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Ecology for the Shrinking City

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Abstract

This article brings together the concepts of shrinking cities—the hundreds of cities worldwide experiencing long-term population loss—and ecology for the city. Ecology for the city is the application of a social–ecological understanding to shaping urban form and function along sustainable trajectories. Ecology for the shrinking city therefore acknowledges that urban transformations to sustainable trajectories may be quite different in shrinking cities as compared with growing cities. Shrinking cities are well poised for transformations, because shrinking is perceived as a crisis and can mobilize the social capacity to change. Ecology is particularly well suited to contribute solutions because of the extent of vacant land in shrinking cities that can be leveraged for ecosystem-services provisioning. A crucial role of an ecology for the shrinking city is identifying innovative pathways that create locally desired amenities that provide ecosystem services and contribute to urban sustainability at multiple scales.

Forum

Urban ecology has undergone a progression from ecology in to an ecology of and now an ecology for the city (Schwarz and Herrmann 2016). Ecology in the city focuses on understanding ecological structure and function in cities using methods and questions similar to traditional ecological studies (McDonnell et al. 1997). Ecology of the city is an

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interdisciplinary approach to urban ecology that seeks to understand cities as socioecological systems (Grimm et al. 2008). An improved understanding of the connections between urban structure and function has positioned practitioners and researchers in the ecology community to further expand to an ecology for the city: shaping city form and function to create better outcomes for people and places. Ecology for the city is inherently more applied and inclusive (e.g., Childers et al. 2015), and it aims to improve the sustainability and livability of cities through the application of urban ecological knowledge to the processes of city building in collaboration with stakeholders.

The basic concept of ecological sustainability is the same for different types of cities. That is, sustainable cities use ecosystem services to ameliorate environmental degradation due to urbanization, to contribute to city functioning, and to improve the quality of life for residents (Pincetl 2010). As ecology becomes more embedded in the understanding necessary for transforming cities toward sustainable trajectories, specifying from what we are transforming becomes increasingly relevant as challenges and opportunities will depend on a city's legacy and contemporary milieu. Here, we present shrinking cities as a specific type of city for which an ecology-for-the-city approach is needed. Shrinking cities present both unique challenges to creating sustainable cities and great opportunities for innovation in urban form and function.

Shrinking cities

Urban ecological research has largely presented the growth and expansion of urban areas as a justification for why we need more research focused on cities. However, highlighting the urban growth paradigm has overshadowed the hundreds of shrinking cities worldwide that have experienced substantial and long-term declines in population and economic activity. Globally, one in six cities can be considered shrinking (Blanco et al. 2009). In the United States, some of the most notable shrinking cities are Great Lakes–region cities that were industrial powerhouses in the middle of the twentieth century (e.g., Buffalo, New York; Cleveland, Ohio; and Detroit, Michigan). Below, we start with a directed and brief overview of shrinking cities; more in-depth discussions of shrinking cities can be found elsewhere (Beauregard 2009, Blanco et al. 2009, Hoornbeek and Schwarz 2009, Rieniets 2009, Martinez-Fernandez et al. 2012, Wiechmann and Pallagst 2012).

Shrinking is a general conceptual description of a city mode—a set of conditions and dynamics that define a city (Pickett et al. 2013). Shrinking is not a normative term, as would be the case for urban revitalization or urban renewal, which largely focus on a return to a previous population or economic state. Rather, it can be thought of as one end of a growing–shrinking spectrum on which all cities are positioned. In the growth paradigm, cities grow at different rates on the basis of multiple structural factors, many of which are outside the control of the city itself (Batty 2008). Similarly, shrinking is typically catalyzed by one or more structural changes, such as shifts in the geographies of economic production or transportation, suburbanization, demographic transitions (e.g., declining birth rate, immigration rate), or geopolitical transitions (Rieniets 2009, Reckien and Martinez-Fernandez 2011). The process of shrinking, like growth, can also be self-reinforcing, such

that some declines in economic activity or population losses are due to past shrinking (Beauregard 2009).

