

Emerging trend of urban green space research and the implications for safeguarding biodiversity: a viewpoint

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Abstract: It is now abundantly clear that rapid urbanization is greatly transforming the spatial pattern of urban land use worldwide. Consequently, the resulting losses of urban green space at local to global level are continuously altering urban ecosystems. Recent research on this aspect has stressed on the importance of urban green spaces as well as their losses due to rapid urban growth. The importance of ecosystem services provided by urban green spaces for human well-being is gaining recognition and has been highlighted by most of the recent studies. In this short communication, we discuss the emerging trend of urban green space research and its implications for safeguarding biodiversity in line with the declaration by the United Nations that 2010 to be the International Year of Biodiversity. [Nature and Science 2010;8(7):43-49]. (ISSN: 1545-0740).

Keywords: Urban Green Space, Biodiversity, Ecosystem Services, Urban Dwellers, Sustainable Development

1. Introduction

Biodiversity of urban green spaces is well recognized for the provision of variety of ecosystem services to humanity. Hence green spaces are recognized as one of the most popular resources of the urban ecosystems today. The increasing urbanization and human population growth during recent decades have resulted significant loss of habitats in the urban landscape (Mckinney, 2002) and accompanied by many environmental problems, such as a reduction of green spaces and ecosystem deterioration (Lee *et al.*, 2005). In urban areas, the importance of urban green spaces is well highlighted as remnant habitats with high value for biodiversity and because some of rare and endangered species with significant conservation value may present in these habitats. Urban green space includes everything in cities that has the vegetation. Collectively it is sometimes referred to as 'Green Infrastructure', encompassing the entire working landscape in cities that serve roles such as improving air quality, flood protection and pollution control (Girling and Kellett, 2005). Some of the many benefits of urban green spaces are; air and water purification, mitigation of the impact of environmental pollution, carbon sequestration, regulation of microclimate, habitat for urban wildlife, recreational, spiritual and therapeutic value as well as social integration (Miller, 1997; Milton, 2002; Hague and Siegel, 2002). Hence, green space improves the environmental quality of life, urban tourism, active and passive recreations and many other urban ecological functions (Kaplan and Kaplan, 1989; Randall *et al.*, 2003). At present, several studies

have pointed to urban green spaces as a resource in promoting public health and providing valuable ecosystem services to urban dwellers (Maas *et al.*, 2006; Alver, 2006; Jim and Chen, 2008; Rafiee *et al.*, 2009; James *et al.*, 2009). Monitoring land use changes in the urban environment is an important issue in planning and management and remote sensing and geographic information systems are considered as the most efficient techniques for this type of studies. Using these modern tools, a range of recent studies have focuses on monitoring urban growth pattern, land use and land cover changes, urban green space patterns, and biodiversity conservation in urban areas (for e.g. Herold *et al.*, 2003; Jim and Chen, 2003; Bauer *et al.*, 2003; Yuan *et al.*, 2005; Jim and Chen, 2006a, b; Jensen and Im, 2007; Johari, 2007; Kazmierczak and James, 2008; Faryadi and Taheri, 2009; Rafiee *et al.*, 2009; James *et al.*, 2009; Chen *et al.*, 2009). Considering the fact that urbanization is having enormous impact on the environment at local, regional and global scale (Turner *et al.*, 1990) the trend of studying different aspects of urban green spaces is gaining momentum among urban researchers. Conservation of biological diversity and ecosystem services in urban environment necessitate valuable ecological information which could be incorporated into urban green space planning and management.

