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Urban regeneration: Community engagement process for vacant land in declining cities

Gunwoo Kim¹, Galen Newman², Bin Jiang³

¹Graduate School of Urban Studies, Hanyang University, 222 Wangsimni-ro, Seongdong-gu, Seoul 04763, Republic of Korea

²Department of Landscape Architecture and Urban Planning, Texas A&M University, 3137 TAMU, College Station, TX 77843, USA

³Virtual Reality Lab of Urban Environments and Human Health, Division of Landscape Architecture, Department of Architecture, The University of Hong Kong, Hong Kong Special Administrative Region, China

Abstract

Vacant land presents many challenges for older financially distressed cities. Community engagement is a very important element to solve the urban vacant land problem and assist in long term regeneration. This paper reviews what plans, policies, implementation methods, and community engagement process were developed to overcome barriers and challenges to vacant land projects. Most studies reveal that the importance of community engagement process in terms of understanding the problems and potential value of vacant land, redevelopment process, financial support, regulation, and neighborhood organizations participation for vacant land projects. To encourage community engagement to repurpose vacant land, municipalities should have to provide adequate information about vacant land conditions and their potentials in terms of ecological and social value. Code enforcement and tax foreclosure are efficient ways to control vacant land and the abandoned building problem. Tax incentive systems, such as high taxation rates on land but a low rate or no tax at all on infill development on vacant land, tax credits on vacant land forest structure, and rehabilitation abatement on abandoned buildings can increase public investment in vacant land. Local governments should support such efforts by creating community involvement groups, such as neighborhood coordinators, civic leaders, CDCs (Community Development Corporations), and other community-based nonprofit organizations. Community engagement is not specific planning, but it is part of an ongoing process in planning strategies to urban regeneration and renewal vacant land.

Corresponding author: Gunwoo Kim, gwkim1@hanyang.ac.kr.

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Keywords

Shrinking cities; Community engagement; Planning strategies; Urban regeneration; renewal

1. Introduction

1.1. Vacancy, abandonment, and decline

Contemporary American cities experience uneven changes in population relocation dynamics; at one moment, different neighborhoods within a given city can be populating, depopulating, remain relatively stable, or experience demographic shifts (Schilling & Logan, 2008). The economic forces of globalization and deindustrialization play a key role in the social, ecological, and technological transformation of urban neighborhoods (Koritz, 1991). The relevant factors include rising consumer wealth, increases and decreases in demand for specific services rather than manufactured goods, rapid increases in productivity and the capabilities of the manufacturing sector, and expanding trade links with global economies (Kollmeyer, 2009). As a result, between 1950 and 2010, many cities worldwide decentralized and lost significant numbers of residents, businesses, and industries (Hall, 2010). Decentralization in the United States is most common in post-industrial cities, such as St. Louis, Philadelphia, and Detroit. For example, since 1950, Detroit has lost more than 50% of its population, 165,000 industrial jobs, and 147,000 housing units (Hall, 2010); approximately 32% of the city's landmass is vacant property (King, 2012). Between 1978 and 1998, the city saw 108,000 demolitions and only 9000 new buildings (Oswalt, 2008). As the population of Detroit continues to decline, an estimated 2400 properties become newly vacant each year (Daskalakis, Charles, & Jason, 2001).

Depopulation increases vacancy rates in urban core areas more frequently than in the surrounding areas (Bowman & Pagano, 2004). These vacancies become leftover urban spaces, known as urban voids or negative spaces in the urban fabric. Newman and Kim (2017) call this collective ensemble of low regenerative-potential non-productive space 'urban shrapnel.' The physical characteristics (size, shape, and location) of vacant parcels can result in long-term vacancy and increase future amounts of vacant land (Lee, Newman, & Park, 2018). A recent survey of large U.S. cities by Newman, Bowman, Lee, and Kim (2016) found that most vacant urban parcels are small (70.7%), oddly shaped (39.7%), and disconnected (41.4%), making them difficult to regenerate.

Surpluses in vacant land presents significant challenges, especially for financially distressed cities (Kim, Miller, & Nowak, 2018; Kim, 2018; Németh & Langhorst, 2014; Kremer et al., 2013). Excessive amounts of vacant land over time can lead to widespread urban decline (Zhang, Yuan, & Li, 2015) due to factors such as depopulation (Rieniets, 2009), ineffective regeneration policy (Németh & Langhorst, 2014), economic decline (Ryan, 2012), and urban decentralization (Audirac, 2007). The presence of long-term vacant land can then amplify crime and decrease quality of life through visual blight and safety concerns (Kivell, 1993), which, then, can result in decreased property values and amplified depopulation that further decreases the tax base (Setterfield, 1997). Ultimately, these negative externalities can

continue to amplify vacancy rates, making vacant land a causal factor of itself (Immergluck, 2016).

Buffalo, New York, for example, is another U.S. city currently characterized by significant amounts of vacant land and structural abandonment. In 2016, the City of Buffalo demolished more than 5000 vacant or abandoned buildings (Nolan, 2017). Land banking, in Buffalo and other cities, is a popular method for accumulating and repurposing vacant properties, with mixed results. For example, Detroit and Cleveland have similar indicators of demand for land, but whereas Cleveland's land bank has been an effective way to sell tax-reverted land for reuse, Detroit's method of land disposition has been less successful (Dewar, 2006). Many other post-industrial cities undergoing steady population and job losses since the 1950s are in similar circumstances (Schilling & Mallach, 2012): they have lost their industrial base and not yet found new strategies or replacement options for future economic growth (Kivell, 1993). As a result, population decreases have given rise to increased amounts of vacancy/abandonment, which has eventually resulted in widespread decline (Goldstein, Jensen, & Reiskin, 2001).

1.2. Engagement and a remedy for decline

Urban decline is not only an economic problem; it can also result in the loss of community identity (Crauderueff, Margolis, & Tanikawa, 2012; Goldstein et al., 2001; Kim et al., 2018), which depends on place attachment to produce a state of psychological well-being. Place attachment is also a result of access to a place and the state of distress upon separation from that place (Giuliani & Feldman, 1993). Due to this interrelation, urban decline is often accompanied by social problems and indifferent governmental intervention (U.S. Government Accountability Office, 2011). As a result, people can begin to lose trust in their government, and community identity can be lost (Johnson, Hollander, & Hallulli, 2014; Schilling & Mallach, 2012). The physical characteristics (such as abandoned buildings or structures) and social perceptions of vacant land (such as that it is an unsafe haven for illegal activity) can cause residents to lose pride in their community (Cohen, 2001; Crauderueff et al., 2012; Kim, 2018).

Thus, both social and civic infrastructures typically weaken as cities decline because residents do not always actively participate in community engagement processes (Schilling & Mallach, 2012). Civic engagement requires an understanding of the present and past issues faced by cities and is particularly important if progress is to be made toward urban regeneration and renewal in depopulating cities (Schilling & Mallach, 2012). Successful community engagement is a dynamic process in which ideas and opinions are exchanged over time through a process of informational feedback loops which varies from community to community (Watson, 2014). Many public problems and challenges in modern society, such as achieving environmental sustainability, reducing poverty, and improving human health and well-being, cannot be solved by a single organization (Masterson, 2018). Instead, these problems must be solved through the co-production and planning of multiple sectors, including governmental organizations, nonprofit organizations, businesses, and community groups (Watson, 2014). Such multi-sector collaborations increase the civic capacities of the collaborating organizations. Thus, community engagement is an important element in

addressing the problem of vacant urban land and assisting in long-term regeneration (Roberts, 2000).

