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Research Paper

Conceptualizing the nexus between urban shrinkage and ecosystem services

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HIGHLIGHTS

- Urban shrinkage has become an issue for urban planning and policy.
- Shrinkage offers great potential to re-create urban green space and ecosystem services.
- This paper develops a matrix approach that links shrinkage and ecosystem services.
- The matrix consists of four steps and helps evaluating synergies and trade-offs.
- We show how planning policy in shrinking cities could benefit from considering ecosystem services.

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ABSTRACT

Urban shrinkage has become an issue for urban planning and policy in Europe because approximately 40% of its large cities are currently losing population. Shrinkage implies dramatic land-use impacts, including under-utilisation, vacancy, demolition, emerging brownfield sites, and de-densification. However, shrinkage also offers great potential to "re-create"—that is, to enhance and implement—urban green space including the ecosystem services it provides: Local climate and air quality regulation by trees that grow on abandoned land, carbon sequestration and storage by vegetation on vacant lots, preservation or enhancement of urban biodiversity, and recreational facilities that support the mental and physical health of the inhabitants through the enlargement of parks and woodlands. This paper argues that there is a linkage—a nexus—between shrinkage and ecosystem services provisioning. We develop a matrix approach that links the potentials of land use (change) related to urban shrinkage with ecosystem services provisioning in cities. Through a discussion of these potentials, challenges, and the relevant strategies of urban planning such as interim uses, urban afforestation, or community gardens, we show how planning policy in shrinking cities could benefit from considering the nexus between shrinkage and urban ecosystem services provision. Empirical evidence comes from Leipzig, Germany, a city that has, until very recently, experienced decades of shrinkage and still faces many of the resulting challenges.

1. Introduction

Urban shrinkage has become increasingly important for urban planning and policy in Europe because approximately 40% of its large cities with >200,000 inhabitants are currently decreasing in population size (Turok & Mykhnenko, 2007; Kabisch & Haase, 2011). Urban shrinkage results from the specific interplay of macro-processes in economic, demographic or settlement systems, environmental hazards, and changes in political or administrative systems, such as the systemic changes in Eastern Europe coupled to the introduction of a market economy, that operate at a local level. Haase, Rink, and Großmann (2012), Haase, Schwarz, Strohbach, and Kroll (2012), Haase, Kabisch, Haase, Kabisch, and Rink (2012), Haase, Rink et al. (2012) explains that current urban shrinkage in early industrialized regions results from "a decline of traditional industries, a decline that induces general economic crises, unemployment and outmigration to other prospering regions. [Simultaneous] ... rampant suburbanization leads to residents abandoning the city. Both processes often rapidly cause an increase

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in the age of the remaining population, resulting in further demographic decline" (p. 93).

Recent studies show that a considerable proportion of Europe's large cities is shrinking, currently mostly in either the older industrialized West (Rhine-Ruhr area, Alsace; Lorance Rall & Haase, 2011) or post-socialist Eastern Europe. In the US, shrinkage goes beyond the so-called rustbelt (Schilling & Logan, 2008). Asian countries such as Japan, South Korea, Taiwan, and even China have become increasingly affected (Oswalt, 2005). Shrinkage, at the local and regional scale, brings about a range of consequences for almost all policy fields such as population development, real estate markets, infrastructure provision, land use management, labor markets, and finance markets. This shrinkage deeply irritates and challenges traditional growth-oriented approaches to city planning (Schilling & Logan, 2008).

On the one hand, urban shrinkage implies dramatic impacts for urban land use and properties: under-utilization, de-densification and vacancy, demolition and resulting grayfields and brownfields (Schilling & Logan, 2008). Nevertheless, planning policy-makers still struggle to find appropriate strategies, instruments, and governance schemes to cope with these developments. In addition, planning in shrinking cities is commonly confronted with a lack of resources and capacities (Couch et al., 2012).

On the other hand, land use change and land conversion related to shrinkage offer great potential to "re-create", enhance and implement urban green space, including the services it provides: local climate and air quality regulation by trees that either naturally invade or are planted on abandoned land (Rink & Arndt, 2011), carbon sequestration and storage on vacant lots and unsealed land (Strohbach, Arnold, & Haase, 2012), moderation of heavy rainfall (Kubal, Haase, Meyer, & Scheuer, 2009), preservation or enhancement of green infrastructure and urban biodiversity, recreational facilities that support the mental and physical health of the residents (Schetke, Haase, & Breuste, 2010), community gardens that revitalize urban environments and empower community residents (Rosol, 2005) and last but not least, novel, innovative, and possibly interim land re-use strategies to stabilize dysfunctional real estate markets (Schilling & Logan, 2008; Lorance Rall & Haase, 2011).

