



A review of urban ecosystem services: six key challenges for future research



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ABSTRACT

Global urbanization creates opportunities and challenges for human well-being and transition towards sustainability. Urban areas are human-environment systems that depend fundamentally on ecosystems, and thus require an understanding of the management of urban ecosystem services to ensure sustainable urban planning. The purpose of this study is to provide a systematic review of urban ecosystems services research, which addresses the combined domain of ecosystem services and urban development. We examined emerging trends and gaps in how urban ecosystem services are conceptualized in peer-reviewed case study literature, including the geographical distribution of research, the development and use of the urban ecosystem services concept, and the involvement of stakeholders. We highlight six challenges aimed at strengthening the concept's potential to facilitate meaningful inter- and transdisciplinary work for ecosystem services research and planning. Achieving a cohesive conceptual approach in the research field will address (i) the need for more extensive spatial and contextual coverage, (ii) continual clarification of definitions, (iii) recognition of limited data transferability, (iv) more comprehensive stakeholder involvement, (v) more integrated research efforts, and (vi) translation of scientific findings into actionable knowledge, feeding information back into planning and management. We conclude with recommendations for conducting further research while incorporating these challenges.

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1. Introduction

Urbanization is increasing on a global scale, creating both opportunities and challenges for fostering people's quality of life and managing the transition towards sustainability. Today, the majority of the world's population lives in urban areas, and two-thirds of the world's population is expected to be urbanized by 2050 (United Nations, 2012). It has been argued that urban living has the potential to fulfill basic human needs at the least cost due to economies of scale (Bettencourt et al., 2007). Urban development plays a significant role in the transition to lower birth rates and lower childhood infections while increasing life spans (Dye, 2008), and in fostering economic development and facilitating innovation (Johnson, 2008; UN-Habitat, 2012). However, urbanization processes may also have adverse effects on many aspects of human well-being, including increasing crime rates (Bettencourt et al., 2007) and growing human ill-health (Frumkin, 2003; Lederbogen et al., 2011), thus benefits and drawbacks of urban development may differ among cities and regions. Moreover, although urban areas cover a small fraction of Earth's terrestrial surface, they account for a significant portion of global carbon emissions, energy and resource consumption (IEA, 2008), contributing to climate change, ecosystem degradation and biodiversity loss on a global scale (Grimm et al., 2008; McDonald et al., 2008; Seto et al., 2012).

In the context of a rapidly urbanizing world, understanding complexity and managing human–environment interactions within urban areas is vital if we are to balance the interdependent social and ecological goals of sustainability (Ash et al., 2008; Bettencourt and West, 2010; Clark, 2007). Urban planning can tackle these sustainability challenges by addressing the inherent linkages between the interacting economic, environmental and social components in coupled human–environment systems (Wilkinson et al., 2013; Wu, 2013). A comprehensive planning approach has the potential to harmonize human–environment interactions and mitigate the harmful impacts of urbanization (Andersson, 2006). Such an approach requires planners to understand and value nature's multiple contributions to the quality of urban life

(Hubacek and Kronenberg, 2013).

The concept of ecosystem services, here defined as “the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfil human life” (Daily, 1997, p. 3) provides a framework for conceptualizing and managing human–environment interactions (Daily et al., 2009) within the broader context of sustainability. Applied to urban planning, the ecosystem services concept reveals urban populations' dependence on the goods and services appropriated from ecosystems (Elmqvist et al., 2013; Gómez-Baggethun and Barton, 2013). However, the question as to what constitutes an ‘urban ecosystem service’ is contested, in part, due to the spatial and temporal mismatches between the physical boundaries of urban areas and the resources drawn into and used within them (Borgström et al., 2006; Ramalho and Hobbs, 2012). Ecosystems – both within and outside urban areas – are frequently modified to provide specific ecosystem services to urban dwellers (Gutman, 2007; Sandhu and Wratten, 2013). Following McGranahan et al. (2005), Gutman (2007) and Jansson (2013), we define urban ecosystem services as those services that are either directly produced by ecological structures within urban areas, or peri-urban regions. For example, rural food production can be ‘delivered’ to either rural or urban dwellers and therefore does not, in our definition, constitute an urban ecosystem service.

Although the notion of ecosystem services and its application to urban environments potentially provides a useful conceptualization for further understanding the human–nature interface (Söderman et al., 2012; Tobias, 2013), its operationalization is fraught with difficulties. In this review we identify some of the operational challenges of urban ecosystem services research.

The ecosystem services concept conceptualizes human–environmental interactions through a series of linked components that relate ecological processes to human well-being. Here, we use a particular conceptual model of those components and their linkages referred to as the ‘ecosystem services cascade’ (Haines-Young and Potschin, 2010; Potschin and Haines-Young, 2011), where ecological structures generate ecological processes and

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