A community engagement process to decide how to manage or repurpose vacant land within declining cities can enable community organizations and individuals to better understand the problems and potentials of vacant urban properties in terms of their ecological and social values (Kim, 2016; Kim, Miller, & Nowak, 2016). This perspective is important because cities experiencing structural crises and excess vacancies do not always have high development potential (Goldstein et al., 2001). In most cases, vacant land is viewed as a temporary and solely economic problem; the social and economic values of vacant land are often not considered, which can leave the land itself underused and unappreciated (Kim, 2018; Kim et al., 2018). Vacant, as a descriptive term, carries multiple negative connotations; excess amounts of vacant land can thus exacerbate negative urban perceptions (Crauderueff et al., 2012). High vacancy rates, therefore, presents financially unstable cities with many challenges. A community engagement strategy to articulate the positive potential of vacant land would allow the general public to understand the importance of transforming vacant urban land into ecologically and culturally productive spaces. The purpose of this study is to identify and demonstrate how citizens can be engaged to address the issue of vacant urban land through community engagement processes.

2. Methods

A comprehensive literature review was conducted to identify and demonstrate how the public could be engaged to address the issues of vacant urban land. Electronic journal databases (Science Direct, Web of Science, and Google Scholar) were used to identify journal articles about community engagement, shrinking cities, and urban regeneration and renewal. The journals included in the literature review were Sustainable Cities and Society, Sustainability, Journal of Environmental Psychology, Cities, and Landscape and Urban Planning. Using the keywords “vacant land,” “community engagement,” “social capital,” “urban regeneration,” and “renewal,” 44 recent articles were identified. Book publications were also included. The literature review focused on what plans, policies, implementation methods, and community engagement processes had been developed to remove the barriers and address the challenges that face vacant land projects. The literature highlights the importance of community engagement in understanding the problems and potential value of vacant land, beginning and managing the redevelopment process, gaining financial support, determining adequate regulations, and ensuring the participation of neighborhood organizations in regeneration projects. From this body of knowledge, a community engagement strategy was developed to better understand how community engagement can be used to address the issues of vacant urban land and better use such spaces.

3. Results

Among the 44 identified articles addressing community engagement processes for vacant land in declining cities, community involvement, community engagement strategy, comprehensive neighborhood planning, and special-area plans were the identified primary

topics. Table 1 describes the types of community engagement and the number of studies on vacant land management, planning, and design.

3.1. Community involvement

Integrative community involvement, defined as community leadership resources can bring diverse groups and organizations together in semi-permanent ways (typically across sector boundaries) to remedy complex public problems and achieve common good and has shown promise in solving vacant land problems in transitional cities (Crosby & Bryson, 2010). Diverse groups and organizations work together to create civic capacity through community involvement meetings and groups that include residents, neighborhood groups, civic leaders, and community development organizations or corporations, mostly non-profit organizations. The major goal of these groups is to increase community value by solving complex community problems to meet common goals derived from public input and desires. During the process of civic engagement, it is necessary to resolve conflicts among government, business, and social groups. In other words, complex community problems require not only the engagement of governmental bodies, but also multiple civic capacities that can recognize common community issues and problems with collective attitudes.

To encourage public engagement in addressing the issues of vacant urban land, both formal (grass-top) and informal (grassroots) civic processes should be used to enhance communication and provide diverse experiences for participants. Workshops, town hall meetings, and seminars can be strategically introduced to encourage multi-sector collaborations to address specific local problems. During that process, citizens can exchange their opinions and thoughts about the community with one another, and that communication can help to integrate the neighborhood into a cohesive community (Meyer et al., 2018). The behaviors of both citizens and organizations during that process are thus important elements for the overall success of the endeavor.

To address the problems of vacant urban land, the literature suggests that integrative civic capacity can be a catalyst for multi-sector collaboration by producing: (1) integrative thinking, (2) integrative behavior, (3) integrative community leadership resources, and (4) integrative structures and processes (Fig. 1). Integrative collaborative learning fosters and enhances the ability of stakeholders to think about and (therefore deliberate about) issues systemically, instead of focusing on individual problems, which can allow the community to avoid the common pitfalls associated with most linear “cause-and-effect approaches” (Gastil & Levine, 2005). The goal of inviting stakeholders to communicate with one another is to facilitate systematic approaches that benefit from multiple perspectives. In that process, stakeholders might discover new possibilities that go beyond their own vision, such as transforming vacant land from a blighted area into a green space with community value rather than speculating on future land-use value.

3.2. Community engagement strategies

According to the literature, community groups typically use the following methods to meet their goals. The first strategy is to educate residents to better understand the potential value of vacant land and provide adequate information about green reuse options (Kim, 2016).

Many vacant properties in transitioning cities have no short- or even long-term development potential (Kim et al., 2018), making those sites good candidates for use as green infrastructure. Table 2 presents a list of potential green reuses for small sites and large parcels in declining areas. The success of such projects depends heavily on the willingness of neighborhood residents to take responsibility for them.

For example, side-lot programs rely on homeowners willing to tend or manage adjacent vacant lots (Crauderueff et al., 2012). Community gardens require gardeners in the vicinity willing to take on maintenance responsibilities. Uses for large vacant parcels in disinvested areas can differ, but typically, those projects have few adjacent neighbors, and often even fewer people are eager to take responsibility. Because previous and current urban land use structures, not to mention the existing condition and redevelopment potential of each vacant lot, can vary widely, each plot will require its own unique approach for future reuse (Kim et al., 2015). Vacant urban land can have unique and desperate characteristics to utilized lots, so a thorough stakeholder-informed understanding of the potential for and obstacles to redevelopment of each space must be identified (Kim et al., 2018). Table 3 present a matrix of the key attributes by which specific cities successfully implemented community engagement programs and planning strategies, along with the dates and methods used. Adequate public education about vacant land leads to an increase in community engagement and can greatly assist in solving the problem of excessive vacant urban land.

Second, an engaged approach connects landlords and residents in community networks to develop new knowledge and create solutions for vacant land. Beyond discussion, stakeholders, including property owners and property renters, engage in the process and learn about adaptive management of the vacant land. Stakeholders often have the clearest and most accurate perception of their vacant land, and they should make decisions themselves. The dialogue process offers them a chance to solve conflicts and create common goals that inform their decisions about the vacant land. Residents must make their opinions heard during the decision-making process. When property owners receive adequate information, they can make better decisions, though conflicts between residents and property owners might still need to be resolved. Informal associations and networks of individuals, including social clubs and churches, are often more cohesive than formal neighborhood organizations. Relatedly, informal, self-organized gatherings, such as study circles, neighborhood coffee meet-ups, and potluck dinners, can bring people together to discuss vacant land issues and build strong place attachment within neighborhoods.

Other techniques are specific to the design and planning process. For example, charrettes are intensive community participatory design exercises that engage residents with students and faculty from planning or architecture programs at nearby universities to generate valuable design ideas for vacant land in neighborhoods. The primary benefit of this process is that the final design products are useful to the community and reflect the goals and concerns of the area's residents. In this way, communication involvement approaches, such as town hall meetings, seminars, and community education programs about vacant land, can increase community engagement.

