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Greening US legacy cities: urban agriculture as a strategy for reclaiming vacant land

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GREENING US LEGACY CITIES—URBAN AGRICULTURE AS A STRATEGY FOR RECLAIMING VACANT LAND

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Abstract. Repurposing vacant land for food production is expanding as a response to urban blight, food insecurity and food deserts. As municipalities integrate urban agriculture in their sustainability plans and zoning regulations, scholars are beginning to take a broader look at the benefits from this and other types of greening strategies. This article investigates current state of research and practice of urban agriculture as an emerging strategy for regenerating shrinking cities. It highlights key findings while offering observations on how public officials and practitioners can leverage this research to enhance urban agriculture as a treatment for vacant land.

1. Introduction

Interest in urban greening and productive landscapes has emerged worldwide as a strategy to address long-term social and economic challenges from large inventories of abandoned properties often found in older industrial "legacy cities." These so-called legacy cities have experienced significant job loss and population decline over the past few decades, and have had a difficult time bouncing back (The American Assembly 2011, Mallach and Brachman 2013). High rates of vacancy created a series of problems including reduced tax base, reduced property values for remaining homes and increased crime, as well as giving the general appearance of neglect and disuse. In several older industrial cities such as Philadelphia, PA,

Cleveland, OH, and Detroit, MI, communities are creating networks of gardens and urban farms, pocket parks, and implementing other green initiatives on vacant lots as a means of addressing their blighting influence (Schilling and Hodgson 2013). The wide array of greening program types and policies has been a great resource for researchers as it provides a lot of subjects to study, but, at the same time, makes it quite hard to generalize from any single study. Building on the early studies investigating how basic green interventions increase property value, researchers have renewed their investigation of urban greening programs, attempting to explore socio-economic and policy impacts of such initiatives. Current research on urban sustainability examines environmental, public health, and socio-economic benefits of urban greening strategies, such as maintenance and expansion of green space and healthy tree canopies, use of green infrastructure to address stormwater mandates, and the resurging urban agriculture movement (Rubin 2008). Urban agriculture projects reclaim vacant properties into urban multifunctional and sustainable spaces, provide an opportunity for urban dwellers to reconnect with food production, improve food access and promote sense of community through gardening. Post-industrial urban landscapes, however, pose a challenge when planning for environmental, economic, and social sustainability. Research and education is needed to support effective revitalization and regeneration programs in legacy cities, especially when they involve food, energy, and water resources (Herrmann et al. 2016).

This paper starts with a brief historical perspective and explanation of the interrelationship of urban greening, urban gardening and urban agriculture movements with a special review of the contemporary literature on urban agriculture as it applies to land use planning in the United States. Using a framework of sustainability, we investigate the role of urban food production

and highlight major benefits and limitations. Barriers and constraints to urban agriculture are discussed, followed by research opportunities and approaches that might be used to address them. Summarizing key findings and observations on urban agriculture and greening programs in legacy cities, and offering suggestions for further research in the field, this work has implications for urban planners, landscape designers, and extension agents, as opportunities to integrate urban agriculture into the fabric of our cities expand.

2. Legacy Cities

Urban shrinkage and potential regeneration strategies to address the issue have become a focus of intense debate and scrutiny over the past decade (Hollander 2011, Pallagst et al. 2009, Schilling and Logan 2008, Herrmann et al. 2016). Over the past ten years, research and practice networks[1] have developed a robust body of comparative work which examines the experiences of shrinking cities/legacy cities in the US, Europe, Australia through academic networks (Shrinking Cities Research International Network) and professional exchanges. Definitions of urban shrinkage in the United States have mostly taken into account the consistence and long-term persistence of population decline affecting urban cores and deindustrialized regions (Pallagst et al. 2009). In the US, the term shrinking cities did not get much support from policymakers and even academics, so in 2011 the American Assembly at Columbia University convened close to 100 experts, scholars, policymakers and practitioners to examine the