Shrinking is criticized as a metaphor because a shrinking city typically is not reducing its spatial extent (Nassauer and Raskin 2014). However, it is increasingly used by academics and practitioners for its broad conceptualization that accommodates the range of contexts in which it occurs (Martinez-Fernandez et al. 2012, Haase A et al. 2014). Common to most shrinking cities is legacy infrastructure. Water supply, roads, and other components of existing infrastructure were built in the past when the population and economy were larger (Reckien and Martinez-Fernandez 2011). As such, legacy cities is another term that is used to describe shrinking cities (Nassauer and Raskin 2014). However, oversized physical infrastructure is only one part of the dynamics and challenges facing shrinking cities; there is an array of factors—cultural, social, economic and environmental—that are in flux as a result of the previous and/or ongoing economic and human capital disinvestment in these cities (Martinez-Fernandez et al. 2012).

Cities as institutions of governance (i.e., laws, policies, rules, norms, etc.) are largely created for and have functions carried out by people organizing to shape growth (Molotch 1976). Unsurprisingly then, one common barrier to creating better outcomes in shrinking cities is resistance to accepting shrinking and coping with it as a reality. Many declining US cities initially battled to return to previous population levels, particularly through the urban-renewal-era projects of the 1960s and 1970s (Ryan 2012). As population losses continued, however, some cities have embraced shrinking as a planned pathway to a better city. For example, in the United States, planned shrinkage as a radical way forward for cities became better known after the city plan of Youngstown, Ohio, Youngstown 2010, received media attention in the early 2000s. The first vision statement for the plan is a powerful summary: “Accepting that Youngstown is a smaller city.”

Accepting a smaller population and economy in the future than that which was achieved in the past necessarily changes how a city manages its legacies. One legacy is a built environment that has been slowly abandoned, leading to blighted properties. In the past few decades, US cities, in particular, have increasingly turned to demolition as a tool to manage abandoned, blighted properties (e.g., Detroit Future City 2012). As a result, shrinking cities have vast extents of vacant land, typically diffused throughout the urban landscape, although vacancy can also be spatially clustered (e.g., Cleveland, Ohio; figure 1; Green et al. 2016).

Planning and design in the shrinking city

Modern urban planning, both formal and informal, is rooted in the desire to shape city and regional growth and has been a mechanism for people, particularly local “elites,” to shape how and where growth occurs (Molotch 1976). How to shrink, in contrast, is not a well-developed field of planning, but it has been gaining traction (Wiechmann and Pallagst 2012). Planners of shrinking cities are also advancing planning approaches that are more inclusive of the broader community rather than just local elites in shaping a city’s future (Dewar and Thomas 2012). An emerging school of thought is that shrinking can and should be a planned strategy; just as we plan growth, we can plan the process of shrinking (Blanco et al. 2009),

including the creation of relevant urban policy (Blanco et al. 2009) and governance structures (Green et al. 2016). An ecology-for-the-city approach can contribute to the planning of shrinking cities. For example, one vision of ecology for the city is a practice situated at the ecology–design nexus (Childers et al. 2015). In particular, ecologists collaborate with urban planners, landscape architects, city residents, engineers, artists, and city government officials to design livable urban spaces and promote desirable ecological functioning. In shrinking cities, ecologists working in collaboration with other professions and communities can contribute ecologically informed and innovative solutions that help shrinking cities capitalize on the advantages of existing and emerging open spaces (Green et al. 2016).