Third, the literature indicates that establishing and maintaining a dialogue with residents through diverse social media throughout the engagement process is extremely beneficial because it allows residents to offer significant input. Social media, such as Facebook, Twitter, Instagram, and YouTube, can be an effective place to discuss social issues. For example, residents can make photo essays or YouTube videos to illustrate their neighborhood's vacant land problems. Online dialogue is an excellent mechanism for a large-scale discussion of public policy, and it is a valuable supplement to conventional public hearings and solicitations for written comments (Gastil & Levine, 2005). Online conversations can be structured to encourage a thoughtful and constructive exchange among participants interacting freely and rapidly with one another, exchanging information and ideas in the nonthreatening environment of their office or home. In the long term, such dialogues can help create an active, engaged citizenry that pays attention to its government and expects to be involved in an open discussion of policy.

In addition, most cities (depopulating or otherwise) contain groups underrepresented in positions of power. Community engagement should include diverse groups and ensure that all members' ideas and interests are heard. To establish community engagement, vacant land projects must consider the needs of groups with few resources, such as low-income people, which will require deliberate forums for marginalized populations. Special questionnaires for groups with few resources are another way to gather information. When citizens with few resources enter deliberative forums, they generally take their roles seriously and are willing to learn and discuss the issues at hand. As a result of such deliberations, citizens reported that they learned about the broader dimensions of the policy issues under consideration, and many ultimately shifted their preferences or altered another's perceptions (Gastil & Levine, 2005). Groups with few resources should be accepted by all as part of the community that should be able to influence community development.

3.3. Comprehensive and neighborhood plans

Few transitional cities have a planning approach which is adequate enough to address the scope and complexity of their vacant land problems. Many cities in transition lack an adequate planning process or political leadership, despite having a document that describes their past and offers a comprehensive plan for revitalizing their future. The comprehensive plans of many cities in transition reflect an insufficiently systematic planning approach. In some cases, the comprehensive plans are outdated and do not represent current conditions, market situations, or growth trends. Thus, many transitional cities need to revise their comprehensive plans through a process of community involvement, even though that will require an additional investment of time and resources.

For example, in early 2002, Youngstown, Ohio, initiated a revision of its comprehensive plan, which dated from the 1950s. The Youngstown 2010 Plan focuses on building a sustainable future based on smart shrinkage, a method of planning for fewer people, buildings, and types of land use (Hollander & Németh, 2011). The planning process by which the participants rewrote the comprehensive plan took 3 years (Newman, Li, Ren, & Guo, 2018) and was the city's first step in solving its vacant land problem. Many cities experiencing urban decline as a result of depopulation, like Youngstown, now practice smart

shrinkage (sometimes called smart decline or right-sizing). The inability to retain viable developments in vacant areas has created a wider embrace of smart shrinkage policies (Schilling & Logan, 2008). Rather than force new development into decaying areas, cities right-size themselves, taking advantage of future developmental opportunities only when the potential is clear. Tactical urbanism, pop-up urbanism, and related temporary use-based programs that rely on community engagement are all grassroots programs similar to smart shrinkage (Finn, 2014).

In addition to local governments, community development corporations (CDCs) and other neighborhood-based nonprofit organizations have become increasingly engaged in neighborhood planning. Many CDCs have full-time professional planners and use studio programs at graduate planning and architectural schools, such as the Community Design Assistant Center at Virginia Tech. CDC employees generally have professional knowledge about community issues and a strong relationship with community residents. They are nonprofit organizations, so CDCs try to represent community residents and focus on their well-being and their voice. A team at Cleveland State University developed a definition of neighborhood planning: a process whereby residents and other stakeholders learn about their neighborhood, envision a shared future, and develop strategies to shape their community for the better and sustain it for the long term. That process produces a plan that encourages and directs future social and economic investments toward the development of a healthy neighborhood (Burkholder, Chupp, & Star, 2003).

Thus, neighborhood planning is a good strategy for integrating public engagement to address vacant land issues. A neighborhood-scaled plan might focus primarily on neighborhood revitalization, which may be difficult given a severely declining neighborhood condition. A neighborhood revitalization plan must focus not just on desirable activities; it must change the theoretical vision for the community. A community engagement neighborhood plan can help to establish long-term and short-term plans for vacant land in transitional cities. The neighborhood planning process can help residents and other stakeholders invest in the community's future goals and increase the credibility of revitalization efforts (Schilling & Mallach, 2012). A neighborhood plan is not a temporary effort, but rather a long-term, engaged process that encourages public participation to address the problems of vacant land in a city.

3.4. Special-area plans

Small-area plans facilitate the success of city-wide plans. Sometimes, a city-wide plan might not consider special areas or districts, such as gentrifying neighborhoods, brownfield sites, or urban vacant/abandoned lots, for revitalization or redevelopment. A special-area plan can provide more sophisticated planning details and an opportunity to respond to the special needs or concerns of a particular neighborhood or district. Many transitional cities have areas that will require special planning and policies before a city-wide comprehensive or strategic plan can be created.

A small-area plan can take many forms, and the nomenclature of such plans varies from state to state (e.g. district plans, corridor plans, transit-oriented development plans, and in California, specific area plans) (Berke & Kaiser, 2006). Recently, small-area plans have been

used as creative planning tools to manage public issues in terms of new growth and urban policies. Special area plans encourage community involvement. For example, the neighborhood planning process for Youngstown's Idora neighborhood in Ohio began with a stakeholder meeting in August 2007 (Schilling & Mallach, 2012). In September, the Idora planning team, composed of Youngstown city planning staff and Ohio State University campus planners, held a meeting to present background information about the challenges of the neighborhood and ask residents for their opinions and ideas (2012). With that community input, planners were able to understand the priorities of the community and link them with other city planning documents, such as the priorities in the Youngstown 2010 Plan. The Youngstown community used that information to prepare a comprehensive neighborhood plan with practical goals and strategies for the community, including greening strategies for vacant land in Youngstown (www.yndc.org/neighborhood/idora).

A similar example of a special-area plan is in Detroit's Lower Eastside neighborhood, where a non-profit citywide association of CDCs created a community engagement process for revitalization planning. Several other cities have also used special-area revitalization plans with city-wide approaches. For example, Indianapolis, Indiana, and Roanoke, Virginia, have city-wide redevelopment plans for brownfields by which they are revitalizing formerly contaminated, vacant commercial and industrial sites. Indianapolis used a smart growth renewal district plan for its brownfield sites with the principle of transit-oriented development. This development strategy was created by CDCs and a community partnership and supported by federal government resources. This plan is a prime example of cooperation among a community, a city, and government officials. District planning can thus establish a public engagement process by which neighborhoods articulate their own needs and essential goals, and it sets a strong precedent for using public engagement to address vacant land problems in transitional cities.

4. Discussion

4.1. Understanding the problems and potential value of vacant urban land

Before people can fully understand the potential ecological and social value of vacant land, cities and residents must understand the current conditions of their vacant properties. Most urban residents do not even know how many vacant properties are in their municipality (although municipal vacant land inventories are increasing globally), which are eligible for tax sale or tax foreclosure, and which are in the process of mortgage foreclosure. In addition, they might be unaware of which vacant properties have contamination issues (e.g. brownfields) that could potentially adversely affect people's health. An inventoried assessment of vacant land conditions can provide detailed descriptions of neighborhood issues using both statistical and qualitative information. Vacant land data should not rely only on statistics or geographic data; they should also include resident surveys to understand their attitudes and perceptions and identify which vacant parcels are creating the most problems and therefore most require stabilization or revitalization.