[1] The Shrinking Cities International Research Network (SCiRN™) is a research consortium of 30 scholars and experts from 14 different countries pursuing research on shrinking cities in a global context. https://www.ru.uni-kl.de/en/ips/research/networks-and-cooperations/shrinking-cities-international-research-network-scirn/

regeneration efforts in Detroit where the term legacy cities were coined to account for the positive and negative legacies these former industrial power house cities must confront. Legacy cities could be seen as a special subset of older industrial cities that have experienced significant and sustained population loss (25 percent or greater over the past 50 years) and increasing levels of vacant and abandoned properties, including blighted residential, commercial, and industrial buildings (Schilling and Logan 2008). Beyond population loss caused by a combination of deindustrialization and sprawl, these legacy cities also reflect decline of the physical environment, and other social and operational factors that have led to their present condition (Mallach and Brachman 2013). Legacy cities are mostly concentrated in the Midwest and Northeast, with the majority in the states of Ohio, Michigan, New York and Pennsylvania (Mallach and Brachman 2013). Over the past 50 years, market dynamics, global economic forces, inconsistent land use and urban policies have drastically altered the economic trajectory and physical landscape of these communities (Mallach 2017). Specifically, the popularity of land use policies that facilitated suburbanization and sprawl in concert with the advent of the modern car in the 1950's were significant drivers of the concentration of decay and disinvestment in urban core areas (Hoyt 2007). The decline of traditional industrial and manufacturing jobs, leading to high unemployment rate, has been equally influential in determining depopulation and mounting inventories of vacant properties and abandoned buildings in rundown communities (Schilling and Logan 2008).

Blighted areas and substandard housing are economic liabilities to local government because they produce lower tax revenue than the cost of the public services they receive, such as infrastructure and welfare assistance (Nassauer and Raskin 2014, Schilling and Mallach 2012,

Hollander 2011). Furthermore, sustained and persistent population decline can lead to processes of class selection, racialization and impoverishment of communities living in urban cores. As highly vacant landscapes become less appealing for homebuyers and socially disadvantaged individuals (many of which are minorities) move to, or remain in such neighborhoods that are underserviced and do not offer amenities that more affluent communities have. Vacant properties are also strongly associated with crime and violence. Spelman (1993), for example, found that crime rates on blocks with abandoned properties were twice as high as on those without, while a Philadelphia study found the risk of violence increasing as the number of vacant properties goes up (Branas et al. 2011). Additionally, depopulation and poverty concentration in urban cores can lead to closing of grocery stores, generating so called "food deserts" -- areas without full-service grocers that tend to be dominated by fast food restaurants, corner stores, and gas station. Limited access to fresh and affordable foods is a health hazard increasing risk for obesity, diabetes, malnutrition, and heart disease (Colasanti, Hamm, and Litjens 2012).

With more cities in the US and worldwide grappling with shrinking population, deindustrialization and a variety of environmental and social problems, academic researchers, public officials and planners must design and implement new regeneration plans and community development schemes. Policies bound to ideas of both economic and demographic growth have not succeeded in reversing the decline of these cities, and contributed to the persistence of socio-spatial differentiation and residential segregation inside urban centers and between them and the surrounding areas (Rhodes and Russo 2013, Coppola 2014). Recently, the idea of "right sizing" in response to the conditions of post-industrial cities has emerged

within academic researchers and municipal governments circles and entered the planning and policy discourse. Experimenting with new policy tools for vacancy management, shrinkage and population decline have been reframed under the paradigm of "smart decline" (Hollander 2011, Johnson, Hollander, and Hallulli 2014, Rhodes and Russo 2013). Recognition that it may be unrealistic to plan redevelopment for a city that is unlikely to return to the higher population densities of the past has prompted city governments towards a new vision of urban redevelopment in which vacant land becomes intentional open space, reshaping urban cores into more sustainable environments (Rhodes and Russo 2013). Local government officials, residents, private and community entities, increasingly view vacant properties as opportunities and lead initiatives to green post-industrial landscapes, repurposing blight and dilapidation areas as urban farms, community gardens, and parks. In this new approach, vacant and abandoned properties become assets in neighborhood stabilization and regeneration programs (Nassauer and Raskin 2014, De Sousa 2014). These urban regeneration enterprises, responding to a degree of sustained social and/or economic deterioration, can bring new life and vitality into an ailing community by addressing economic, social and environmental needs and providing sustainable, long term improvements (Evans and Shaw, 2004). Urban green space offers recreational opportunities, a place to socialize, and increase property values of adjacent homes (Wachter, Gillen, and Brown 2008). Furthermore, by changing the quality and appearance of the built-up area through greening projects such as brownfield reclamation, new businesses would consider locating there bringing jobs, and in the process space would be re-used and land saved (Schilling and Logan 2008).