An opportunity for ecology to contribute to solutions

The science of ecology is the study of how organisms interact with the environment to generate structure (e.g., -species abundance) and function (e.g., primary productivity). Because humans are dominant drivers of the structure and function of urban ecosystems, the development and application of social–ecological theories have been foundational to advancing our understanding of urban ecosystems (Alberti et al. 2003). However, cities have often been conceptualized under the modernist or sanitary-city model, which is dominated by the use of technical systems to manage urban structure and function (Pincetl 2010). In this model, the primary acknowledged role of green and blue space (i.e., vegetated and aquatic land cover, respectively) is related to livability (e.g., aesthetics, recreation). But scientists have outlined and quantified a significantly broader role that natural systems can contribute to the structure and function of cities, such as stormwater management (e.g., Shuster et al. 2014), food provisioning (e.g., Schwarz et al. 2016), and wildlife habitat (e.g., Herrmann et al. 2012). The role of ecology for informing the management of urban and other human-dominated systems has been greatest where traditional ecological theories are most useful, generally where nontechnical systems control structure and function, such as the green and blue spaces of cities. Therefore, the role of ecology in shaping urban systems becomes increasingly relevant as green and blue spaces occupy a greater proportion of the urban matrix, with an opportunity to shift along the urban-design spectrum from highly technical to highly ecological systems (Nassauer and Raskin 2014). Simultaneously, the modernist or sanitary-city model becomes less applicable as a city transitions to a mode of shrinking because the infrastructure and services that create the modernist city become economically prohibitive to sustain (Hoornbeek and Schwarz 2009). Shrinking cities, then, are a case in which the science of ecology can play a central role in urban design and planning and in which social–-ecological approaches to urban systems can promote processes that create sustainable cities.

Ecosystem services and the transformation to the sustainable city

Ecology for the shrinking city starts with an emphasis on the neighborhood and community that is affected by vacancy and blight, but it should also include designing landscapes and shaping processes for ecosystem services that benefit city systems. Ecosystem services are advocated as an important component of the transformation to a sustainable city, and vacant land in a shrinking city is a great opportunity to leverage transformations toward

sustainability through ecosystem services (Haase D et al. 2014, Nassauer and Raskin 2014). Pickett and colleagues (2013) summarized the key differences between modern cities (i.e., "sanitary" cities; see Pincetl 2010) and sustainable cities that are especially relevant to ecosystem services and ecology for the shrinking city. In the modern city, gray infrastructure solutions (e.g., pipes, water-treatment plants) address pollution issues and provide services such as water supply and stormwater management. Accordingly, functions are centralized and carried out by technical experts that are organized through formal government. In contrast, sustainable cities intentionally use ecosystem services in addition to gray infrastructure solutions to accomplish city functions. These functions are decentralized and carried out by both expert and nontechnical actors in the public and private sectors who work with communities in defining how to achieve sustainability.

An increase in vacant land offers a rare commodity in urban landscapes—namely, the space to invest in place. The distinction of place from space is an important one in an ecology for the shrinking city. A space such as an urban parcel has a geographic location and physical features. Places are spaces that are given meaning or value by people or cultures (Gieryn 2000). According to Gieryn (2000), "place is space filled up by people, practices, objects, and representations" (p. 465). Vacant lands—as available space—hold the potential to provide and enhance ecosystem services in cities (Nassauer and Raskin 2014). Using vacant lands to provide ecosystem services—such as food provisioning or the mitigation of pollution, stormwater runoff, and urban-heat-island effects—can help leverage urban transformations to sustainable cities, making cities less dependent on technological solutions. However, efforts to manage vacant lands for ecosystem services must be considered in concert with the needs and desires of the community in order to create a space that is environmentally sustainable and a place that is socially sustainable (Schwarz et al. 2016). For example, vacant lands managed for stormwater retention may help meet environmental sustainability goals but may not be aligned with the desire of communities that potentially would create a place in which the community grows food.

Amenities and neighborhood-led transformations

Amenities are widely used by economists to quantify the value that urban residents attribute to urban landscape features. This has been applied to environmental features such as parks and trees (e.g., Tyrväinen and Väänänen 1998), which can provide ecosystem services, and suggests that vacant properties may have amenity value. Amenities derived from ecosystems, though, are not the core amenities that form the foundation of why cities exist. Rather, traditional urban amenities—homes, places of employment, stores offering goods and services, and neighbors—are the basics of why people and economic activities spatially organize into cities (Glaeser and Gottlieb 2009). These are also the aspects of the city that form the basics of human well-being and how neighborhoods thrive (Jacobs 1961). In shrinking cities, these amenities have been lost in many neighborhoods (e.g., stores) or to many residents (e.g., jobs).