Map-based information about vacant land can help the general public better understand the situation and enable them to determine which neighborhoods are experiencing high ratios of vacancy (Kim et al., 2016; Kim et al., 2018). Indicating which types of vacant land should

be repurposed is an important step when targeting vacant lots for reuse and can be informed through an engaged process. Also, identifying and prioritizing vacant land for redevelopment projects, such as constructing housing, green spaces, and other infrastructure, is essential for the general public to understand the potential and importance of transforming vacant urban land into ecologically and culturally productive landscapes (Kim, 2016). Identifying the most appropriate way to reuse vacant land, such as demolishing, rehabilitating, or waiting for future development (as well as assembling small scattered vacant parcels into larger parcels for future redevelopment) is essential to best use or reuse vacant urban land. Depending on the land conditions, the object of transformation will vary (Kim, 2018) but can include improving the housing market, reducing crime, or creating green spaces to improve quality of life. Specific strategies for change and the rationale for repurposing each plot of vacant land should enable all city residents to understand current land issues and the potential future value of those spaces.

To provide this type of data and information, municipalities can hold town hall meetings or expos for the general public. These meetings should be advertised in media announcements and include public hearings and reviews/comments on reports about existing vacant land. Public brochures, surveys, and polls can both inform the public and allow people to provide feedback. Advisory committees can present successful precedents, such as the Pennsylvania Horticultural Society's Philadelphia Green program for urban greening. Such precedent programs and studies can motivate the general public to perceive vacant land not as a liability but an asset. Changing the general negative perception of vacant land is the most important element in encouraging community engagement (Fig. 2).

4.2. Practical information about the redevelopment process for vacant land

To encourage community engagement with vacant land reuse, it is essential to provide practical information about redevelopment. Residents would like to know how they can reuse vacant land, but they often lack the technical knowledge or financial means to redevelop it. Therefore, municipalities should provide vacant land classifications and tax policy investment incentives for vacant land reuse. When cities create categorization recommendations for each type of land, the general public can easily understand the obstacles, challenges, or potential benefits of future development for each type of vacant property (Kim et al., 2018).

Depending on the conditions, the redevelopment process could vary from temporary or short-term uses to permanent, long-term uses. For example, small parcels of vacant land can be repurposed with short-term or vernacular uses, such as community gardens, pocket parks, or small open spaces with natural habitats; or they can be valuable portions of a green network system connecting existing green spaces within a city and providing networks of recreational opportunities for walking and biking that offer health benefits for residents. Large parcels of vacant land, on the other hand, might be better reused as long-term green infrastructure, such as sites of urban agriculture for food production, sustainable biomass energy systems, carbon sequestration, or large urban parks for recreational use. Green infrastructure can also help manage stormwater, increase biodiversity, restore water quality and soils, and improve air quality. Stormwater management strategies for vacant land in

particular can eliminate the need for billions of dollars in improvements to a city's sewer systems by providing an increased ability to capture stormwater, increase groundwater recharge, and decrease flood risk.

Certain vacant sites, particularly ones close to highways and railways, could have long-term potential for industrial use that could bring economic investment and create jobs. It is important to be able to distinguish between areas where long- and short-term uses are appropriate when a community makes decisions about the use and reuse of vacant land and abandoned buildings. Short-term revenue goals might lead cities to maximize the revenue from a land sale or tax receipt immediately by selling the right to vacant land foreclosure to developers and receiving tax revenues from investors. Inversely, reusing vacant land as urban green spaces for long-term use might not bring immediate revenue benefits but generate greater value over time. Green infrastructure can improve the quality of life for residents, increase property value in terms of ecology and aesthetics, and provide numerous environmental benefits, such as air pollution filtration, heat island effect protection, carbon sequestration, and urban stormwater management (Kim et al., 2015). The cumulative return might exceed that of building a housing development on the same vacant land. Green reuse decisions will affect a site and its surroundings for the next 10–20 years. Vacant lots reused as green infrastructure also act as a potential developable land bank, should economic base or development potential increase in the future. If they are given adequate information about vacant land in terms of short- and long-term goals, people should be able to make good decisions about how to use the vacant land in their community.

4.3. Financial support for vacant land

Financial struggles can hinder community engagement with vacant land reuse. Residents must have the information about grants, short-term loans, incentives, and other potential sources of money to assist in vacant land regeneration. Assessing the financial requirements and sources to implement plans is essential to the community engagement process. Most cities lack adequate economic incentives to support vacant land reuse and remove (or maintain and improve) abandoned buildings (Gu, Newman, Kim, Park, & Lee, 2019). Tax foreclosures and enforcement codes can increase the amount of vacant land or the number of unmaintained properties over time (Goldstein et al., 2001). Unmaintained vacant lots and abandoned buildings negatively affect both the property values and quality of life in the surrounding neighborhoods (Kivell, 1993). Maintenance of properties has its own inherent value that can encourage future redevelopment (Kim, 2018). Municipalities should therefore consider vacant land investment policies, such as tax incentives, tax credits, and rehabilitation abatements (Accordino & Johnson, 2000; Schilling & Mallach, 2012).

As public incentives, abatements can encourage citizens to invest in vacant land to build new structures and rehabilitate abandoned houses. If homeowners reinvest and maintain their houses and tangential properties, new families will want to move back into once declining neighborhoods. As new residents come to a neighborhood, new structures are needed and can be used to fill vacant land. Contractors can rehabilitate abandoned houses or build new houses on vacant land, which will bring new business. People can participate in civic associations, such as cleaning vacant land. Private investment in vacant land can catalyze

increased property values and make the community more self-sustaining. Encouraging residents to invest in their homes and neighborhoods and increasing homeownership rates can establish or enhance neighborhood stability. If a city does not have enough money to redevelop its vacant land, the private market could be encouraged to acquire and re-use it (Fig. 3).

4.4. Regulations for vacant land

Government regulatory strategies, such as enforcement codes for maintenance, can encourage community engagement related to vacant land (Kim, 2018). Vacant property enforcement codes typically include maintenance requirements and registration fees. These can motivate people to improve their properties and keep their surroundings more secure. Neighborhood residents can be trained to inspect vacant lots and send warning notices to the owners of properties that violate the city's property maintenance code. If owners do not respond to a notice, an official can then inspect the property and enforce actions to improve it (Accordino & Johnson, 2000; Schilling & Logan, 2008; Schilling & Mallach, 2012). Neighborhood groups can also pressure the owners of an abandoned property to improve it. In addition, the owners of neglected lots can be forced to pay registration fees. Clean and lien programs can create levies on people who use vacant land as dumps or for another illegal purpose. Building inspectors can post signs near vacant land and order owners to clean up the land (Schilling & Mallach, 2012).

An effective strategy to control the maintenance of vacant/abandoned lots is for cities to acquire the land through foreclosure and then clean or demolish structures and maintain the property until it can be sold. However, property acquisition, demolition, maintenance, and cleaning bring significant costs to a municipality. Even if the city acquires such a property, it is unlikely to generate tax revenues, and it will require continuous maintenance. Without redevelopment programs or a way to transfer property to private owners who can pay taxes, costs to the city continue to grow and the number of tax-revenue-generating properties can drop. When people actively live in houses, the problems of poorly maintained vacant land and abandoned properties tend to improve (Fig. 4).

4.5. Neighborhood organization participation

Most declining cities do not have enough money to enforce their existing codes on all vacant properties. CDCs and neighborhood organizations can help provide code enforcement on vacant land, which is particularly productive when many residents are engaged in those civic associations. To encourage community engagement, municipalities should support neighborhood residents and organizations. When neighborhoods have a strong CDC, more people have a way to participate in the planning process to revitalize their community.