3. What is Urban Greening?

Practitioners and researchers use the term urban greening to refer to the creation of green spaces within a city's urban core as well as the preservation, protection and enhancement of urban forestry and existing natural areas for the purpose of improving the urban environment (De Sousa 2014). Urban greening is not a new concept, tracing back to broader environmental justice and economic policy and reform movements, but has recently evolved into a future vision for sustainable urban landscape planning and can be understood by the range or types of urban greening activities, interventions, and treatments (Schilling and Vasudevan 2013). Greening strategies are often incorporated in sustainability plans and environmental programs, and comprise creation, preservation and expansion of pubic green spaces, gardens, tree canopy, natural habitats, greenways, etc. (De Sousa 2014). Rather than individual sites or strategies, urban greening often encompasses a system of natural and engineering elements that together provide various ecosystem goods and services, which translate into socio-economic, cultural, and environmental benefits for people (Eisenman 2013).

Within the framework older industrial cities regeneration, urban greening takes on a special meaning often in the context of applying diverse treatments and interventions for reclaiming hundreds or thousands of vacant and abandoned properties (e.g., lots, homes, businesses, and industrial plants) left behind by decades of depopulation and decline (Schilling and Logan 2008). Quality of life for people living in highly vacant neighborhoods dramatically diminishes for they face increasing physical deterioration of properties, declining tax revenues, and mounting public costs (Nassauer and Raskin 2014, Schilling and Logan 2008). Among the several potential interventions included under the umbrella of urban greening, a number of strategies are

commonly used to activate underutilized lots in urban landscapes (Carlet, Schilling, and Heckert 2015). These urban greening strategies are not necessarily mutually exclusive as particular projects or programs may involve one or a combination of these interventions:

1. *Conversion of neglected urban parcels and public rights-of-way into parks, trails, and open space.* The abundance of underutilized land offers the opportunity to create new permanent parks and green spaces. Particularly in densely populated cities or low-income areas lacking access to parkland, repurposing of small vacant lots to green space can provide social and ecological benefits to urban dwellers (De Sousa 2014).
2. *Vacant land/lot greening as neighborhood stabilization strategies*. Basic cleaning and greening strategies applied to urban vacant lots, including removing debris and trash, overgrown vegetation, and planting grass and flowers (Heckert and Mennis 2012).
3. *Temporary pop-up interventions*. Pop-up gardens, parklets, guerilla interventions, "open streets" are forms of community-focused tactical urbanism strategies that aim to activate vacant spaces, connect people and places, and transform the identity of the city (Németh and Langhorst 2014).
4. *Green infrastructure*. The term green infrastructure refers to greening projects designed for the primary purpose of reducing stormwater runoff. There are many types of green infrastructure projects, ranging from simple contouring to redirect and hold the flow of stormwater to highly engineered rain gardens with complex infiltration or holding systems (Shuster et al. 2014).
5. *Urban agriculture*. For the purposes of this study, urban agriculture refers to the raising of animals and growing of fruits and vegetables within city boundaries. Community gardens,

often owned or managed by civic organizations, public entities, or community-based organizations and maintained by volunteers, have historically been used as both a short-term or long-term strategy to increase access to fresh produce to underserved urban residents and, more recently, to address the abundance of vacant land within cities (Mogk 2010, Colasanti, Hamm, and Litjens 2012). While some urban farms may focus on community development goals, such as community education, consumption or workforce training, others are created to improve food access in a particular neighborhood (Krishnan et al. 2016). Commercial farms growing fresh food to be sold to local restaurants, retailers or the general public can be developed on larger parcels of vacant land.