The physical spaces that the traditional amenities occupied have become blighted, and blighted properties are effectively a disamenity for the residents and other users of the neighborhood (figure 2). Blight can include unmanaged vegetation growth, illicit trash

dumping, or the perception that crime is present or a neighborhood is unsafe because of the condition of vacant lots. In shrinking cities, residents have co-opted vacant lots, transforming neighborhood disamenities into amenities, often in the form of community gardens or community green space. In some cases, this process—operating at the neighborhood scale—has been supported by city-scale efforts to incentivize transformations. Examples include initiatives such as Detroit's Adopt-a-Lot, Garden for Growth, and White Picket Fence programs, which encourage residents to lease or buy vacant lots at a low cost for a range of uses (Powers 2015). Even without integration into formal city programs, residents are already defining how amenities would look and what they would offer. It can benefit both neighborhoods and cities to work together in the use of vacant land. In many cases, city involvement is necessary because the vast extent of vacant land is greater than residents can repurpose.

However, cities are also limited in the transformations they can support as limited funds are a hallmark of shrinking cities. To realize the greatest potential, an ecology for the shrinking city must do more than engage in design process. Ecology for the shrinking city must identify value that can leverage transformations and ensure the maintenance of ecological structure and function that provides continued value. The role of ecologists, in particular, is to bring an understanding of cross-scalar links in natural systems and of ecosystem services as they are relevant to a range of stakeholders. This could include links to carbon sequestration, to habitat for migrating animals and species whose ranges are shifting under climate change, or to the regulation of nutrient cycles. By linking to ecological and social benefits that extend beyond the boundaries of a vacant lot, neighborhood, or city, ecology for the shrinking city is identifying new partners and pathways to leverage transformations and potential funding. Stormwater management, in particular, is an area of great value, and a focus on urban hydrology and green infrastructure (e.g., rain gardens) allows cities, residents, and the environment to all experience significant advances when approached with ecological understanding. Overall, innovative ecological approaches are needed to transform vacant land into an amenity and maintain the space and its functioning as an amenity.

The focus on amenity is important because what constitutes an amenity is defined by the people living in a neighborhood (i.e., place-based). Also relevant is the fact that shrinkage and blight are inextricably linked to social-equity (e.g., Sugrue 1996) and environmental-justice concerns. In many US cities, shrinking has coincided with the departure of middle-class residents—typically majority white—and the movement of power and resources to suburban and exurban areas (Martinez-Fernandez et al. 2012). Residents that remain in neighborhoods experiencing high rates of vacancy often lack residential mobility and disproportionately represent lower-income and/or minority groups (e.g., Silverman et al. 2013). In some cases, such as when vacant lots are overgrown with vegetation or perceived as dangerous, vacant-land green space can function as a disamenity—an undesirable feature of a neighborhood.

Emphasizing community involvement requires partnering with communities to identify what would constitute an amenity for community residents while offering ecosystem services that contribute to urban sustainability. This approach situates ecology for the shrinking city as grounded in and led by local communities that define and experience the benefits of the

transformation (figure 2). In doing so, ecology for the shrinking city is positioned to be sensitive to issues of gentrification. Historically, improvements made in communities have in many cases led to the displacement of residents as newcomers are attracted to the area, particularly if the changes start to reflect the aesthetic preferences of higher-income households (Aoki 1992). Successful models of "just-green-enough" efforts have been able to strike a balance between environment and economy, increasing green amenities and maintaining working-class communities (Curran and Hamilton 2012, Wolch et al. 2014). In addition, ecological approaches to urban spaces will necessarily elicit environmentalist motivations that are shaped by experiences, race, and class (Taylor 2002). Therefore, integrating how urban environmental perspectives are shaped by race and class into new pathways forward is of central importance to an ecology for the shrinking city.