5. Conclusion

Community engagement is an ongoing process, not a one-time act. The process of engaging people can be more important than the specific planning strategies themselves. Vacant urban land is the result of multiple social, cultural, and economic variables within a complex web of urban situations. To encourage community engagement in repurposing vacant land,

municipalities should thoroughly inventory and provide adequate information about the condition and potential ecological, economic, and social value of their vacant lands. They should also suggest and be open for repurposing ideas from residents about strategic short- and long-term methods in which to use those spaces. In declining cities, many people have limited resources, and the civic infrastructure for engaging in a public process can be shaky, which are obstacles to engaging people in solving issues with vacant land.

Code enforcement and tax foreclosure are efficient ways to control vacant land and the problem of abandoned buildings. However, without a healthy housing market, community stabilization might be impossible. Most depopulating cities lack adequate economic incentives to support vacant lands and ensure that abandoned buildings are maintained and improved. Unmaintained vacant lands and abandoned buildings negatively affect both the property value and quality of life in the surrounding neighborhoods. Thus, maintenance has value in itself and can encourage future redevelopment. Tax incentive systems, such as high taxation rates on land but a low rate or no tax on infill development on vacant land, tax credits on vacant land forest structures, and a rehabilitation abatement for abandoned buildings, can increase private investment in vacant land.

Community engagement in planning for vacant land reuse is the first step to solving the problem of vacant urban land. Local governments should support such efforts by creating and encouraging community involvement groups, neighborhood coordinators, civic leaders, CDCs, and other community-based nonprofit organizations that can support community engagement efforts and facilitate neighborhood meetings to discuss community issues. Regional, neighborhood, and site-specific plans for vacant land can be developed by residents, decision-makers, and experts working together (Watson, 2014). The current condition and redevelopment potential of vacant land can differ depending on previous and current urban land-use structures, so various approaches to future development are needed (Kim et al., 2015). Vacant urban land has unique characteristics, so all the stakeholders have to understand the potential for and obstacles to redeveloping those spaces (Kim et al., 2018).

Finally, it is important to understand the potential effects of repurposing vacant lots. For example, gentrification can occur from greening vacant lots in underserved communities, so urban planners, designers, and ecologists need to focus on urban green space strategies that are both socially and ecologically sustainable. Similarly, the distribution of green space often disproportionately benefits predominantly white and affluent communities to the exclusion of minority and marginalized ones; access to green space is therefore increasingly recognized as an environmental justice issue (Wolch, Byrne, & Newell, 2014). Community engagement is not a specific plan; it is instead part of the ongoing process of urban regeneration and the renewal of vacant land.

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References

- Accordino J, & Johnson GT (2000). Addressing the vacant and abandoned property problem. *Journal of Urban Affairs*, 22(3), 301–315.
- Ackerman K (2012). The potential for urban agriculture in New York City: Growing capacity, food security, & green infrastructure [PDF]. New York: Urban Design Lab at the Columbia Earth Institute.
- Audirac I (2007). Urban shrinkage amid fast metropolitan growth (two faces of contemporary urbanism). Online [cit. 25. 9. 2009] Retrieved from <http://www.coss.fsu.edu/durp/sites/coss.fsu.edu.durp/files/Audirac2009.pdf>.
- Berke P, & Kaiser EJ (2006). *Urban land use planning*. University of Illinois Press.
- Blakeman C, Brown B, Fitzpatrick BT, Shaw I, & Williamson A (2008). City-wide brownfield redevelopment plan Report prepared for the City of Roanoke, VA. Roanoke, VA: City Council.
- Bowman AOM, & Pagano MA (2004). *Terra incognita: Vacant land and urban strategies*. Washington DC: Georgetown University Press.
- Burkholder SH, Chupp M, & Star P (2003). *Principles of neighborhood planning for community development*. Cleveland: Center for Neighborhood Development, Maxine Goodman Levin College of Urban Affairs, Cleveland State University.
- City of Chicago (2014). Greencorps Chicago. Retrieved from http://www.cityofchicago.org/city/en/depts/cdot/provdrs/conservation_outreachgreenprograms/svcs/greencorps_chicago.html.
- City of Philadelphia (2010). *Greenworks Philadelphia: 2010 progress report*. Philadelphia.
- City of Tallahassee & Leon County, *Blueprint 2000 & Beyond*. (n.d.). *Blueprint 2000 technical coordinating committee*. Retrieved from http://www.blueprint2000.org/committee_tcc.html.
- Cohen JR (2001). Abandoned housing: Exploring lessons from Baltimore. *Housing Policy Debate*, 12(3), 415–416.
- Colasanti K, & Hamm MW (2010). Assessing the local food supply capacity of Detroit, Michigan. *Journal of Agriculture, Food Systems, and Community Development*, 1(2).
- Crauderueff R, Margolis S, & Tanikawa S (2012). *Greening vacant lots: Planning and implementation strategies*. New York: The Nature Conservancy.
- Crosby BC, & Bryson JM (2010). Integrative leadership and the creation and maintenance of cross-sector collaborations. *The Leadership Quarterly*, 21(2), 211–230.
- Daskalakis G, Charles W, & Jason Y (2001). *Stalking Detroit*. Barcelona: Actar.
- Dewar M (2006). Selling tax-reverted land: Lessons from Cleveland and Detroit: New this spring Westchester. *American Planning Association*, 72(2), 167–180.
- Finn D (2014). DIY urbanism: Implications for cities. *Journal of Urbanism: International research on placemaking and urban sustainability*, 7(4), 381–398.
- Garrison N, & Hobbs K (2011). Rooftop to rivers II: Green strategies for controlling stormwater and combined sewer overflows [PDF]. Retrieved from <http://www.nrdc.org/water/pollution/rooftopsii/files/rooftopstoriversII.pdf>.
- Gastil J, & Levine P (2005). *The deliberative democracy handbook: Strategies for effective civic engagement in the twenty-first century*. Jossey-Bass San Francisco.
- Giuliani MV, & Feldman R (1993). Place attachment in a developmental and cultural context. *Journal of Environmental Psychology*, 13, 267–274.
- Goldstein J, Jensen M, & Reiskin E (2001). *Urban vacant land redevelopment: Challenges and progress*. Cambridge, MA: Lincoln Institute of Land Policy.
- GrowNYC (2012). Rainwater harvesting I GrowNYC. Retrieved from <http://www.grownyc.org/openspace/rainwater>.
- Gu D, Newman G, Kim JH, Park YM, & Lee JK (2019). Neighborhood decline and sustainable urbanism: Mitigating housing abandonment in shrinking cities. *Land Use Policy*, 83(1) (505–501 in-press).
- Hall PA (2010). *The regeneration of urban empty space Detroit*. Master University of Cincinnati.
- Hollander J, Kirkwood N, & Gold J (2010). *Principles of brownfield regenerations*. Island Press.