Each of these greening categories includes a range of primarily local programs and policies and diverse combinations of strategies and treatments (in the traditional context of landscape architecture and urban ecology, treatment means the site-specific design techniques and tools used to implement the broader urban greening policies and programs). With so many different types of urban greening interventions, what it means to be effective or successful varies among these different types of programs and policies. Local context and ecological conditions matter when reviewing research findings and determining how they may or may not apply to other places (Nassauer and Raskin 2014, Prové, Dessein, and Krom 2016). American legacy cities, such as Detroit, Cleveland and Youngstown, are leading the way in challenging current land-use management and practice, experimenting with urban greening alternatives, reinventing and reshaping the urban landscape (LaCroix 2010).

4. Planning for Sustainability

Urban greening research follows the evolution of different planning and greening movements in response to a wide array of urban challenges. A huge new movement to add agricultural activities in the urban core grew from the need to bring locally-grown fresh and affordable food into our cities, but has now added core goals of sustainability and urban regeneration--economic and social vitality--to post-industrial cities that had been lacking (Handel 2016). Urban agriculture has been traditionally a community-based, grassroots strategy, and often considered a transitional land use in cities on temporarily available land (Drake and Lawson 2014). Historically, community gardens in both Europe and the US have been championed by local governments and flourished in conjunction with economic crisis as a short-term emergency measure to address food scarcity within cities, such as in the establishment of victory gardens during World War II (McClintock 2010). Urban gardening, however, has been often excluded from the urban planning initiatives at times of economic prosperity (Nettle 2014). Many community greening programs to address blight began in the 1960s and 1970s as cities lost population to the suburbs, leaving empty spaces behind. These high rates of vacancy created a series of problems including reduced property values for remaining homes and increased crime as well as giving the general appearance of neglect and disuse. Communities began to create community gardens and other green settings on vacant land as a means of addressing its blighting influence and improve access to fresh produce. Several of today's most successful community greening programs were established in the 1970's, including Green Guerillas in New York City, Tree People in Los Angeles, Philadelphia Green in Philadelphia, P-Patch in Seattle, and many more (J. Blaine Bonham, Spilka, and Rastorfer 2002, Wiland and Bell 2006, Schmelzkopf 1995).

Today's greening and urban agriculture initiatives have stronger focus on sustainability and often a more active role of the municipal government in promoting it. Regeneration and revitalization of legacy cities may entail a paradigm shift from growth-centered planning to a more careful and place-based approach towards more livable cities (Hollander 2011). In this framework, sustainability policies that create functioning ecological places and alternative sites for food production can give cities a competitive advantage, allowing aging industrial communities to transform themselves into sustainable, profitable centers while addressing the socio-economic circumstances shaping urban development. Recognition of the multiple benefits of greening projects that may or may not translate to direct revenue to the city government benefit from two important concepts in determining the value of these policies– ecosystem services and the triple bottom line of social, environmental and economic sustainability. Ecosystem services are direct and indirect benefits provided to humans by functioning ecological systems (Farber et al. 2006). These services encompass provisioning services, such as the supply of food and water, as well as regulating services, such as regulation of climate, air and water quality; cultural services, such as recreation and aesthetic enjoyment, and supporting services, i.e. activities that contribute supporting ecosystems, such as pollination and soil formation (Costanza et al. 1997, de Groot, Wilson, and Boumans 2002). Underutilized urban land can be converted into green space that serves multiple functions and provides multiple ecosystem services: support biodiversity and habitat conservation and allow residents to cultivate for flowers, fruit, and vegetables (Gardiner, Burkman, and Prajzner 2013), offer recreation and enjoyment opportunities (Schetke, Haase, and Breuste 2010) and help manage stormwater runoff quantity and quality (Jaffe 2010, Mell 2009, Shuster et al. 2014),

and contribute to carbon sequestration and storage and to air temperature reduction (Haase, Haase, and Rink 2014, Nowak et al. 2013). Additionally, strategic community gardening and land reclamation greening projects in underserved neighborhoods can have a positive impact on surrounding property values (Voicu and Been 2008, Heckert and Mennis 2012). Increased property value is a direct revenue source for municipalities, because it increases the tax base without the need for additional infrastructure or services (Crompton 2001).

