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Editorial

Advancing the frontier of urban ecosystem services research

1. Introduction

The continuous growth in the number and size of urban areas along with an increasing demand on resources and energy pose great challenges for ensuring human welfare in cities while preventing loss of biodiversity and degradation of ecosystems (Seto et al., 2013). Studying how urban ecosystems function, provide goods and services for urban dwellers, how they change, and what allows or limits their performance can add to the understanding of ecosystem dynamics and improve governance of urban ecosystem services (Elmqvist et al., 2013; Haase et al., 2014).

A rapidly developing body of knowledge suggests that ecosystem services production and provisioning cannot be detached from the social context in which they reside (Schewenius et al., 2014). Developing new and improved ecosystem services valuation methods (see for example Escobedo et al., 2015) is necessary but not sufficient for understanding the mechanisms that allow for the production, distribution and use of urban ecosystem services. For this reason, a social–ecological approach for the study of urban ecosystem services is developing (Andersson et al., 2007; Reyers et al., 2013). Finding ways to meaningfully incorporate the societal dimension in the study of urban ecosystem services in theory, in empirical study and in practice has been, and still is, a major challenge in adapting the concept of ecosystem services for planning and decision-making.

This special section in Ecosystem Services presents multiple approaches to better incorporate societal dimensions in urban ecosystem services research. It explores (1) how the ecosystem services approach might be expanded and provide important bridges to achieve urban sustainability and resilience; (2) specifically how cultural ecosystem services in urban areas may represent a key to valuation, improvement and preservation of urban ecosystem services in general, and (3) the institutional structures surrounding the implementation of ecosystem services oriented policies and management. Within these themes we explore new conceptual and theoretical approaches, empirical studies, and methodological and analytical developments critical for providing new tools and approaches for applying urban ecosystem services frameworks to promote more sustainable and resilient urban social–ecological systems.

2. Expanding ecosystem services frameworks

McPhearson et al. (2015) draws on the resilience literature to highlight how green infrastructure supports sustainable production of ecosystem services in the city, both by directly reducing vulnerability to environmental disasters and hazards (for example weather related events) and by offering defined targets for management and monitoring. The authors suggest that understanding and addressing resilience through urban ecosystem services and resilience of urban ecosystem services may enable urban planning and governance to become adaptive and reflexive, and that improving resilience in urban systems, in research and in practice, requires that we deal with the complex nature of and interactions within urban social–ecological systems. Andersson et al. (2015a) use the ecosystem service providing units approach to explore the internal structures and preconditions of ecosystems that influence and shape the provision of ecosystem services and discuss the context dependent nature of ecosystem services production. This conceptual contribution emphasizes the contextual factors affecting the performance of service providing units and thus influencing the quantity and quality of ecosystem services provision. Doing so, they place the production of ecosystem services within their physical landscape and societal boundaries. The authors argue that developing this nuanced approach is key to anticipating consequences of land use change, designing multifunctional landscapes and achieving multiple ecosystem services goals. This ongoing evolution of the ecosystem service framework suggests that policy and planning must be continuously engaged in rethinking and updating recommendations and tools, which requires a strong mandate in urban governance for engaging with ecosystem services as well as an institutional setting that allows for adaptation.

3. Cultural ecosystem services

Several articles in this special issue emphasize and scrutinize the urban perspective of cultural ecosystem services (CES) and the particular importance of these in urban social–ecological systems. Andersson et al. (2015b) propose that CES and urban nature experiences can be used as a gateway to more informed discussions about what kind of urban green infrastructure might be desirable, and guide efforts to mainstream and build support for all urban ecosystem services. They argue that CES can be especially important in cities as they are intimately known and acknowledged by most urban residents. People often notice changes in these services and can be motivated to engage in protection or promotion of CES. Since CES are often bundled with other ecosystem services, engaging in their stewardship will implicitly include other ecosystem services. This bundling effect could be used as a starting point for increasing stewardship of all urban ecosystem services.

Four papers investigate ways to integrate the perceptions of urban dwellers into CES assessment to achieve a deeper and more nuanced understanding of the multi-layered values and benefits of an important ecosystem services providing unit: urban parks. In one case study in Salzburg, Austria, Voigt and Wurster (2015)