Shaping a dynamic city

Much of the success in planning for smaller urban populations and economies lies in creating an opportunity in which diverse stakeholders have a voice in developing solutions that can offer the flexibility to manage simultaneously for multiple ecosystem services (Haase D et al. 2014) and competing societal demands (Folke et al. 2005). It also recognizes that neither urban space nor stakeholders' desires are static. This view is in contrast to many urban projects that assume that a space, once constructed, will continue to function as it was conceived in perpetuity. Flexibility, therefore, allows for not only the management of multiple ecosystem services but also the changing desires of the community. Community engagement at every stage of development, as is promoted by an ecology for the shrinking city, creates an opportunity for the desire of diverse stakeholders to change over time and mechanisms for community members and city governance to respond to that change. For example, at one point in time, a community may decide it wants a garden, but shifting demographics or the loss of a key community member may no longer make that desirable. The community may then decide the space would be better used as a park or children's play area.

If transformations are recognized as ongoing and dynamic processes and community members are engaged from the beginning of that process, community members are more likely to demonstrate agency and make yet another transformation that fits their current needs. In other words, the long-term sustainability of transformations relies on early community engagement, because that promotes ownership and agency over placemaking through shaping amenities. In many ways, then, an ecology for cities is an ecology with cities: The sustained dialogue between ecologists and multiple stakeholders allows for the flexibility needed to address a constantly shifting social–ecological landscape, and the continued conversation assures that community desires and ecological visions are aligned. This requires partnerships between researchers and communities that are themselves a challenge, and an understanding of good partnerships and how to proceed in practice is needed. The requisite investments in time and resources for both community members and researchers are substantial; currently, there is little support to cultivate such partnerships before funding is in hand, which can lead to hurried and weak networks rife with miscommunication. Building partnerships with community groups as "bridging organizations" (Folke et al. 2005) that are embedded in the community, have spent time

there, and have built trust is a good strategy to start an ecology with the city. This is especially so for urban ecological transformations that are visioned or initiated by regional- or national-level organizations who lack adequate social capital, such as the familiarity, trust, and relationships among local residents that are necessary for a community to embrace and benefit from an urban transformation (Hibbitt et al. 2001). Trust in various forms is essential for building diverse, resilient, and therefore sustainable natural-resource management institutions and organizations—including those necessary to usher urban ecological transformations (Stern and Baird 2015).

Transforming the Slavic Village neighborhood in Cleveland, Ohio, through ecosystem services

Ecosystem services and green infrastructure are being used as part of the redevelopment strategy for the Slavic Village neighborhood, an inner ring suburban community mixed with industry in Cleveland, Ohio. Its stabilization after decades of decline was severely set back in the home foreclosure crisis of the late 2000s (McGraw 2015). As a result, vacant lots are a large proportion of land in the Slavic Village neighborhood (figure 1). Now, work is being done to intentionally use the vacant land in shaping the future of the neighborhood through providing ecosystem services. The lead bridging organization is a nonprofit redevelopment corporation, Slavic Village Development Corporation (SVDC). The top priority of SVDC is the return of vibrancy to the Slavic Village community, and perceived as central to achieving that goal is a desirable aesthetic quality to retain and attract residents and businesses.

To accomplish their goal, SVDC is using their social capital to facilitate community projects in collaboration with the sewer district, the city and federal governments, academia, nongovernmental organizations, and residents. With these partners, SVDC has transformed an extensive number of blighted parcels into socially and ecologically beneficial vacant lots. Examples include rain gardens, pocket prairies, and vegetable gardens, as well as the development of a recreational trail and new housing. The rain gardens are being monitored for the ecosystem services of stormwater detention, and the neighborhood is being monitored for the ecosystem services of groundwater replenishment and climate regulation (e.g., reductions in urban heat island). Biodiversity and arthropod-related ecosystem services such as beneficial predation and pollination are also being assessed in experimental prairies and the rain gardens (Gardiner et al. 2013). The rain gardens and pocket prairies are demonstrating the potential to greatly improve species diversity in shrinking cities with the potential for a suite of desirable outcomes from ecosystem functioning. Rain gardens and prairies are also intended to improve the beauty and perceived safety along the railway converted to a new biking and walking greenway that runs through Slavic Village. The trail being added retrofits the neighborhood with better recreation options and a safe transit corridor for walking and cycling trips. The greenway is building more equitable (e.g., by providing car-independent transit options) links between the neighborhood and the relatively economically vibrant Cleveland downtown and other job centers; previously, the interstate highway system installed in the mid twentieth century cut off the neighborhood from downtown, only 4 miles away.