Although only the increase in property values and translates directly into increased revenues, each of the ecosystem services benefits discussed above represent potential monetary savings related to a reduction in service needs. Similarly, with the sustainability approach based on the triple bottom line, costs or savings associated with a project include not only direct economic effects, but also the environmental and social impacts of a project (Elkington 2013). Albeit useful and beneficial, sustainability planning may not always be considered essential framework by cities experiencing widespread population decline and economic contraction. However, many of the sustainable development concepts, such as urban greening, and green infrastructure for storm water management, have the potential to be more easily developed in shrinking cities than in areas of high growth due to lower land costs and lack of development pressure (Pallagst et al. 2009). As cities are increasingly adopting a holistic approach to planning based on principles of sustainable development and the triple bottom line, the perception of the economic benefits of greening is shifting. Combined with the concept of smart decline, this is paving the way to new approaches to vacant land management in shrinking cities. Designing of green space that delivers multiple benefits and provide for the well-being and quality of life of city dwellers have become a key goal of urban planning. Urban greening efforts such as the

Philadelphia Horticultural Society's LandCare (PLC)[2], Reimagining a More Sustainable Cleveland[3], Detroit Future City[4] and Youngstown Lots of Green[5] programs help reconstruct community food-productions activities through vacant lot transformation, and seek to create green areas in places that were previously lacking.

5. Benefits of Urban Greening and Urban Agriculture

Urban gardening can extend traditionally rural services to urban cores, improving access to healthy and locally-grown culturally acceptable food and green space that is often lacking in neighborhoods plagued by blight and disinvestment, thus contributing to alleviate social issues of environmental justice, infrastructure and health equity (Thornbush 2015, Schilling and Vasudevan 2013). Research about the PLC, for examples, demonstrates that implementation of the program reduced disparities in neighborhood greenness related to race and socioeconomic status. Even though some racial and economic differences exist, overall, more than 45,000 people and 16,00 households in Philadelphia now have access to green space within half a mile of their residence thanks to PLC (Heckert 2013).

[2] The Pennsylvania Horticultural Society (PHS) has been running programs in the city since the 1970s, originally around community gardening. Because of its record of accomplishments in revitalizing rundown neighborhoods, the LandCare has become a model for an interim landscape treatment addressing the issue of vacant private and public lots using treatments that include removing all debris and weedy vegetation, grading the site and adding compost-enriched topsoil, planting trees, sowing grass seed, and installing a wooden post-and-rail fence around the perimeter (Pennsylvania Horticultural Society 2016, Wiland and Bell 2006).

[3] "Re-imagining a More Sustainable Cleveland: Citywide Strategies for Reuse of Vacant Land" was intended to focus on "reuse of vacant land with the goal of making Cleveland a cleaner, healthier, more beautiful, and economically sound city" (Kent State University Cleveland Urban Design Collaborative 2008).

[4] Detroit Future City is a nonprofit that created a strategic framework for Detroit's long-term development, which includes a Field Guide to Working with Lots, designed to provide actionable guidance for reinvigorating empty lots. As part of the program, fifteen grassroots organizations from around Detroit received a share of $65,000 in mini-grants to transform vacant lots (Detroit Future City 2016).

[5] Lots of Green, the YNDC's vacant land reuse program, seeks to repurpose all land in a target area, transforming the physical fabric of strategic neighborhoods. These lots are converted to community gardens, native planting sites, pocket parks, small community orchards, a 1.5-acre urban farm and training center, and side yard expansions (http://www.yndc.org/programs/lots-green)

Community gardens play a meaningful role in community development, particularly in urban areas. Growing collections of plants for educational purposes and employing professional staff, they partner with local governments to provide technical expertise to school gardens, train communities to grow food, and advocate for sustainability and environmental stewardship, among other pursuits (Gough and Accordino 2013). Generally speaking, green space supports social cohesion by establishing and expanding social networks, which provide the basis for community building (Okvat and Zautra 2011). Community gardens may help build social capital and function as catalyst for social cohesion. Participation in ongoing gardening activities within a community can instill empowerment and sense of ownership in individuals, and improve quality of life (Westphal 2003, Sadler and Pruett 2015). A research project conducted in a public housing development in Chicago, IL, found that residents living closer to green common spaces, in comparison to those living near barren spaces, enjoy "more social activities and more visitors, know more of their neighbors, and have stronger feelings of belonging" (Kuo et al. 1998). Community gardens can take on the role of neighborhood gathering spaces, often used for large formal events in addition to informal gatherings (Saldivar-Tanaka and Krasny 2004, Lawson 2004). Urban dwellers may participate in gardening as a means of creating safe outdoor spaces that would address both negative influences of vacant lots - especially drug dealing and perception of personal safety - and alleviate space constraints due to the small size of their living quarters (Schmelzkopf 1995, Garvin, Cannuscio, and Branas 2013).

