

## CURRENT APPROACHES IN METROPOLITAN GREEN INFRASTRUCTURE STRATEGIES

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### **Abstract**

*In the last decade, in developed countries the awareness of green infrastructure and its impact on quality of life has increased considerably. Thus, increasingly more cities have initiated development and conservation plans for metropolitan green infrastructure. The research consists of a comparative analysis of a number of green infrastructure strategies from different cities around the world, including major cities such as New York, Sydney, London, and smaller metropolitan areas like Milwaukee (USA) and Cambridge (UK). Within the study, green infrastructure plans are analyzed in terms of structure, underlying studies, visions, objectives, approached themes, complexity, relating to national and international directives, etc. The results reveal the complexity and interdisciplinary character of green infrastructure development plans. The strategies contains various current global issues approached at local level, such as climate change, energy efficiency, pollution reduction, storm water management, biodiversity conservation, public health, etc. The study shows different green infrastructure planning approaches, highlighting an increasingly interest to integrate green areas in urban development strategies and policies.*

**Key words:** Development Strategies, Green Infrastructure Plan, Landscape Planning, Metropolitan Areas, Sustainable Development.

### **INTRODUCTION**

The continuous development of the concept of green infrastructure in the last two decades has led international organizations, central and local authorities to develop specific policies and strategies at international, national and local level. Such measures have been initiated especially in the last 10 years, mostly in developed countries such as USA, Canada, Australia or Western Europe. Since 2008 the European Union introduced green infrastructure into its institutional discourse through the European Environmental Bureau (EEB, 2008). Subsequently the concept was taken over by the European Commission (EC, 2012; EC, 2013), which intends to develop a general strategy at EU level on GI (green infrastructure) till 2020. The European documents presents the importance of green infrastructure benefits, particularly for urban areas and their role in combating threats to human security and to the environment (Boc,

2014). Thus, metropolitan green infrastructure strategies can be used to propose natural solutions to various global challenges such as climate change, energy efficiency, urban microclimate conditions, food security, carbon footprint, water management, etc.

### **MATERIALS AND METHODS**

The following comparative analysis illustrates different approaches to green infrastructure strategies for metropolitan areas from Western Europe, North America and Australia, developed in the last 5 years. In the analysis are studied both large cities such as London, New York, Sydney and smaller metropolitan areas such as Milwaukee (USA) and Cambridge (UK). The results of the research are listed within a table, which contains a synthesis of the analysis, and also in a descriptive manner by presenting each criterion gradually according to which the metropolitan green infrastructure strategies have been analyzed (Table 1).