There is great potential for the work being done in Slavic Village to be enhanced through an ecology-for-the-shrinking-city approach. Much of the work to date has been research-driven and motivated by shaping the future of the Slavic Village (Gardiner et al. 2013, Shuster and Garmestani 2015, Green et al. 2016). Through an ecology-for-the-shrinking-city approach, the ongoing efforts can coalesce into a more socially and ecologically inclusive approach, advancing the potential for reformed urban policy to promote such an approach. There are several areas in which the implementation of an ecology-for-the-shrinking-city approach may improve social and environmental outcomes. For example, rain garden siting could be more fully integrated into the development strategy. New homes occupied the most infiltrative soils in the low-lying areas, restricting rain gardens to less effective fine texture soils in higher positions in the watershed. One rain garden was installed on the top of a hill, substantially limiting its potential to reduce stormwater volumes. Better coordination with the City of Cleveland regarding landscape management can protect the rain gardens and prairie plantings from destructive mowing. In addition to improved coordination, broadening the scope of the activities may also improve social and environmental outcomes. For example, the greenway is transportation infrastructure, but it is not part of a regional transportation plan and is not receiving funds from public-transportation budgets. From an ecosystem perspective, it is also not linked to, for example, the changes to urban biogeochemistry that can translate into ecosystem services, such as reduced carbon dioxide emissions or the prevention of ozone formation. As another example, stormwater is being viewed exclusively as an urban waste stream to be managed rather than as an urban resource to be exploited. There is potential for using the increased groundwater availability created by the closed loop urban hydrology in applications such as the irrigation of urban agriculture, industry (e.g., laundry services, soda bottling), and possibly, creating a decentralized water supply for household use. Of crucial importance to an ecology-for-the-city approach, community residents can be actively engaged in the shaping of the ongoing projects. On a field work trip in fall 2015, several years into the project, one of us (DLH) had the opportunity to talk with many residents, some owning and living in houses adjacent to a rain garden. Most people did not know what they were or the organizations behind them. Greater community engagement in decisionmaking processes may improve the long-term sustainability of the project.

Projects such as the one in Slavic Village, which involve organizations and residents, are in many ways vulnerable to tenuous relationships, because they are not necessarily compelled by two-way needs or legal requirements. This may lead to opportunistic projects rather than an effective application of scientific understanding integrated into a community’s vision for itself. This limits the type, magnitude, and range of scales for ecosystem services and their potential to benefit the livability and sustainability of a community.

Opportunity for transformation

Transformations are possible when a system is reorganizing and are more likely when the current situation is a crisis that requires major change (Chaffin and Gunderson 2016). Growing cities are increasing infrastructure, which represents an opportunity to shape urban design (Pickett et al. 2013). However, growth is typically not seen as a crisis because new financial capital investments are able to create the perception that traditional sanitary-city

models are, in fact, sustainable. Shrinking, though, is often perceived as a crisis as the maintenance of infrastructure becomes unmanageable and social capital (e.g., networks, trust, leadership, institutional structure) is lost (Ryan 2012). Shrinking cities are undergoing reorganization and therefore also have room for transformation to sustainable trajectories (Ryan 2012). Unlike growing cities, though, there are not clear workable plans for shrinking cities to implement (Blanco et al. 2009). Development models are needed, and ecology can play a key role in navigating shrinking cities toward sustainability.