Community and rooftop gardens with combined social-ecological amenities, diminishing impervious surfaces and increasing air cooling, could provide increased resilience to predicted near-term effects of climate change by regulating stormwater and organic waste flows and

reducing urban heat (Shuster et al. 2014, Nowak et al. 2013, Haase, Haase, and Rink 2014, Aerts, Dewaelheyns, and Achten 2016). In addition, urban orchards and gardens can contribute to carbon sequestration and provide wildlife habitat, support pollination and pest control, and increase biodiversity (Nowak et al. 2013, Strohbach and Haase 2012, Lin, Philpott, and Jha 2015). As explained in the previous section of this paper, environmental impacts and ecosystem services provided by urban green spaces are highly valuable and may translate into economic advantages for local governments. Researchers and planners also see economic benefits to gardening in the food that is produced, either for their in-site consumption, sharing, or sale through local markets, which provide income for individual residents and economic vitality to the whole community (Schmelzkopf 1995, McCormack et al. 2010, Lawson 2004, Hanna and Oh 2000, Lovell 2015). Indeed, the economic value of urban agriculture systems can be significant. Attempts to quantify the value of produce grown in community gardens have found that food grown on 650 New York City gardens each year is worth more than $1 million (Schmelzkopf 1995) and 212 community gardens in Philadelphia produced nearly $1 million worth of food in 2008 (Vitiello and Nairn October 2009). An urban farm in Milwaukee, WI, by using intensive production strategies and focusing on high value crops, grosses more than $200,000 per acre (Lovell 2015).

Urban agriculture could play an important role in food provisioning and security. An inventory of Oakland's public underutilized parks and vacant space suitable for agricultural uses estimates that, in the most conservative scenario, potential contribution of these sites to the city's current and recommended vegetable needs would contribute between 2.9 and 7.3 percent of

current consumption, depending on production methods, or 0.6‑1.5 percent of recommended consumption (McClintock, Cooper, and Khandeshi 2013).

A study by Ohio State University researchers investigates if Cleveland, a city of 400,000 residents with more than 18,000 vacant lots, or about 3,500 acres of vacant land, could achieve self-reliance in the provision of several key foods (Grewal and Grewal 2012). Assuming preservation of produce for winter months and six chickens per city parcel as specified by the city's zoning regulations, the analysis focuses on urban production of foods such as vegetables, fruits, chickens, and honey. The research concludes that Cleveland could provide 46 to 100 percent of fresh produce, 94 percent of poultry and eggs, and 100 percent of honey, given that 80 percent of available vacant land, 9 percent of every occupied residential parcel, and 62 percent of industrial and commercial rooftops were utilized. The authors also estimate that, because of the enhanced level of food self-reliance, the city of Cleveland would retain $29 million to $115 million (Grewal and Grewal 2012).

Similarly, a study by Colasanti and Hamm looks at the capacity for self-reliance in fruits and vegetables in Detroit, a city of 835, 000 residents and roughly 44, 000 vacant properties. Considering different scenarios for storage and production methods, they conclude that about 76 percent of vegetables and 42 percent of fruits could be supplied year-round on 2,000 acres of land using bio-intensive methods (Colasanti and Hamm 2010). All in all, the research makes a strong case for using funds to stabilize and green vacant lots, and where feasible, to facilitate creation of community gardens and urban farms, as a tool of neighborhood change, improved urban food security and environmental sustainability.

