Green infrastructure as a means to deliver a multi-scale approach for urban sustainability

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Introduction

A series of economic, ecological, population and institutional constraints have recently produced new challenges and pressures on urban growth and to the management of cities' critical infrastructures (Hodson and Marvin, 2010). Green infrastructure thereby provides a framework that can be used to guide future growth, land development and conservation decisions to accommodate population growth and protect and preserve community assets and natural resources (Benedict and McMahon, 2006). Key ideas from landscape ecology that are relevant to green urban infrastructure for sustainable cities include: a multi-scale approach with an explicit recognition of pattern-process relationships and an emphasis on physical and functional connectivity (Ahern, 2007).

The contribution of green infrastructure with a view of its multi-scale approach over urban sustainability and its engagement with metropolitan cities such as Melbourne (Australia) and İzmir (Türkiye) have largely formed the content of this work. Hence, this paper aims at exploring green infrastructure as a comprehensive system introduced within the continuum 'metropolitan-district (or local) scales'. This study delivers a concise but comparative analysis between the aforementioned cities in terms of establishing and/or enhancing a consistent green infrastructure that could necessarily support the urban sustainability.

Methods

This work envisaged green infrastructure as a mechanism lying in between 'metropolitan to local' planning hierarchy basically being conceptualized in Melbourne and İzmir respectively. The lack of understanding of a comprehensive green infrastructure has generally resulted in unsustainable urban growth and destruction of natural resources. So some salient facts or challenges extracted from such misused or unsustainable city development have been analyzed in close association with inequality of green infrastructure system across the metropolitan domain. At this point, green infrastructure is being configured as a means to supplement its multi-scale aspect against overriding ecological, socio-cultural and economic challenges (Fig. 1).

Though the green infrastructure concept across Melbourne has been identified within the planning chronicle as the large-scale open space networks, the gaps between planning reservations at either metropolitan or urban or district scales could not allow a thorough and consistent green infrastructure anyway. For instance; green

wedges at metropolitan scale and open space system at urban scale have not been intertwined, nor does this failure exclude the fact of accurate implementation of long term planning decisions. As with the city of İzmir, both concepts of 'green infrastructure' and 'urban open space network' have appropriately not been introduced into the planning literature. Any work over this city should therefore be based on experiments or failures of some peer cities such as Melbourne.

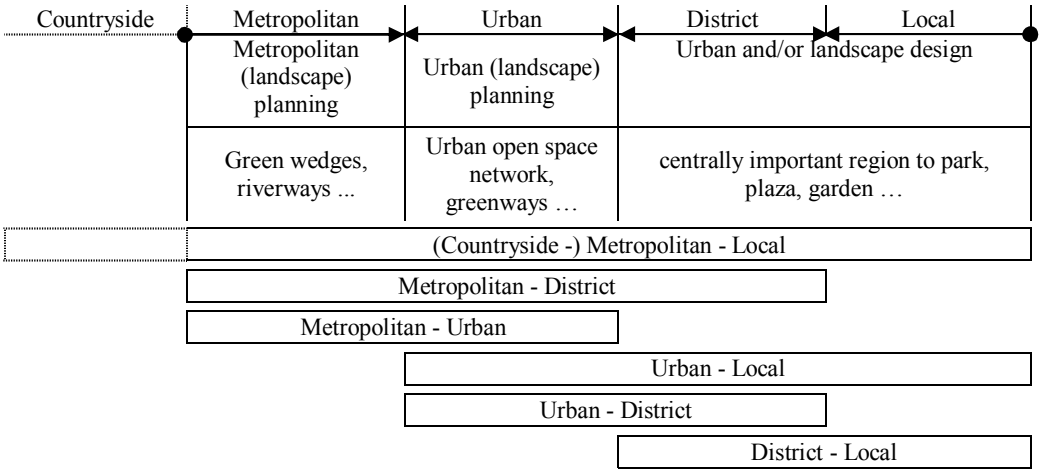

Figure 1. The content of metropolitan-wide green infrastructure

In identifying the content of subject and then conceptualizing the methodology, some extensively used literatures with relevance to the paper are featured as follows; metropolitan green network (Erickson, 2006), the nature of multi-scale approach over green infrastructure (Ahern, 2007), a design charrette on establishing Seattle's green infrastructure (Rottle and Maryman, 2007), planning and management of urban-wide open space network at Melbourne metropolitan scale (Bull, 2008), green infrastructure-sustainable city relationship (Kaplan, 2009), and the engagement of green infrastructure with urban sustainability (Mell, 2009).