Cities are complex systems and are embedded within even more complex ecosystems (Burkhard, Petrosillo, & Constanza, 2010). On the one hand, cities represent hubs of people and resource uses that put pressure on the environment (Elmqvist, Alfsen, & Colding, 2008). On the other hand, urban ecosystems provide a range of benefits to sustain and to improve human well-being and quality of life (Haase, 2008; Schetke, Haase, & Kötter, 2012), which are known as urban ecosystem services (e.g., Bolund & Hunhammar, 1999; Breuste, Haase, & Elmquist, 2013). Urban ecosystem services have been described and classified in a variety of ways; most commonly, they are divided into four categories: provisioning services, regulating services, habitat or supporting services, and cultural services (TEEB, 2011; Cowling et al., 2008). Provisioning services involve the material outputs from ecosystems including food, water, medicinal plants, and other resources. Regulating services act as regulators by regulating, for example, the quality of air and soil or by providing flood, storm, and disease control. Habitat and supporting services underpin almost all other services because they provide living spaces for organisms. Supporting services also maintain a diversity of plant and animal species. Cultural services include the non-material benefits that people obtain from contact with ecosystems. They include esthetic, spiritual, and psychological benefits as well as recreation and tourism. Generally speaking, locally generated ecosystem services have a substantial impact on the quality of life in urban areas and should therefore be addressed more explicitly in the debate on sustainable urban development and the assurance of liveability in cities (Jansson, 2013; Bolund & Hunhammar, 1999).

To date, ecosystem services have only rarely been explicitly linked to the context of shrinking cities, that is, cities with a decrease in their population. Only very few studies address this relationship (e.g., Haase, 2008, in a conceptual way; Kroll, Müller, Haase, & Fohrer, 2012, for Germany; LaCroix, 2011, and Schilling & Logan, 2008, for the US). This is all the more astonishing because urban shrinkage already represents a relatively frequent type of urban development worldwide (Rieniets, 2005; Haase, Athanasopolou, & Rink, 2013).

This paper aims to identify and substantiate the linkage—a nexus—between urban shrinkage and ecosystem services provisioning in cities. To do so, we list, analyze, and discuss the potential and challenge of this nexus: we show the specific potential of urban shrinkage and the concurrent land cover/use (change) to enhance ecosystem service provisioning. We further identify relevant strategies and instruments for urban planning and decision-making that are employed to re-use urban brownfield sites and how these could benefit from using the ecosystem services approach. Theoretical and conceptual considerations will be provided, as well as meaningful examples of land management under shrinkage, such as interim use, urban forests and short-rotation, or community, gardens.

Cities represent a specific case for ecosystem services provisioning for two reasons. First, the conditions and sources of ecosystem services provisioning in cities depend much more on human action and support than in agricultural landscapes: parks must be cared for and upgraded when necessary, greenery in public spaces and streets must be maintained carefully, fresh air corridors must be retained, etc. (Strohbach et al., 2012). Second, in most cases, a large variety of actors/users with distinct interests are negotiating and perhaps competing with each other. They may not always prioritize ecosystem service provision to the same degree (Breuste et al., 2013).

The empirical evidence—census data, land use mapping, ecosystem services modeling, and an analysis of policy documents—for this paper stems from Leipzig, a German city that has, until very recently, been shrinking over decades and still faces many challenges resulting from this shrinkage. Leipzig became a type of a pioneer city in terms of developing innovative strategies to counteract shrinkage (Rink & Kabisch, 2009). The data analysis was carried out in several projects and published in a series of papers (see references); however, this current, more synthetic view on the nexus between urban shrinkage and ecosystem services represents emerging knowledge from this empirical work that comes from a variety of disciplinary backgrounds.

Our paper tackles a conceptual approach and to show its operationalization, we use empirical evidence from the east German city of Leipzig, which is one of the few examples of long-term shrinkage in Europe. The population decline in Leipzig started in 1933 when the city had reached its population peak of 713,000 inhabitants; subsequently, population losses during the war and during the socialist period contributed to further population decline. Finally, the post-socialist transformation accelerated this decline. During the 1990s, the city lost approximately 100,000 inhabitants or 20% of its total population, and the number of inhabitants decreased to 437,000 (Rink, Haase, Grossmann, Couch, & Cocks, 2012). Leipzig's population began to stabilize only from the 2000s onward; more recently, the city as a whole has experienced re-growth and has become a shrunken city rather than a shrinking city. Originally, Leipzig possessed an adequate supply of ecosystem services because it was a compact city situated within a fertile agrarian and riparian landscape. The industrial development in the 20th century impacted ecosystems and caused severe disturbances and restrictions: large agrarian, forest, riparian and natural areas were