6. Challenges to Urban Greening and Urban Agriculture

Uncertainty exists about the long-term feasibility of urban agriculture in post-industrial cities as urban gardeners face specific conditions and a variety of obstacles. In this section, we briefly discuss a few of the challenges discussed in the relatively recent research. Overall, the planning and implementation process of urban greening projects is typically complex, and often requires the interaction and support of various levels of government, private-sector participants, non-profit organizations (De Sousa 2014, Cohen and Reynolds 2015, Nassauer and Raskin 2014). Thus, such complexity makes it hard for many of the pioneering nonprofit organizations to launch and sustain innovative urban agriculture initiatives in legacy cities. The risk of soil contamination poses significant challenges in older industrial legacy cities (Nassauer and Raskin 2014, Pfeiffer, Silva, and Colquhoun 2015). Given the contamination problems common in urban soils a soil quality assessment is necessary and not all land parcels may be suitable for crop production and functional green space. However, several low-cost methods to improve soil conditions exist (bioremediation, capping, and off-site disposal, among others) and are well-documented documented in the scientific literature (Beniston and Lal 2012, Wilschut, Theuws, and Duchhart 2013).

Other major challenges to urban greening and urban agriculture highlighted in the academic literature include land acquisition and zoning regulations (De Sousa 2014, LaCroix 2010),

maintenance issues, costs of transforming vacant lots, participation of multiple entities and citizens with competing goals (Nassauer and Raskin 2014, Kremer, Hamstead, and McPhearson 2013, Green et al. 2016). However, research has shown that these problems, which have grown with the increasing abundance of vacant lots, can be tackled in several ways. In response to the

issue of land title, many post-industrial cities with significant population loss have created land banks, community land trusts and partnerships to aggregate vacant land and make it more readily available for reuse (Schilling and Vasudevan 2012, Milburn and Vail 2010, Mogk 2010, Schilling and Hodgson 2013). In Philadelphia, a land bank ordinance was introduced in February 2012 and was signed into law in December 2013. Its Strategic Plan and Disposition Policies were quickly established, and the Bank received the first deposit of land in in December 2015. These initial 800 properties are 90 percent vacant parcels. Philadelphia has an estimated 32,000 potential Land Bank Vacant, abandoned, and tax-delinquent properties held by a variety of municipal agencies or private sources. Once properties are acquisitioned by the Land Bank, its staff oversees the discharge of tax liens and/or titles, and the properties are then available for sale to the public (Philadelphia Land Bank 2015). Other examples include Flint's Land Bank program and the Cleveland Land Bank. The latter, which has been important in successful programs aimed at repurposing vacant land, was first established back in the seventies (Bright 2003). Cleveland also set up a side-yard program through which home owners could purchase adjacent vacant lots from the Land Bank and incorporate them into their own properties. As cities seek to test innovations they are finding their landscape regulations or zoning provisions may conflict with agricultural uses and must be revisited to support such new uses (LaCroix 2010, Voigt 2011). To address the issue, local and regional governments are now implementing policy changes integrating urban agriculture into planning and zoning practices, sustainability plans, as well tax incentives and policies allowing gardeners permission to use public lands or purchase vacant lands (Hodgson, Campbell, and Bailkey 2011). For example, several cities, such as Cleveland and Detroit, have adopted a specific zoning category for urban gardens (LaCroix

2010). The city of Cleveland adopted an Urban Agriculture and Green Space Zoning Ordinance in 2005, focusing primarily on parks and recreation facilities. The agriculture aspect of the ordinance began to gain traction in 2007 as farming uses started to being allowed through zoning. Zoning ordinances were further modified in 2009 to allow residents to keep chickens, ducks and rabbits, as well as beehives. And in 2010, zoning regulations were altered to permit agriculture as a principal use on all vacant residential lots in the city. Now, people in the city may also raise goats, pigs and sheep (USDA 2014). Urban gardens in Cleveland, which now number over 200, provide employment and business opportunities for new growers and help build stronger community ties. Through the Cleveland High Tunnel initiative, one of the first such programs in the country, urban farmers receive financial aid from the Natural Resources Conservation Service (USDA 2014). In addition, Gardening for Greenbacks program offers grants up to $5,000 for equipment related to growing and selling produce.