Results

At the World Summit for Sustainable Development in Johannesburg (2002), Melbourne has been exemplified as a model for sustainable urban development. Melbourne's principles introduced thereupon is to guide the community's thinking on the creation of environmentally healthy and sustainable cities. In 1971, a 'corridor-wedge' plan set the pattern for metropolitan growth, creating green wedges of open countryside between corridors of urban development radiating from central Melbourne, a parks system of metropolitan significance (Ministry for Planning and Environment, 1992).

In parallel with the Metropolitan Strategy and a part of broader metropolitan planning, Parks Victoria has prepared 'Linking People and Spaces' report (2002), a strategy and a 20 year vision for the continued growth and improvement of open

space network in order to maximise the sustainability and integration of urban spaces and precincts. Some of the key outcomes include completing gaps and extending shared-use trails, forming continuous open space links between areas of parkland along Melbourne's foreshores and waterways (Fig. 2).

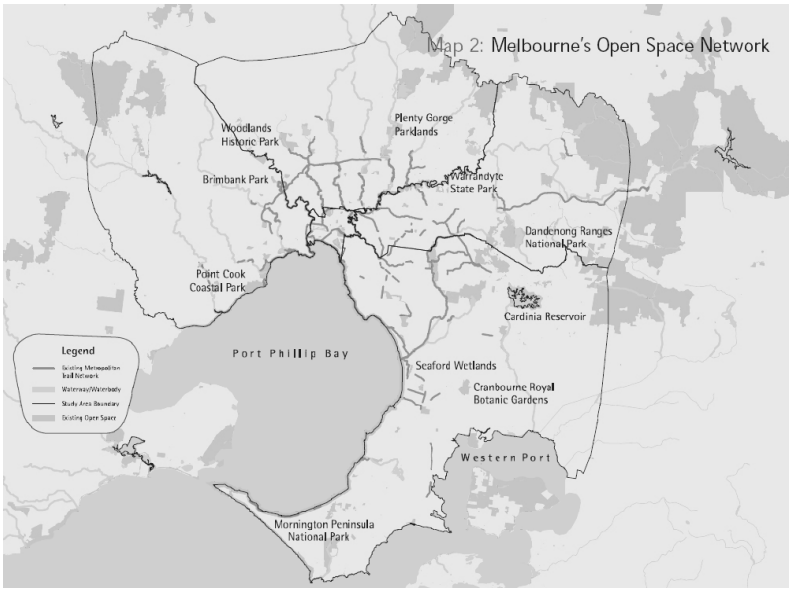

Figure 2. Melbourne's open space network at metropolitan scale (Parks Victoria, 2002)

'Places for People' report at urban design scale provides a ten-year follow-up and reassessment of urban domain for a better pedestrian network, livelier and more active streetscapes. It identified the main open space links to the city and to the water, and strengthened these physically and visually (Fig. 3) (Gehl Architects and the City of Melbourne, 2004), such as linking Dockland with the city (Fig. 4).

Figure 3. Central district of Melbourne and its environs embody a consistent urban open space network (Gehl Architects and the City of Melbourne, 2004).

Figure 4. Project vision of Dockland in relation with the city (Haycox, 2004)

The open space network in Docklands will connect the development precincts of Docklands. Pedestrian and visual connections will link together major open space nodes, the promenade system, and smaller local parks and plazas (Haycox, 2004).

Melbourne 2030 is a strategic plan prepared to manage growth and change across metropolitan Melbourne and its surrounding region. Green wedges, the 12 non-urban areas that surround the built-up urban areas of metropolitan Melbourne are outside the urban growth boundary. A wider definition of green wedges has been adopted for the purposes of Melbourne 2030. The green wedges accommodate agricultural and recreational uses as well as a variety of important functions such as water catchments that support Melbourne (Department of Infrastructure, 2002). Melbourne with its projections to 2030 has been a significant exemplary of rationalizing the sustainable city phenomena within the context of urban growth-green infrastructure relationship (Kaplan, 2009).