2. Urban Green Spaces & Sustainable Development

Presently, urbanization is rapid worldwide and is expected to continue in the coming decades, especially in the developing world where the United Nations Population Fund (UNPF-2007) anticipates 80% of the world's urban communities will be found by 2030 (Beardsley *et al.*, 2009). Thus, in order to respond to the idea of sustainability, urban areas have to maintain an internal equilibrium balance between socio-economic and environmental conditions in such a way that the urban system and its dynamics evolve in harmony, internally limiting, and as much as possible low impacts on the natural environment (Barredo and Demicheli, 2003). As far as the roles of urban green spaces in urban environment are considered, they are recognized as key ecological service providers to urban dwellers with multiple functions and also an important pillar of sustainable development. Some authors (e.g. Yli-Pelkonen and Niemelä, 2005; Sandstrom *et al.*, 2006) pointed out that the multiple functions of urban green spaces are reasonably well developed, but these are not well integrated into the urban planning, design and management process. Furthermore, reliable and robust approaches to the valuation of urban green spaces that effectively support decision making are often absent (Tyrvaäinen, 2001; Neilan, 2008). However, under the 'Greenkeys- urban green as a key for sustainable cities' (www.greenkeys-project.net) project, some efforts have been made recently to address the issues of improvement of urban green space systems as a step towards more sustainable cities by developing a 'Pool for Green Space strategies'. Also, a manual on 'Greenkeys @ your city- a guide for urban green quality' was developed under the project which contains suggestions for the green space development in European cities and provide guidance on the preparation and implementation of an urban green space strategy. Subsequently, the key role of urban green space plays for improving the quality of life in urban areas was discussed in the International Conference on Urban Green Spaces (held in Sofia, Bulgaria, 2008). Therefore, there is a continuing need to promote such initiatives for sustainable development of urban landscapes. Gill *et al.* (2007) emphasized that the urban green spaces can play a central role in both climate-proofing cities and in reducing the impacts of cities on climate. Presently, as rapid urbanization is causing losses of even more urban green space across the globe, this may have therefore important implications for future changes in the Earth's climate. Hence, urban green spaces need to be preserved and promoted for future generation as they provide key ecological services.

3. Urban Green Space Research in Malaysia

At present, with the increase in the proportion of global urban population, cities are also expanding spatially and resulting in loss of urban green spaces. Particularly the expansion of residential and commercial land uses towards the periphery of urban areas has been recognized as the main factor in influencing the urban ecosystems (Yuan *et al.*, 2005). The negative environmental impacts of urban growth have been demonstrated in developed and developing countries (Chiesura, 2004; Colding, 2007; Theobald *et al.*, 2000; Tzoulas *et al.*, 2007). Therefore the need of establishing sustainable equilibrium between ecological, social and economic functions of the urban ecosystems has been debated in different forum and continues towards achieving sustainable urban landscapes. In Malaysia, urban population in 2000 was more than 57% of the total population and is projected to reach 70% of the total by 2020 (Department of Statistics, Malaysia 2000, Salleh, 2000). The trends of rapid urbanization are evident in cities such as Kuala Lumpur and Georgetown, Penang with high population density. This increase in urban population in due course will result in a transformation of the physical appearance of many cities in Malaysia (Ghazali, 1999). The need of careful planning and monitoring of urban growth by local and federal authorities of Malaysia has also highlighted by Samat (2006), who pointed out that the changes in land use can generate local, regional or global impact on biodiversity, landscape or living environment. In general some comprehensive studies addresses the issues of urban development, sustainable urban landscapes and urban planning and conservation in Malaysia (e.g. Goh, 1991, 2002; Ghani, 2000; Salleh, 2000; Jenkins and King, 2003; Omar, 2003; Abdullah, 2003; Omar, 2003; Tahir and Roe, 2006; Lee *et al.*, 2008). In order to guide economists and urban planners in making a decision pertaining to urban development, Osman *et al.* (2008) developed a framework of understanding urban sprawl and its financial cost in Malaysia. Other researchers applied different approaches to analyze the relationship between urban growth and the impacts on urban environment. Some studies focuses on application of geospatial tools to develop decision support framework for urban environment (Rainis and Noresah, 2004; Noresah, 2006; Samat, 2007; Noresah and Rainis, 2009). And more recently, Tan *et al.* (2009) used an integrated approach of remote sensing to evaluate urban expansion and determine land use changes. Results of this study illustrated that Landsat multi-temporal image could provide an accurate map and detailed descriptions of land cover changes and these findings can be efficiently used for decision-making in land management and policy making. However, studies on urban green spaces have not received much