Shrinking cities can also be great partners in advancing the sustainable city frontier. Pushing the urban sustainability process requires a willingness to experiment with new ideas, and shrinking cities are in many cases ready to experiment with novel solutions (e.g., Detroit Future City 2012). Even at a basic level, shrinking cities need strategies to reduce costs or tap into new revenue streams for “blight” management, which is often approached as merely keeping vacant lots mowed, as is the case for Flint, Michigan (Pruett 2015). There is potential for radical change, though, especially as cities start to include the shrinking process in their master plans. Detroit has sketched a planning vision for the future that pioneers new land-use typologies, including “Innovation Ecological,” which are forests, grasslands, or other ecological landscapes that provide ecosystem services, including functioning as wildlife habitat (Detroit Future City 2012). Innovation is also being seen in the same way scholars are discussing urban sustainability as being a process, as is seen in this quote from the former director of Detroit Future City: “the meaning of innovation we should use in Detroit is about doing things differently, redefining our future, and challenging ourselves to move beyond business as usual. Innovation in this way is not an objective in itself…rather it is a collection of new means and methods” (Kinkead 2015). Shrinking cities are even innovating new economic models in which the creation of industry for and by the most affected communities is emphasized. For example, in Cleveland, large-scale worker collaboratives (e.g., Evergreen Cooperatives, www.evgoh.com) are started with seed money from local “anchor” organizations, such as hospitals and universities, to serve the procurement needs of those organizations, such as solar-electricity installations or laundry services (Alperovitz et al. 2010).

Conclusions

Shrinking cities are in a state of transition. It is in these phases of reorganization that opportunities exist to incorporate ecological knowledge into how cities work (Pickett et al. 2013). Shrinking presents a broad range of challenges—social, economic, technical, and environmental—to cities, but these challenges also come with opportunities to advance sustainability goals and initiatives. An ecology for the shrinking city is needed to help efforts already underway in navigating toward sustainable trajectories. The research community can also advance understanding around open research questions as shrinking cities are an opportunity to test new ideas for the city and to tackle a grand challenge facing urban ecology: the “large-scale implementation of actions, policies, and designs influenced by ecological concepts” (Pataki 2015).

Shrinking is a reality for many cities globally and should be a city mode that is a priority research focus among the social–ecological systems research community. Ecology is

particularly well suited to contribute to sustainable futures for shrinking cities because of its focus on green and blue space and its ability to inform transitions from sanitary to sustainable cities. Ecologists working in cities have long recognized the opportunities in urban open spaces. Researchers have also found that vacant lots can function as species habitat and provide multiple ecosystem services. However, the concept of shrinking cities is an idea that has not been widely embraced in framing the research and applications of urban ecological theory. Given the rich body of work with ecology in and ecology of the city, urban ecology is situated to rapidly advance an ecology for the shrinking city.