A metropolitan green infrastructure-like development on İzmir has more recently been suggested following a radical shift in planning paradigm, which addressed legal, administrative, and technical aspects of urban sustainability, instead of perpetuating common stereotypes over the issue of urban growth boundary and pattern. İzmir's urban development plan envisioned creating a thorough green infrastructure in the form of green corridors and belts that would substantially link some significant yet relatively distant settlements with the central region. Such conversion in the planning paradigm might be determined to further manage the urban physical structure, whilst encouraging future city scenarios based on some evidence of the green infrastructure concept (İzmir Metropolitan Municipality, 2008). The concept basically has been referred as a measure against the uncontrolled and mushroom-like urban development towards rural settlements and natural

landscapes encircling the urban domain. İzmir metropolitan plan sets out a framework of managing urban development across the regional hinterland through well-conceived green corridors. Besides this, forming a continuous open space network along İzmir Bay and its linkage with other centrally significant open spaces and networks, and inner precincts are much more the backbone of creating regional green infrastructure (Fig. 5). This approach would practically ensure sustainable urban development with regard to an understanding of such corporate infrastructure.

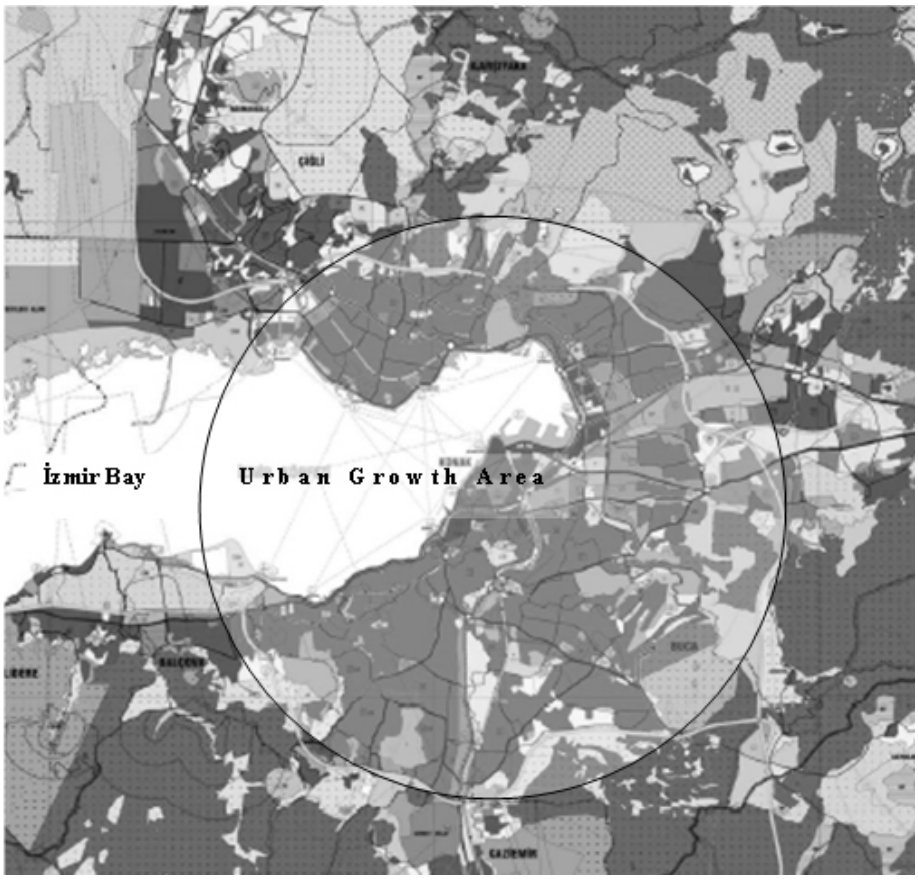

Figure 5. Green system needs to be retrofitted into a substantial linkage within and outside of Urban Growth Area (İzmir Metropolitan Municipality, 2008)

A metropolitan-scale green belt has been planned to curb the current urban encroachment around and between the centrally urban and rural regions whereby providing a significant linkage across the metropolitan city (İzmir Metropolitan Municipality, 2008).

