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Research Paper

Urban vacancy and land use legacies: A frontier for urban ecological research, design, and planning

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HIGHLIGHTS

- Highly vacant urban landscapes do not "return to nature" regardless of appearance.
- Contaminant and infrastructure legacies introduce uncertainty at fine scales.
- Landscapes that look well-cared-for discourage abandonment and crime.
- Social capital may be nurtured by and also promote physical evidence of care.
- Management choices affect health, ecosystem services and development potential.

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ABSTRACT

Around the world, many urban districts and some entire cities are dominated by vacant and abandoned property. Former uses of these properties range from heavy industry to residential neighborhoods, and each bears many potential legacies of past uses, including: introduction of contaminants that may threaten the health of humans and other species, engineering of land and infrastructure that may undermine hydrological ecosystem services, and introduction of species including invasives. While the ecological functions that characterize vacant urban lands have been only partially investigated, the legacies associated with their past uses are known to affect ecosystem services. In addition, changed industries, weakened economies, arcane financial systems, population migration, and aging resident populations have left many people living in the midst of this vacancy, with clear implications for human health and safety. Since market demand is weak in highly vacant districts, social capital may be particularly important to protecting quality of life and ecosystem services. New design and planning approaches should be informed by urban ecological knowledge that is synthesized with social and cultural understanding of residents' perceptions and values. Interest in urban agriculture, green infrastructure, and open space planning for vacant urban lands is burgeoning. However, without adequate knowledge of highly vacant districts as socio-ecological systems, design and planning may have unintended consequences for human health, water quality, adaptation to climate change, and a panoply of other ecosystem services. Research questions and design and planning applications require a transdisciplinary approach to address highly vacant urban districts with legitimacy and relevance.

1. Introduction

As population growth rates have declined globally, aging populations and population migrations have left vacant and abandoned properties dominating many urban districts, towns and villages. In every part of the world, entire cities have been affected by post-industrial economic decline, real estate financial miscalculations, or natural disasters (Martinez-Fernandez, Kubo, Noya, & Weyman, 2012; Tacoli, 2009), and this has been associated with falling standards of living, ineffective governance, racism, and growing rates of crime and insecurity (Beauregard, 2009; Meurs & Ranasinghe, 2003; Vassilev, 2003). In the United States (US) in 2000, 21 of the 200 largest cities had lost more than a quarter of their residents since 1950 (Dewar & Thomas, 2012). To describe these cities, we use the term "legacy cities", which Mallach and Brachman (2013) operationalize as cities with populations less than 20% of peak but larger than 50,000. Detroit, MI, is the largest US city to lose more than half its population – shrinking from over 1.8 million in 1950 to under 714,000 in 2010 (US Census Bureau, 1950, 2010). More than a

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quarter of all Detroit properties are abandoned or vacant, and these approximately 100,000 properties occupy about 20 square miles, which is about 14% of the land area of the city and an area larger than all parks and open spaces in the city combined (Detroit Future City, 2013). Even in China, India, and South Africa, where cities are growing rapidly, vacant buildings and abandoned landscapes dominate certain urban districts (Martinez et al., 2012). While the etiology of abandonment, cultural expectations for urban form, and types of governance vary from place to place and time to time, all highly vacant urban landscapes have these conditions in common:

1. They combine occupied structures, abandoned structures, and vacant, formerly occupied, land in a dynamic, patchy pattern.
2. They bear the legacies of past human uses, including contamination, altered hydrologies, altered soil profiles, and introduced species, including invasives.
3. In the near term, they have limited potential to attract financial investment: the real estate market is weak in highly vacant districts.

More specific factors that are believed to have historically affected legacy American cities include: economic restructuring from manufacturing to a service economy, suburbanization, constrained annexation of regional landscapes by local governments, declining quality and support for public services and schools, racism, and longtime infrastructure disinvestment (Beauregard, 2009; Mallach & Brachman, 2013). Age of housing, sewer, water, transportation, and communication infrastructure also affect the dynamics of vacant land.