The deurbanizing process of the city of Detroit has left an estimated 20 square miles of vacant land and 40,000 blighted properties. To address the issue, the City with the help of the Detroit Black Community Food Security Network (DBCFSN), the Detroit Food Justice Task Force, and other actors, moved towards establishing food policy initiatives, including urban agriculture. Urban agriculture amendments to the city zoning ordinances were introduced and became effective in 2013, allowing urban gardens, urban farms, greenhouses and high tunnels in all residential and business districts, and it is now considering an urban livestock ordinance (City of Detroit 2013).

Historically, revitalizing projects including greening interventions have often lead to “environmental gentrification” (Herrmann et al. 2016, Checker 2011). The creation of green

areas and amenities, while addressing environmental justice issues and creating healthier neighborhoods, can increase housing price and displace the community's original residents (Wolch, Byrne, and Newell 2014, Checker 2011). Research findings, however, appear to suggest that gentrification tends to happen in cities with tight housing markets and in a select number of neighborhoods (e.g. New York City, see Checker 2011). In legacy cities that have suffered from extensive housing vacancy and population decline, housing markets tend to be "loose", meaning that the levels of displacement pressure brought by revitalization projects such environmental improvements may be significantly less severe (Swanstrom, Webber, and Metzger 2015). In so-called gentrifying neighborhoods of legacy cities that are bouncing back, economic and racial diversity may be an asset for the community, rather than a problem (Swanstrom, Webber, and Metzger 2015). Nonetheless, to support environmental equity, academics suggest that green space projects should bound environmental rehabilitation and social justice by re-engaging local stakeholders and be shaped by the local community's desires and needs (Wolch, Byrne, and Newell 2014, De Sousa 2014). Siting of green amenities should be carefully planned so they are equitably distributed, maximizing community benefits from investments while reducing disparities between neighborhoods and along racial and income lines (Heckert and Rosan 2016).

7. Conclusions and Future Research

Local governments are adopting urban greening strategies and treatments as part of broader initiatives to create more sustainable, healthy and just communities. Legacy cities may use urban agriculture to reclaim vacant lots and abandoned properties that help stabilize declining

neighborhoods and dysfunctional economic markets, while many growing cities are beginning to view urban greening and urban agriculture as a front-line response to sustainability issues. Urban greening work and research also involves diverse fields (e.g., public health, planning, policy, design, engineering, etc.) and seems to span the divide of academic inquiry and practice. As a specialty field, urban greening now has a strong following among groups of local leaders, community based organizations, non-government organizations, and academic institutions. One major conclusion from this study is the promise of urban greening and to deliver multiple benefits to urban communities from increasing property values, reducing environmental degradation, to better access to fresh produce. In order to unleash the environmental, economic and social psychological benefits of greening urban spaces, it will be critical for practitioners and researchers to develop a solid foundation of evidence based policy analysis and policy decision-making. Particularly, research documenting results of long term projects is necessary to uncover the critical determinants of success, both from a technical and from a policy and planning perspective. Tracking and assessing the performance of various urban greening interventions becomes important as practitioners need this type of feedback to evaluate what design and urban greening programs better fit the specific conditions of their community. From a research perspective, such a project should involve a multi-disciplinary approach to develop performance metrics (economic, environmental and social) to measure multiple benefits than could flow from various greening treatments. As highlighted in the academic literature, because of the complex nature of urban vacancy, transdisciplinary research is needed to fully understand and tackle the issue (Nassauer and Raskin 2014).

Further research investigating the contribution of urban food production to urban sustainability and the evaluation of landscape alternatives integrating urban agriculture would make an important contribution to the literature and support the expanding field of urban sustainability. Land use and decision-making models representing these alternatives and comparing them based on various indicators selected by experts and/or stakeholders would be useful.

Also, another possible topic for future research is the study of urban greening and urban agriculture applied to suburban areas. What are lessons learned from urban greening models that could be applied or adapted successfully to more isolated, poverty-stricken suburban neighborhoods?

Capitalizing on decline to set aside land for recreation, agriculture, green infrastructure, and other non-traditional land uses will benefit existing residents in post-industrial cities and attract future development, and enable communities to reinvent themselves as more productive, sustainable, and ecologically sound places. This new approach, combining a recognition of both economic needs and environmental and social realities, is forging a solution with the potential for multiple benefits to complex urban ecosystems.

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