- Hollander JB, & Németh J (2011). The bounds of smart decline: A foundational theory for planning shrinking cities. *Housing Policy Debate*, 21(3), 349–367.
- Immergluck D (2016). Examining changes in long-term neighborhood housing vacancy during the 2011 to 2014 US national recovery. *Journal of Urban Affairs*, 38(5), 607–622.
- Johnson MP, Hollander J, & Hallulli A (2014). Maintain, demolish, re-purpose: Policy design for vacant land management using decision models. *Cities*, 40, 151–162.
- Kim G (2016). The public value of urban vacant land: Social responses and ecological value. *Sustainability*, 8(5), 486.
- Kim G (2018). An integrated system of urban green infrastructure on different types of vacant land to provide multiple benefits for local communities. *Sustainable Cities and Society*, 36, 116–130.
- Kim G, Miller P, & Nowak D (2016). The value of green infrastructure on vacant and residential land in Roanoke, Virginia. *Sustainability*, 8(4), 296.
- Kim G, Miller PA, & Nowak DJ (2015). Assessing urban vacant land ecosystem services: Urban vacant land as green infrastructure in the City of Roanoke, Virginia. *Urban Forestry & Urban Greening*, 14(3), 519–526.
- Kim G, Miller PA, & Nowak DJ (2018). Urban vacant land typology: A tool for managing urban vacant land. *Sustainable Cities and Society*, 36, 144–156.
- King KL (2012). *Design vacancy: Vacant land and urban system in Detroit*. MI Master University of Colorado Denver.
- Kivell P (1993). *Land and the city: Patterns and process of urban change*. London: Routledge.
- Kollmeyer C (2009). Explaining deindustrialization: How affluence, productivity growth, and globalization diminish manufacturing employment. *American Journal of Sociology*, 114(6), 1644–1674.
- Koritz D (1991). Restructuring or destructuring? Deindustrialization in two industrial heartland cities. *Urban Affairs Quarterly*, 26(4), 497–511.
- Kremer P (2011). Local food systems as a strategy for sustainability: Analysis of a scale dependent sustainable urban food system a case study in Philadelphia. University of Delaware Retrieved from <http://gradworks.umi.com/34/65/3465799.html>.
- Kremer P, Hamstead ZA, & McPhearson T (2013). A social–ecological assessment of vacant lots in New York City. *Landscape and Urban Planning*, 120, 218–233.
- Lee J, Newman G, & Park Y (2018). A comparison of vacancy dynamics between growing and shrinking cities using the land transformation model. *Sustainability*, 10(5), 1513–1530. [PubMed: 30687533]
- Masterson DTR (2018). *Network Recruitment Experiments: Causal Inference in Social Networks and Groups of Known or Unknown Network Structure*. Working paper.
- Masterson J, Meyer M, Ghariabeh N, Hendricks M, Lee RJ, Musharrat S, ... Van Zandt S (2019). Interdisciplinary citizen science and design projects for hazard and disaster education. *International Journal of Mass Emergencies and Disasters*, 37(1), 6. [PubMed: 31244503]
- Meyer MA, Hendricks M, Newman GD, Masterson JH, Cooper JT, Sansom G, ... Cousins T (2018). Participatory action research: Tools for disaster resilience education. *International Journal of Disaster Resilience in the Built Environment*, 9(4/5), 402–419. [PubMed: 30519288]
- Misky D, & Nemke C (2010). From blighted to beautiful. *Government engineering*, May to June, 14–16. Retrieved from <http://govenerger.com/ArticleMay10/Menomonee%20Valley%20Brownfield.pdf>.
- Németh J, & Langhorst J (2014). Rethinking urban transformation: Temporary uses for vacant land. *Cities*, 40, 143–150.
- Newman G, Bowman A, Lee RJ, & Kim B (2016). A current inventory of vacant urban land in America. *Journal of Urban Design*, 21(3), 302–319.
- Newman G, Hollander JB, Lee J, Gu D, Kim B, Lee RJ, ... Li Y (2018). Smarter Shrinkage: a Neighborhood-Scaled Rightsizing Strategy Based on Land Use Dynamics. *Journal of Geovisualization and Spatial Analysis*, 2(2), 11.
- Newman G, & Kim B (2017). Urban shrapnel: Spatial distribution of non-productive space in a growing city. *Landscape Research*, 42(7), 699–715.

- Newman G, Li D, Ren DD, & Guo R (2018). Resilience through regeneration: The economics of repurposing vacant land with green infrastructure. *Landscape Architecture Frontiers*, 6(6), 10–23.
- Newman G, Malecha M, Yu S, Qiao Z, Horney J, Lee J, ... Berke P (2019). Integrating a resilience scorecard and landscape performance tools into a geodesign process. *Landscape Research*. 10.1080/01426397.2019.1569219 (inpress).
- Nolan EP (2017). Vacant land conversion in Detroit, Michigan: A spatial analysis of neighborhood stabilization and communal access. Master's thesis Harvard Extension School.
- NYC Parks GreenThumb (2014). About: NYC Parks GreenThumb. Retrieved from <http://www.greenthumbnyc.org/about.html>.
- Oswalt P (2008). Shrinking cities. *Shrinking cities: Complete works 3 Japan* 3–16.
- Pennsylvania Horticultural Society (PHS) (1995). Vacant urban land: Issues and recommendations.
- Rieniets T (2009). Shrinking cities: Causes and effects of urban population losses in the twentieth century. *Nature and Culture*, 4(3), 231–254.
- Roberts P (2000). The evolution, definition and purpose of urban regeneration. *Urban regeneration* 9–36.
- Ryan BD (2012). *Design after decline: How America rebuilds shrinking cities*. University of Pennsylvania Press.
- Schilling JM, & Mallach A (2012). *Cities in transition: A guide for practicing planners*. Washington, DC: American Planning Association.
- Schilling J, & Logan J (2008). Greening the Rust Belt: A green infrastructure model for right sizing America's shrinking cities. *Journal of the American Planning Association*, 74(4), 451–466.
- Setterfield M (1997). Abandoned buildings: Models for legislative & enforcement reform. Trinity Center for Neighborhoods, Research Project 23 (March).
- U.S. Government Accountability Office (2011). Vacant properties: Growing number increases communities' cost and challenge. Retrieved January 5, 2015 from <http://www.gao.gov/assets/590/586089.pdf>.
- Watson V (2014). Co-production and collaboration in planning—The difference. *Planning Theory & Practice*, 15(1), 62–76.
- Wolch JR, Byrne J, & Newell JP (2014). Urban green space, public health, and environmental justice: The challenge of making cities “just green enough”. *Landscape and Urban Planning*, 125, 234–244.
- Zhang L, Yuan M, & Li H (2015). Panel data of China's real estate prices and real estate vacancy—Based on data analysis of 35 large and medium size cities. 2015 international conference on management science and innovative education Atlantis Press.

