26.pdf (26 August 2015)

41. THE CABINET OF THE DEPUTY PRIME MINISTER, UNDP, SIDA 2005 National Sustainable Development Strategy 2008-2017 (*in Serbian*). *Official Gazette* 55/05, Belgrade, Serbia. URL: http://www.srbija.gov.rs/extfile/sr/88898/nacionalna_strategija_odrzivog_razvoja0081_cyr.zip (26 August 2015)

42. URBEL 2011 Development Strategy of the city of Belgrade (*in Serbian*). Urban Planning Institute of Belgrade (URBEL) and Palgo Center, Belgrade, Serbia, 154 p. URL: www.beograd.rs/download.php/documents/SRGBpredlog.pdf (26 August 2015)

43. IEN 2008 Tourism Development Strategy of the city of Belgrade (*in Serbian*). Institut Ekonomskih Nauka (IEN), Beograd, Serbia, 368 p. URL: http://www.projektnicentar.lazarevac.rs/pdf/strat-turizam%20BG.pdf (26 August 2015)

44. LOUMAN B, FISCHLIN A, GLÜCK P, INNES J, LUCIER A, PARROTTA J, SANTOSO H, THOMPSON I, *et al.* 2009 Forest Ecosystem Services: A Cornerstone for human Well-Being. *In*: Seppälä R, Buck A, Katila P (*eds*) Adaptation of forests and people to climate change - A Global Assessment Report. IUFRO World Series (22), International Union of Forest Research Organizations (IUFRO), Vienna, Austria, pp 15-27

45. YOUSEFPOUR R, HANEWINKEL M 2015 Forestry professionals' perceptions of climate change, impacts and adaptation strategies for forests in south-west Germany. *Climatic Change* 130 (2): 273-286. DOI: http://dx.doi.org/10.1007/s10584-015-1330-5

46. LAWRENCE A, MARZANO M 2014 Is the private forest sector adapting to climate change? A study of forest managers in north Wales. *Ann For Sci* 71 (2): 291-300. DOI: http://dx.doi.org/10.1007/s13595-013-0326-4

47. HERZELE A, COLLINS K, TYRVÄINEN L 2005 Involving people in urban forestry – a discussion of participatory practices throughout Europe. *In*: Konijnendijk CC, Nilsson K, Randrup TB, Schipperijn J (*eds*) Urban Forests and Trees. Springer, Berlin Heidelberg, Germany, pp 207-228. DOI: http://dx.doi.org/10.1007/3-540-27684-X_9

© 2015 by the Croatian Forest Research Institute. This is an Open Access paper distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0).