Table 1. Comparative analysis of green infrastructure strategies

	GI Strategies for metropolitan areas				
	Large areas (over 4 million inhabitants)			Medium areas (1,5 mil. inhab.)	Small areas (0,3 mil. inhab.)
	London	New York	Sydney	Milwaukee	Cambridge
Title of the project	Green Infrastructure and Open Environments: the all London Green Grid (ALGG), 2012	NYC Green Infrastructure Plan - 2010 (updated yearly)	Metropolitan Strategy for Sydney, 2012 (Chapters 3.6 Infrastructure, 3.8. Environment)	Regional Green Infrastructure Plan, 2013	Cambridgeshire Green Infrastructure Strategy, 2013 (a review of the 2006 strategy)
Prepared for	Greater London Authority	NYC Depart. of Environmental Protection	NSW Department of Planning and Infrastructure	Milwaukee Metropolitan Sewerage District	Cambridge City Council, Cambridge County Council
Major structure (contents)	<ol style="list-style-type: none"> <li>1. Introduction</li> <li>2. Vision</li> <li>3. Delivery</li> <li>4. Functions (Benefits)</li> <li>5. Green grid areas</li> </ol>	<ol style="list-style-type: none"> <li>1. Build cost-effective grey infrastructure</li> <li>2. Optimize the wastewater system</li> <li>3. Control 10% of water runoff</li> <li>4. Management, modeling impact, monitoring</li> <li>5. Stakeholders</li> </ol>	<p>Infrastructure:</p> <ol style="list-style-type: none"> <li>1. Planning</li> <li>2. Funding</li> <li>3. Social infr.</li> <li>4. Green infr.</li> </ol> <p>Environment:</p> <ol style="list-style-type: none"> <li>1. Environment</li> <li>2. Natural hazard</li> <li>3. Climate change</li> <li>4. Waste</li> <li>5. Sustainability</li> </ol>	<ol style="list-style-type: none"> <li>1. GI in Milwaukee</li> <li>2. Regional GI Plan Goals</li> <li>3. Analysis and results</li> <li>4. GI watershed priorities</li> <li>5. GI benefits and costs</li> </ol>	<ol style="list-style-type: none"> <li>1. Background</li> <li>2. Developing the GI Strategy</li> <li>3. The strategic network</li> <li>4. GI priorities</li> <li>5. Delivery of the strategic network</li> </ol>
Visions and objectives	A GI network of interlinked, multi-purpose open and green spaces with good connections, the Green Belt and the Blue Ribbon Network, especially the Thames.	Improving water quality that integrates green infrastructure, such as swales, rain gardens and green roofs, with investments to optimize the existing system.	Open space should be treated in a holistic and integrated way as a GI system including parks, reserves, protected lands, landscapes, trails, foreshores, national parks and waterways.	To capture more storm water, harvest more rainwater for reuse, and to provide social economic and environmental benefits for all.	Objectives: <ol style="list-style-type: none"> <li>1. Revise the decline in biodiversity</li> <li>2. Mitigate and adapt to climate change</li> <li>3. Sustainable economic development</li> <li>4. Healthy living</li> </ol>
Implementation	20 years	20 years	20 years	22 years	15 years (2007-2021)
Approached themes	Climate change, energy efficiency, food security, biodiversity, air quality, water management healthy living, accessibility, sustainable tourism	Storm water management, climate change, air quality, energy efficiency, green roofs, bio-swales	Climate change, energy efficiency, food security, biodiversity, water management, sustainable tourism, healthy living, landscape	Storm water management, climate change, air quality, energy efficiency, green roofs, bio-swales	Climate change, energy efficiency, food security, landscape, biodiversity, air quality, water management healthy living, accessibility, tourism, heritage
Relation to international directives	INTEREG Climate-Change Project	-	-	-	- European Landscape Convention - RAMSAR - SPA, SAC

The criteria included in the analysis are: the general structure of the strategy, vision and objectives, the expected period to implement strategies, main themes, relating to international guidelines and the number of inhabitants of each metropolitan area.

The conclusions show the common elements of the strategies and the main factors which generates different approaches in metropolitan green infrastructure planning.

## RESULTS AND DISCUSSIONS

Structure of strategies. The approached green infrastructure strategies have different structures depending on the main themes. In general, the first stage includes a presentation of the current situation of green infrastructure in the overall context of local development strategies and policies. The second part comprises the vision and the main objectives of the GI strategy. Afterwards, the priorities in the development of green infrastructure and the specific benefits are mentioned.

The implementation phase is presented either after vision, in the case of London or at the end of the strategy in the case of Cambridge. The common element encountered in all strategic plans is the development vision, which is designed generally for a period of 20 years (Table 1). The exception is the metropolitan area of Cambridge, where the strategy was developed as a review of the strategic plan from 2006, aimed to be implemented during 15 years (2007-2021). In this case, the main goal was to update the strategic objectives for 2021 and to present programs and projects already implemented or ongoing (CCC, 2013).

Visions. In the UK and Australia the vision and objectives of the GI strategies are approached from an integrated perspective, with a strong interdisciplinary character. The green infrastructure development means to create a complex network of interconnected green areas with ecological, economic, social and cultural role. In the case of the American strategies, the focus is primarily on solving storm-water management issues through sustainable methods in environmental and economic terms.