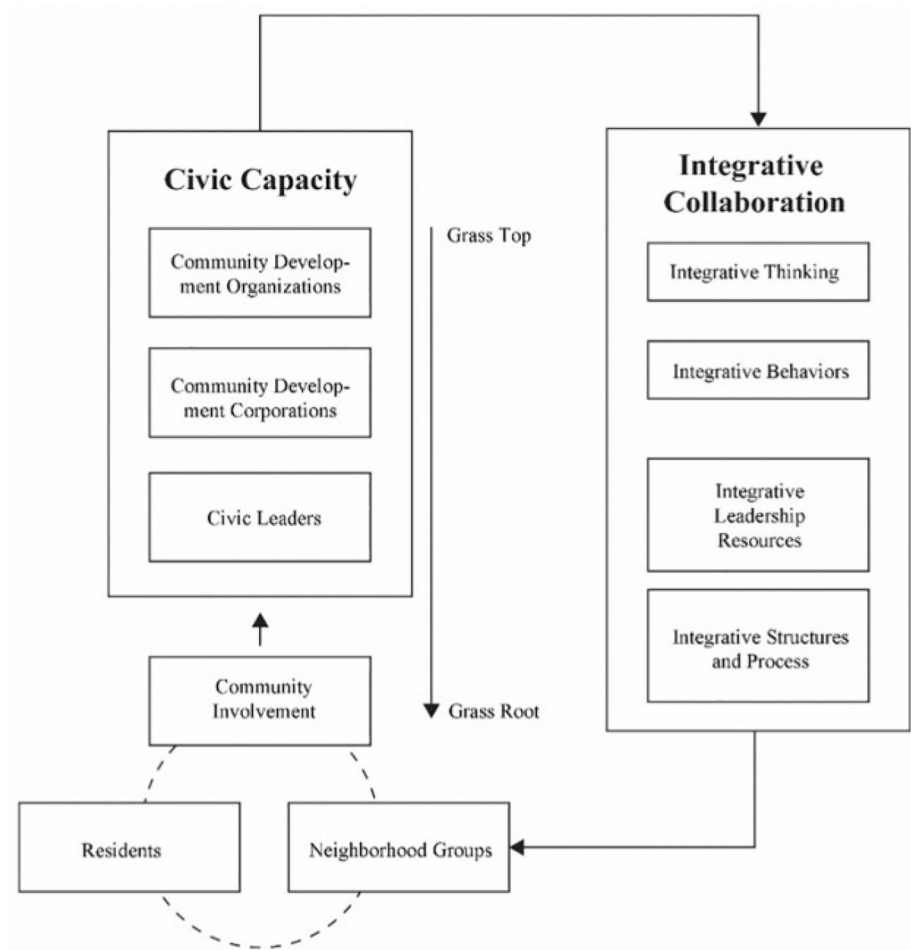


Fig. 1. Typical civic capacity process for regenerating vacant land.

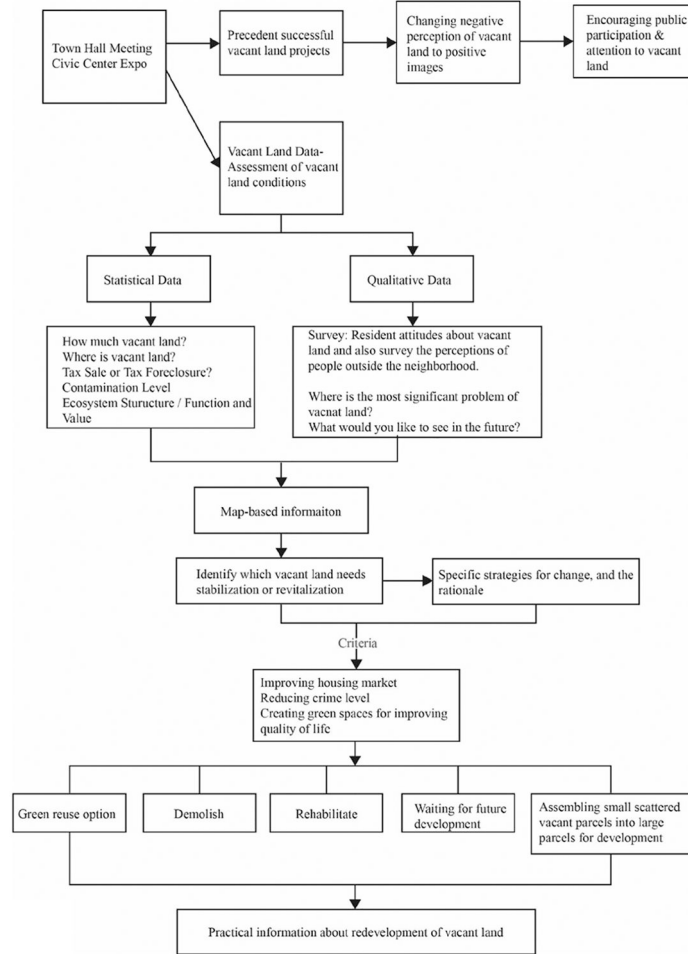


Fig. 2.
Community engagement strategy chart 1.

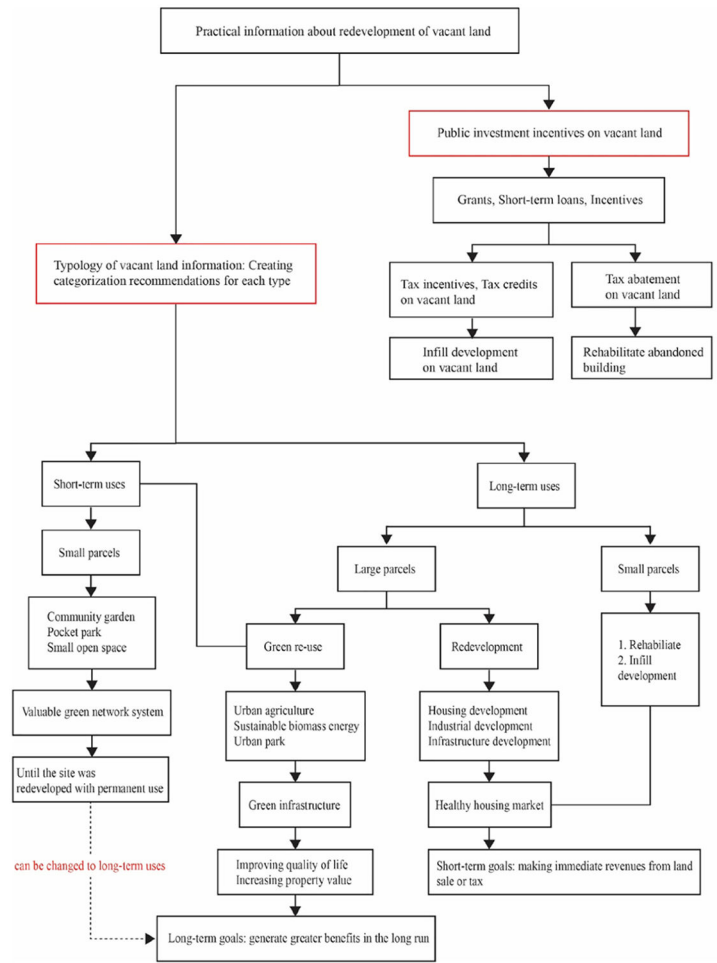


Fig. 3.
Community engagement strategy chart 2.