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study the relationship between ecosystem services, species and landscape biodiversity (i.e. how biodiversity is enjoyed) as part of the urban nature experience. The authors find that although people tend to highly value biodiversity, the ability to define biodiversity and the meanings attached to biodiversity are fuzzy and multi-layered. Bertram and Rehdanz (2015) offer a comparative study of citizens' use and perception of urban parks in four European cities – Berlin, Stockholm, Rotterdam and Salzburg and find varied understandings of the CES provided by urban parks. This comparative study shows both how context and human perception are likely to change the meaning and importance of different CES and demonstrates that the value of urban nature for health and well-being is held high despite differences in the perceptions of the ways this value is realized. Adding additional layers of complexity, Langemeyer et al. (2015) conducted a survey in the largest urban park in Barcelona showing related different park land uses and structures with different CES to derive monetary and non-monetary CES values. Finding distinct relationships between park structure and the CES it provides, as well as demonstrating how different methods will provide distinctly different information, they suggest that urban planners can use urban park design and management strategies to enhance particular CES. Finally, using a Q interview methodology in three parks in Rotterdam, Buchel and Frantzeskaki (2015) found similarly that CES, including recreation, aesthetic appreciation, relaxation and social settings, are perceived as highly important by park users. The Q methodology allowed the authors to distinguish three user profiles: “love of nature”, “recreation and connection” and “social setting and relaxation” that were determined by the combination of individual preferences for specific ecosystem services. They argue that development of parks in accordance with user perceptions and preferences for design elements and amenities can facilitate diversity of park users and increase the accessibility of urban parks to multiple populations.

Together these papers highlight the growing interest in cultural ecosystem services and the importance of the human perception component of ecosystem services, offering new empirical findings, tools, methods, and policy implications.

4. Institutional settings and how they may facilitate or hinder implementation of UES frameworks

Integrating the ecosystem services approach into policy and practice continues to prove challenging. Many environmental problems persist because of the inability of public institutions to take actions that often require significant departure from current status quo. Using urban trees in Poland as an example, Kronenberg (2015) illustrates the potential difficulties in getting local authorities that are responsible for urban greenery, to adopt new management paradigms. The study describes how the authorities are confronted and constrained by ‘other priorities’ dictated by more powerful departments and a general negative attitude towards trees that is at least in part shaped by a negative association with a socialist past. On the other hand, based on an assessment of planning and policy documents from five European and North American cities Hansen et al. (2015) illustrate that urban planning in many cities already integrates ecosystem services, with emphasis on cultural services and habitat services, even if the concept of ecosystem services is not always explicitly considered. Those cities that consciously implement the concept of ecosystem services are often influenced by the length of time since the introduction of the concept, on the context of wider national approach to ecosystem services, and on the diversity of approaches to planning.

Addressing common urban planning practices, Buchel and Frantzeskaki (2015) argue that commonly used characteristics of urban populations, such as demographics, may be insufficient to describe preferences of urban dwellers for urban nature and thus hinder effective planning of urban parks. Instead, the authors offer a park user typology based on user preferences to better link user preferences for benefits of urban nature. Together these articles demonstrate how institutional settings can facilitate or hinder the implementation of ecosystem services as well as some of the key factors that are likely to influence the process of integrating ES concepts into urban planning.

5. Advancing the frontier of urban ecosystem services research: the way forward

Ecosystem services are not merely a present need for urban resident health and well-being, but important for more sustainable urban futures. The rapid pace of urban development and rising urban populations emphasizes the need to make significant and rapid progress with how to assess and ensure resilient flows of ecosystem services to meet the needs of future urban residents living in dynamic urban social–ecological systems. Through conceptual, methodical and empirical research, papers in this special issue draw attention to the particular complexities and nuances that require our attention when eliciting UES and their values. To advance the frontier of urban ecosystem services research we posit that:

1. Ecosystem services are co-produced by people and nature. A social–ecological approach to understanding urban ecosystem services is critical to furthering governance, planning, and policies that seek to utilize ecosystem services for a variety of urban goals, including climate change resilience, public health, and urban sustainability.
2. While CES are often neglected because they are challenging to assess, the cumulative research in this special issue suggest that their assessment and valuation should be at the top of urban ecosystem services research priorities. Developing better understanding of urban dwellers' perceptions and the multi-layered benefits and values they derive from urban CES can support urban planning and decision making that is grounded in and fits the particular social–ecological systems they serve.
3. The provision, value and utilization of urban ecosystem services are highly dependent on multiple contextual factors and human perception. Influences such as location, spatial organization of elements, the arrangement of design elements and amenities, as well as individual background and preferences, translate to major differences in the relevance of urban ecosystems and their values.
4. To understand contextual factor and individual preferences in order to assess the benefits and values of urban CES, integrated methodologies are required. Various CES and multiple value dimensions can produce the overall perception and utilization of any urban ecosystem services. Addressing this multidimensionality often requires highly involved field work such as interviews and questionnaires, and the inclusion of non-monetary values.
5. The institutional setting will strongly influence the extent to which the ecosystem service framework is implemented. Successful adoption of the ecosystem service framework as a new way of working with environmental issues in policy and planning, for example within the Sustainable Development Goals (SDGs), needs further study to identify structural barriers and opportunities.

To effectively protect ecosystems and biodiversity, and enhance the provision of ecosystem services in urban areas, research of urban ecosystem services need to recognize the complex social–ecological systems that drive human-nature relationships in urban

areas. This special issue provides new conceptual and empirical inputs to the expanding body of research on urban ecosystem services. If the ecosystem services framework is to be a useful for planning and policy making for sustainable and resilient urban futures, careful attention to all societal aspects of urban ecosystem services is needed.

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