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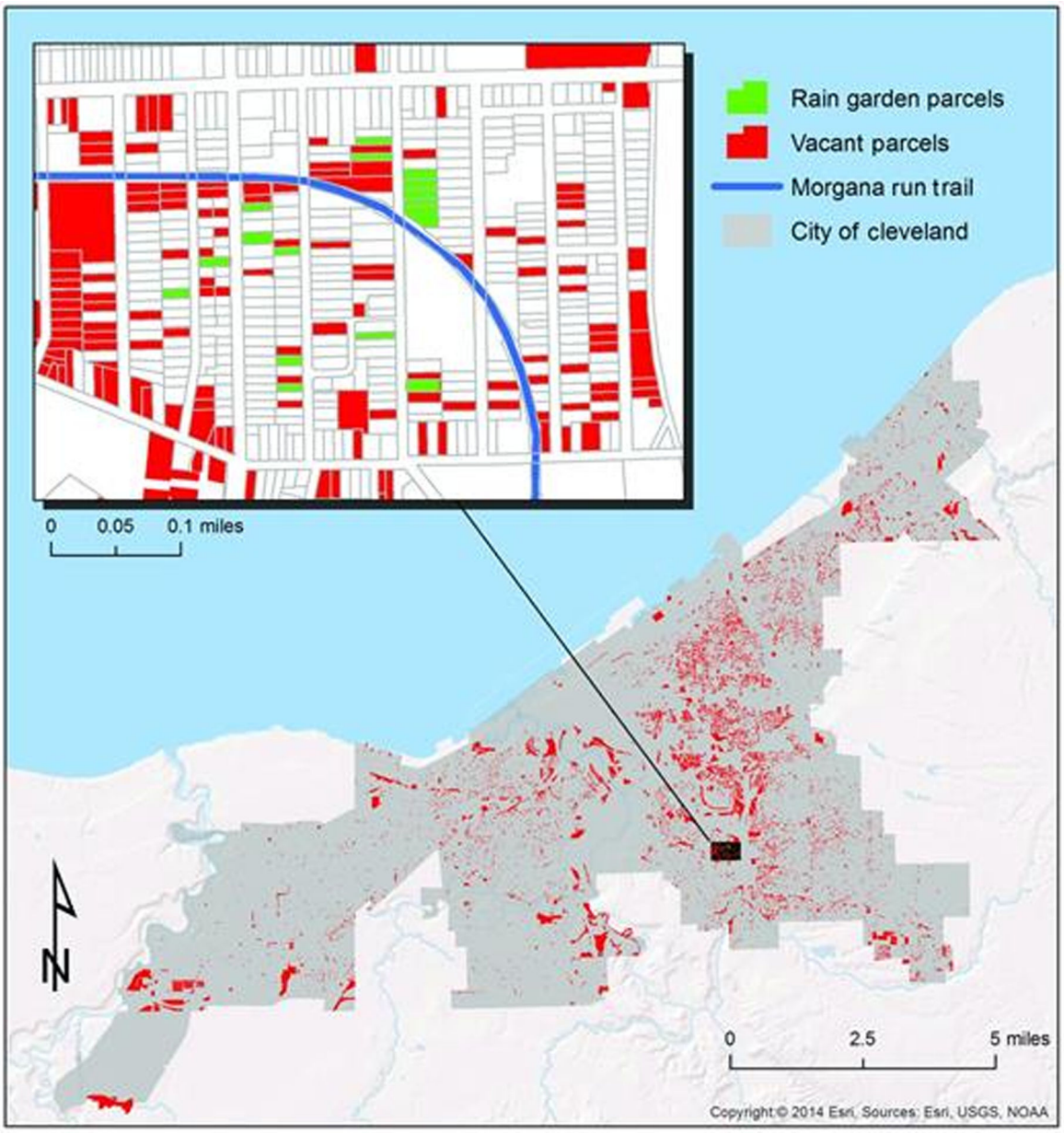

Figure 1.

Vacant parcels in of Cleveland, Ohio. Cleveland has in excess of 20,000 vacant lots that occupy more than 14 square kilometers (Gardiner et al. 2013), approximately 7% of all the land in Cleveland. The inset is a portion of the Slavic Village neighborhood, in which ecosystem services are seen as a major component of shaping the neighborhood's future. Vacant lots have been converted to rain gardens to provide multiple ecosystem services, including managing stormwater to reduce sewer overflows, provide wildlife habitat for beneficial insects, and improve aesthetic quality along the paved trail that facilitates recreation and transit alternatives to the personal motor vehicle.

Figure 2.

The graphic conceptualizes the social–ecological dynamics of land parcels in shrinking cities in an amenities–ecosystem services framework. Traditional land covers or land uses of parcels, such as houses and businesses, can have a high amenity value but low ecosystem-service value; it is depicted by a photograph of a street in Cleveland from the 1950s (lower right), the last decade of the heyday for many of the high-vacancy neighborhoods in Cleveland now. The abandonment and demolition of the built structures result in a loss of amenity value provided by the previous condition and can become a disamenity in the form of blight (lower left). The blighted property may provide greater ecosystem-service value, especially as vegetation cover increases; however, the property is typically not providing amenity value (upper left). Creating both high amenity value and high ecosystem-service value out of the vacant land in shrinking cities is the transformation that an ecology for the shrinking city can inform and help shape (upper right). Photographs: Three of the photos are in the public domain, with Wikimedia photographer credits of John Vachon (lower right), Fortunate4now (lower left), and Garrett O'Dwyer (upper left); the upper right photo is courtesy of the Pennsylvania Horticultural Society.