Many American cities with high proportions of vacant land are located along navigable waters in the Great Lakes watershed (e.g., Milwaukee, Detroit, Cleveland, Buffalo, Rochester) or are coastal port cities (e.g., New Orleans) (Beauregard, 2009; Mallach & Brachman, 2013). Consequently, vacant properties' potential ecosystem services related to climate change and water quality are highly relevant. In the short term, weak market demand for vacant land reduces the opportunity cost for providing land extensive ecosystem services like flood protection, carbon storage, and habitat. In the longer term, maintaining or enhancing ecosystem services may enhance market values and potential for economic development in these cities (e.g., Turner & Daily, 2008).

However, quality of life for people who live in highly vacant landscapes is of immediate concern. An understanding of relationships among associated social, institutional, and ecological processes associated with vacant urban land is vital to framing actionable research (Doussard, Peck, & Theodore, 2009; Etherington & Jones, 2009). Neighborhood dynamics and social capital, and stakeholder values and preferences may be critical to both environmental and social processes (Kruger, 2008; Nassauer, Wang, & Dayrell, 2009; Schilling & Mallach, 2012), affecting flows of materials, energy, and species, as well as the health, safety, and welfare of residents.

Social capital may be even more essential to the environmental health and human well-being of legacy cities and districts than it is to urban areas that are growing in the 21st century. Social capital refers to *the value of support that people provide for each other through their networks, norms, sanctions, and mutual trust* – distinct from financial capital (Schuller, 2007). It may affect maintenance, perceptions of safety, and crime in highly vacant neighborhoods. It has been described as including both bonding capital and bridging capital. Bonding capital may exist among people who are similar in some way – for example, they may live in the same neighborhood and they may undertake neighborhood activities together. Bridging capital links people across more hierarchical relationships – for example, neighborhood residents and local public safety providers may develop bridging capital with each other (Baum & Ziersch, 2003; Brisson & Usher, 2005). People who live in a highly vacant neighborhood may establish bonding capital among each other, and they may establish bridging capital with governments and institutions that contribute to management of and investment in the city.

2. Transdisciplinary research questions

This paper examines how physical evidence of social capital may have particular implications for understanding and management of highly vacant urban landscapes, with implications for their current and future ecosystem services. It examines this issue in the context of three key transdisciplinary research questions about vacant urban land:

1. What spatial and temporal characteristics particular to the process of urban land abandonment and vacancy might affect social and environmental systems?
2. How might the legacies of past land uses as well as land abandonment and vacancy affect social and environmental systems?
3. What aspects of human well-being and environmental function should be considered when managing vacant urban lands?

2.1. The dynamic, patchy landscape of urban property abandonment

The dynamic of urban landscape abandonment and vacancy is both social and environmental, and understanding it requires a temporal perspective. In this paper, we define abandonment as the phenomenon of uninhabited structures. We define vacancy as the phenomenon of land from which structures have been removed. While some parts of a highly vacant city may be uniformly occupied, almost none are uniformly vacant, and the transformation from uniform occupancy to abandonment and high vacancy can be rapid or it can take many years. Neighbors may be surprised when the occupants of a well-tended home nearby are suddenly gone. Maintenance stops when a property is abandoned, and a vacant house may be quickly vandalized. In Detroit, abandoned houses are subject to fire, and arson is common. Demolition of abandoned properties is relatively expensive, and demolitions typically are spatially disaggregated. Consequently, patterns of vacancy are patchy and highly dynamic.

After land becomes vacant, new materials are released into the environment and new disturbance regimes begin, but these vary greatly. Specific material flows are uncertain and unpredictable. For example, some vacant properties may be mown in whole or part several times annually, some only annually or less because of limited financial resources. Urban ecology recognizes the central relevance of patch dynamics and offers substantial knowledge of some of the environmental effects of urban settlement (e.g., Grimm et al., 2008; Jenerette & Wu, 2001; Pickett et al., 2008, 2011), but the environmental characteristics of the patchy, and often surprising patterns and flows of vacant urban land have received little scientific attention to date (Ramalho & Hobbs, 2011; Ryan, 2012). Yet, the coupled human and natural processes initiated by abandonment are likely to have profound effects on subsequent human health, economic development opportunities, and ecosystem services. Importantly, some ecological designers paid particular attention to the potentials of vacant land in urban neighborhoods decades ago. Spirn (1984, 2005) in particular pointed to the vexing reality of urban contaminant legacies and raised essential questions of environmental justice. But the link between the history of design innovations that address the dynamics of cities, and research in urban ecology or coupled natural and human systems remains underdeveloped. Furthermore, the most vacant

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