attention so far. Few studies have been carried out in this area (e.g. Johari, 2007; Hussein, 2006; Mazlina and Ismail, 2007, 2008), however comprehensive studies are still to be conducted in order to achieve sustainable urban landscapes. According to Salleh and Ishak (2002), rapid economic growth and widespread urbanization is deteriorating the Malaysian cities and air and noise pollutions are becoming serious problems in many urban areas. Thus, urban green areas have a vital role to play in the sustainability of towns and cities as they are considered as important parts of natural life support system. The authors also suggested that government must make urban greening mandatory in all development projects and advocated for using local agenda 21 to incorporate sustainable development into local town planning, including tree planting. Urban green space studies have great significance in the near future in accommodating the increasing urban population. Therefore, more studies should be focused on urban green spaces of Malaysian cities. Also getting green space information quickly and accurately can provide a foundation for urban environment, green space system planning and all-level of decision-making. Considering the fact that the understanding of importance of urban green space for obtaining social and ecological sustainability in Malaysian's urban landscapes is essential; such studies therefore would have implications to improve urban environmental quality for people by supporting biodiversity conservation and preserving urban green space resources.

4. Implications for safeguarding biodiversity

The biological diversity or biodiversity was introduced at Rio de Janeiro Earth Summit in 1992 as a major objective in world-wide conservation strategies to ensure conservation and sustainable use of biodiversity. The United Nations General Assembly declared 2010 as the International Year of Biodiversity (IYB), to safeguard the biodiversity and to bring awareness about the significance of biodiversity. Through this, the world is invited to take action in 2010 to safeguard the variety of life on earth: biodiversity (www.cbd.int). This clearly accentuates more and more understanding of biodiversity value and strategic approach to conservation prioritization under global change scenario. The recent biodiversity research revealed that not only natural and semi-natural landscapes can be highly diverse in flora, fauna, and habitats, but that urban and industrial areas also display a wide variety of habitats, communities and organisms (Sukopp, 1998). Hence promoting and preserving biodiversity within urban green spaces is one way to decelerate the rapid rate of biodiversity loss (Alvey, 2006). In urban environment, the urban green spaces

offer important harbors for remnant biodiversity (Kong *et al.*, 2009). Some authors (Miller, 1988; Duhme and Pauleit, 1998) pointed out that urban biodiversity conservation should receive more attention, as urban areas may contain a rich flora that contributes significantly to biodiversity. Fordham and Brook (2010) suggested that policy makers and resource managers must be armed with the most ecologically 'realistic' projective artillery if the impending biodiversity crisis is to be averted. At present, close to half of the world's population lives in urban centers, and the proportion is likely to grow as an increasing amount of the world's economic activities concentrate in urban centers (Satterthwaite, 2002). The proportion of the world's population living in cities is expected to surpass 65% by 2025 (Schell and Ulijaszek, 1999), and dramatic population increases have been accompanied by intensified urban development. Under these scenarios, there is no doubt that the significance of urban green spaces will increase tremendously with increasing urban population. Among others, the maintenance of biodiversity (i.e. preserving diversity; within species, of species, of ecosystems, and of landscape types in the surrounding countryside) and environmental quality of the urban area (i.e. improvement of the local climate, air quality and decrease of environmental noise) are the main functions of green spaces in cities (Boverket's, 1992), which clearly demand safeguarding biodiversity in urban environment. For conserving urban biodiversity, there must be a feasible and replicable action plan for urban environment as per the geographical condition of the area. Likewise, the urban development authorities should include plantation of multipurpose and high conservation value plant species as a routine activity in their urban action plan. For instance, multipurpose tree species which traps pollutant, having long rotation period, evergreen, and provide shelter to wildlife needs to be promoted. In fact in urban areas, plantation of a multipurpose tree in front or backyard of the house should be mandatory for every household and urban development authorities must maintain a green park in the vicinity of every multistory building/ residential area. This will facilitate in creating new habitats for urban wildlife and increasing opportunities for urban biodiversity, restoring cities degraded areas, regulation of microclimate, improve the environmental quality of life, and eventually achieving sustainable urban landscapes. McKinney (2002) advised that fostering a well informed public may be the most important application of urban ecology. We also suggest that formulating strategy for maintenance and development of urban biodiversity values with improved people's awareness will certainly help in achieving the IYB's

major objective of safeguarding biodiversity and hence safeguarding the life on earth.

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