Approached themes. The strategies from Australia and the UK approach numerous

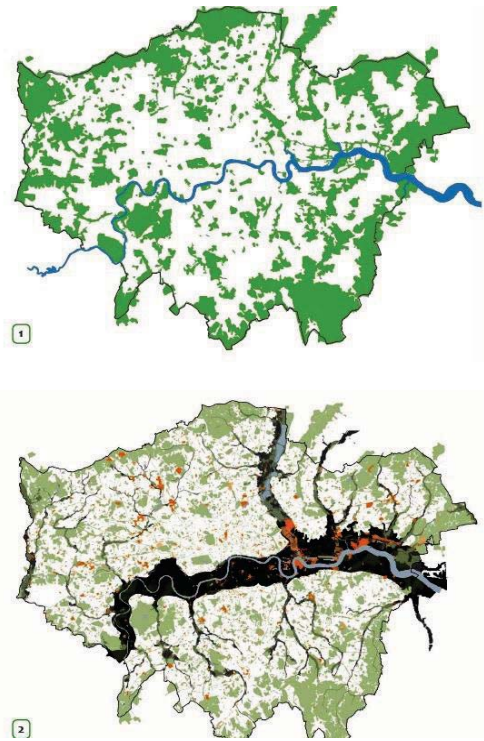


Figure 1. Green infrastructure in London (up), Managing climate change flooding (down), (source: Yuriscic, 2014)

topics mentioned in general within the EU directives, such as climate change, energy efficiency, food security, biodiversity conservation, air quality, high accessibility in green areas, encouraging an environment and style healthy living, sustainable tourism development. Regarding the multiplicity of topics addressed, the most complex is the strategy of Cambridge metropolitan area. In this case, in addition to the above mentioned themes, the cultural dimension of green infrastructure is introduced by integrating the concepts of landscape and heritage within the strategic objectives (GLA, 2012). In contrast, US strategies propose an approach based on the role of green infrastructure in storm-water management. Thus, issues such as climate change, energy efficiency and air quality are addressed in the background, especially in relation to sustainable water management. In New York and Milwaukee, strategic plans aimed at developing green roofs, bio-swales, rain gardens, wetlands and green corridors in

order to reintegrate the rainwater into the natural biogeochemical circuit (MMSD, 2013). Relation to international directives. In general, the studied strategies are not related, at least not directly, to international conventions, policies or programs. Such directives are only specified in the strategies from the UK. In the case of London, the INTERREG trans-boundary program, launched by the European Union, is integrated to combat climate change (Figure 1). The objectives of the program include: urban heat island management, flood prevention, reducing CO2 emissions and improving the quality of life through a range of practical activities (GLA, 2012). The GI Strategy for Cambridge metropolitan area has the widest coverage and is strongly related to international directives. The strategic plan integrates principles of the European Landscape Convention. Specific issues as the erosion of the character of cultural and natural landscapes are mentioned. The objectives related to the European Landscape Convention include landscape restoration and creation of new development projects involving the local community. Beside this, the GI strategy for Cambridge highlights the importance of managing natural areas which are protected through international conventions involved in biodiversity conservation, such as RAMSAR – worldwide and SAC and SPA - at European level (CCC, 2013).

The size of metropolitan areas. The main aspect which varies in this regard is the scale and the level of detail in spatial zoning of green infrastructure.

## CONCLUSIONS

The comparative analysis is noted that the American GI strategies present a sectorial character, geared mainly towards sustainable storm-water management problem. In the case of strategic plans from UK and Australia, the vision is more comprehensive, addressing numerous issues of contemporary global human

security sphere - climate security, energy and food, public health, sustainable tourism, etc. The main common elements in all strategies include an implementation period lasting about 20 years, presenting a general view of the priorities and highlighting the benefits of green infrastructure. At the same time, all GI strategies highlights the importance of green infrastructure to ensure a sustainable future for metropolitan areas. Therefore, the metropolitan authorities foresee increasingly significant investments in GI programs and projects in the coming decades.

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