Amidst these all, İzmir Metropolitan Municipality launched an international urban design project competition in 2001 to ensure an 'emerald necklace' of public parks, trails and a wide variety of activity centers along the strategically important district of İzmir Bay (Fig. 6).

Figure 6. The winning project for the competition depicted a continuous open space network along the central region of the bay (i.e. İzmir Harbor Region) (by courtesy of İzmir Metropolitan Municipality, 2002).

At this stage, the comparative analysis of Melbourne and İzmir metropolitan cities based on the planning hierarchy is briefly described below in Table 1.

Table 1. The comparative analysis of Melbourne and İzmir

	Melbourne	İzmir
Metropolitan scale	Given the ad-hoc urban growth, there has been a growing concern over the management of Melbourne 2030 plan and conservation of green wedges. This also impedes any likely linkages between green wedges and urban open space network.	Implementation of environmental policies over securing (green) linkages across the metropolitan region, under the auspices of İzmir Metropolitan Region Development Plan and Strategic Plan has explicitly failed to realize an extensive green infrastructure system.
	As per some officially confirmed and renewed open space strategies, the main task underway is to lay out a multi-scaled green infrastructure framework between regional parks, riverways, train lines and trails, and urban-wide open space network.	Given the increased level of infrastructural works in the coming years, metropolitan green corridors will substantially take up the agenda as an essential part of such large scale metropolitan or urban works.

	Lack of coordination between administrative bodies at county, metropolitan and local levels has generated an unsustainable management model on the way to achieve a corporate physical planning process.	
Urban scale	A comprehensive urban open space network of parks, trails, boulevards, waterways has been structured through the well-documented planning policies.	Green infrastructure or urban open space network have not, to date, sufficiently been acknowledged in legal frameworks, nor in planning policies.
	The gaps across and in between the green networks need some planning and management interventions in support of effective environmental policies and administrative bodies alike.	Since each open space has been planned and managed only within its context and not been combined with other open spaces, establishing an urban-wide open space network is a real challenge.
District	Despite some particular open space networks, the policies regarding these across the urban boundary have been neglected, and so urban (landscape) design appears now a prospective field.	Existing open spaces should be retrofitted for establishing an open space network and for the renewal of them individually. Such a technical outlook should be supported in management phase.

Discussion and conclusion

In recent years, there has been a positive trend across the world in planning and wording the notion of urban sustainability in accordance with the idea and practices of 'green infrastructure'. Mell (2009) proposes that green infrastructure and sustainability will be used to discuss the development of urban sustainability and the urban renaissance. However, Corkery and Evans (2009) draw the attention that there has been little investigation in Australia of the integration of open space into urban growth as a type of infrastructure. Similarly, in especially developing countries, given that the concept of region as a spatial unit for planning green space networks is ambiguous and undefinable, implementation of valuable regional green infrastructure is problematic (Lawson and Liu, 2009).

Despite the success of many of the planning provisions and relevant legislation in protecting green wedges, there are major challenges to the future of these areas such as residential subdivisions, inappropriate commercial uses. There has been no single authority for the management of the green wedges, and related municipalities have reacted differently. Likewise, as Buxton and Goodman (2003) pointed out that many planners regard Melbourne's green wedges and green belt as a 'holding zone' for urban development to be released when needed. Contrary to these all, green infrastructure as an over-arching policy theme should be employed to ensure that environmental priorities and objectives are given equal policy attention with the social and economic agendas. This is essential for sustainable growth and the future prosperity of the cities such as İzmir (2030), London, Melbourne (2030), Seattle (2100), Vancouver (2030) (Kaplan, 2009).

Although Melbourne and İzmir are now in relatively different stages in achieving a multi-layered (metropolitan to district) green infrastructure, the potentials they hold would overwhelmingly lead them to track down urban sustainability within the context of the infrastructure concept. Such a scheduled green infrastructure would

typically be able to regulate uncontrolled urban development and 'urban growth-open space' equilibrium for urban sustainability.

Acknowledgement

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