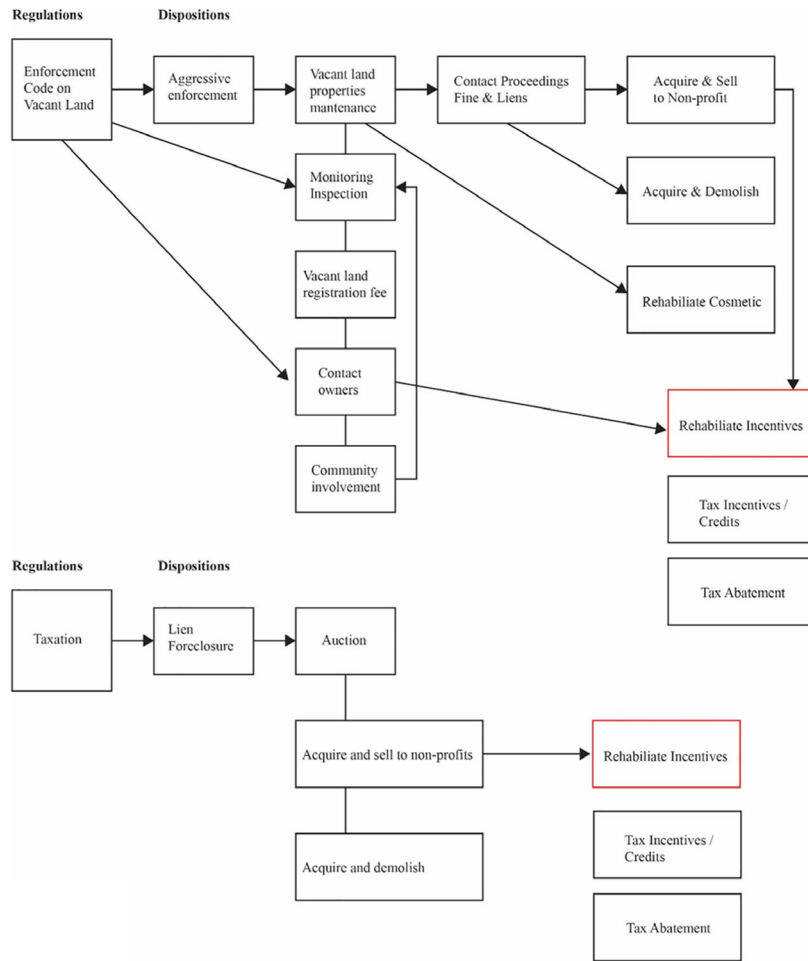


Fig. 4.
Community engagement strategy chart 3.

Table 1.

Methodological details of studies investigating community engagement processes for vacant land use in declining cities.

Citation	Research methods	Community engagement types	Community engagement approaches
PHS (1995)	LR, CS	Community involvement	- Integrative collaboration
Ackerman (2012)	LR, CS, GIS		- Civic capacity
City of Chicago (2014)	LR, CS		- Green corps
City of Philadelphia (2010)	LR, CS		- Hope garden
NYC Parks GreenThumb (2014)	LR, CS		- Community garden
GrowNYC (2012)	LR, CS		- Rainwater harvesting systems
Crauderueff et al. (2012)	LR, CS		- Greening vacant lot
Kim et al. (2018)	GTM, CS, GIS		- Alternative uses
Kim et al. (2016)	LR, CS		- Potential value
Crosby and Bryson (2010)	LR, CS		- Civic capacity
Meyer et al. (2018)	LR, CS		- Participation design
PHS (1995)	LR, CS	Community engagement strategy	- Neighborhood strategy
Ackerman (2012)	LR, CS, GIS		- Urban agriculture
City of Chicago (2014)	LR, CS		- Green industry
City of Philadelphia (2010)	LR, CS		- Children education
NYC Parks GreenThumb (2014)	LR, CS		- Community workshops
GrowNYC (2012)	LR, CS		- Training volunteers
Crauderueff et al. (2012)	LR, CS		- Green infrastructure
			- Side lot transfer programs
Kim et al. (2018)	GTM, GIS, CS		- Vacant land assessment tool
Kim et al. (2016)	LR, CS		- Typology of vacant land
Schilling and Mallach (2012)	LR, CS		- Greening options
Gastil and Levine (2005)	LR, CS		- Online dialogue
Masterson et al. (2019)	GTM, GIS		- Citizen science
Newman et al. (2018)	GTM, GIS		- Feedback loops
Crauderueff et al. (2012)	LR, CS	Comprehensive neighborhood plan	- The greening of Detroit
	LR, CS		- Seattle parks & recreation plan
Hollander and Németh (2011)	LR, CS		- Youngstown, Ohio comprehensive plan
Schilling and Logan (2008)	LR, CS		- Smart shrinkage policies
Finn (2014)	LR, CS		- Tactical urbanism/pop-up urbanism
Newman et al. (2019)	GIS		- Engagement with local planners
City of Chicago (2014)	LR, CS		- Children farming
City of Tallahassee and Leon County (n.d.)	LR, CS		- Capital cascade trail
Blakeman, Brown, Fitzpatrick, Shaw, and Williamson (2008)	LR, CS, GIS	Special-area plans	- City-wide brownfield redevelopment
Kim, Miller, and Nowak (2015)	LR, CS, GTM		- Ecosystem service assessment
Crauderueff et al. (2012)	LR, CS		- Staten island bluebelt
Misky and Nemke (2010)	LR, CS		- Menomonee valley industrial center

Citation	Research methods	Community engagement types	Community engagement approaches
Garrison and Hobbs (2011)	LR, CS, GIS		- Green stormwater system
Kim et al. (2016)	LR, CS, GTM		- Ecosystem service assessment
Schilling and Mallach (2012)	LR, CS		- Youngstown city planning
Hollander et al. (2010)	LR, CS		- Principles of brownfield
Colasanti and Hamm (2010)	LR, CS		- Local food supply capacity
Kremer (2011)	LR, CS		- Local food systems
Kremer, Hamstead, and McPhearson (2013)	LR, CS, GIS		- Social-ecological assessment

LR literature review, *CS* case study, *GIS* geographic information systems, *GTM* ground truth method.

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Table 2.

Greening options for vacant lots.

Vacant land type	Potential green reuse	Description
Small-to moderate-lots scattered throughout viable neighborhoods	Park expansion	Adding parcels of land to existing lots
	Side lots	Sale of lots to adjacent homeowners
	Stabilization/minimal treatment	Basic treatment and maintenance to provide attractive environment and minimize blighting effects
	Pathways	Midblock or multiple pedestrian and bicycle paths
	Mini-parks	Small playgrounds and passive parks for use by neighbors
	Community gardens	Small gardens supported by neighborhood residents
	Stormwater management	Restoring buried natural stream
	Low-intensity open space	Re-creation of meadows, woodlands, and other sustainable spaces
	Greenways	Linear green spaces for pedestrian and bicycle use
	Large parcels in largely disinvested areas	Urban farms
Stabilization/minimal treatment		Basic treatment and maintenance to provide attractive environment and minimize blighting effects
Stream daylighting		Restoring buried natural streams
Alternative energy production		Using land for renewable energy production such as solar, wind, or geothermal energy

Source: Schilling and Mallach (2012): 98, reorganized by author.

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Table 3.

Characteristics of community engagement programs and policies for vacant lots in the U.S.

Case	Year	Program	Goals	Planning strategies
New York, NY	1999	Community gardens	Provide permanent space and support to community gardens.	114 community gardens through Trust for Public Land (TPL) & New York Restoration Project (NYRP). More than 600 community gardens are registered with Green Thumb (of over 1000 citywide). NYRP & TPL purchased 114 community gardens in 1999 from the City of New York, which threatened to develop the sites as housing. The TPL incubated three local land trusts (Bronx Land Trust, Manhattan Land Trust, & Brooklyn Queens Land Trust) based on community interest.
Detroit, MI	1989	The greening of Detroit	Increase vegetative cover and improve communities in Detroit.	Appx. 1400 vacant lots greened and maintained, appx. 1400 family, school, and community vegetable gardens developed, and 80,000+ trees planted. For urban reforestation program, uses GIS to ensure that each planting maximizes ecosystem services, as well as social considerations.
Genesee County, MI	2002	Genesee County Land Bank Authority	Acquire, manage, and dispose of foreclosed properties for public benefit, including urban redevelopment and the greening of vacant lots.	Community gardens, urban agriculture, side yards. Through the clean & green program, Signature Greening projects demonstrate new greening practices, including low-maintenance plantings and pocket parks. The Land Bank works with community organizations & residents to identify and prioritize sites for greening.

Source: Crauderueff et al. (2012), reorganized by author.