Regenerative Green Infrastructure Governance in Weak, Rebounding, and Wealthy Land Markets

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Too often scholars valorize green infrastructure without critically examining the dynamic and multi-faceted ways that greening impacts urban environments. Cities are complex, evolving forces of their own, which grow and shrink according to time and place. Governance strategies in different economic conditions powerfully shape the impacts of specific green infrastructure installations. They determine the value, quality, quantity, and spatial arrangement of green infrastructure. However, most scholarship focuses on the psychological, social, economic, and environmental benefits of urban greening. Green infrastructure is overwhelmingly studied as apart from historical urban governance trajectories, and it largely fails to consider the role of greening within the process of urban regeneration. This disconnect constitutes a significant gap that constrains understanding of green infrastructure for regenerative cities, and it limits our ability to strategically deploy it in beneficial rather than harmful or irrelevant ways. In this article, I argue that green infrastructure lays fundamentally different roles in poor and wealthy parts of cities, and that these roles change as the overall rank and status of the cities change over time. These changing meanings cause city governments to treat green infrastructure as fundamentally different targets of management. These conclusions are based on an ethnography of the public policy processes surrounding urban greening in three cities with different land markets. In the strong land market, the emphasis is placed firmly on revenue-generating projects, and the major players are private firms in conjunction with city departments. Greening is conceived as a byproduct of large-scale development projects, and rarely apart from them. In the weak land market city, in contrast, the environmental and civic organizations play major roles, and they conceive of green infrastructure apart from development projects. Weak land markets seem to create the possibility for increased political participation of environmental actors and for the installation of green infrastructure for the primary purpose of community health and well-being. However, the increased strength of environmental civic coalitions appears negatively correlated with the city's economic capacity to fund greening projects without support from the business community. These dynamics suggest a counter-cyclical relationship between the political will for urban greening and the investment capacity

to pay for it. The analysis of green infrastructure in different land markets demonstrates that green infrastructure is deeply embedded in the historical and geographical legacies of cities.

Keywords: green infrastructure (GI), regenerative, vacant and abandoned property, economic change, cities, urban governance, trees, urban greening

INTRODUCTION

Like many older U.S. cities, Philadelphia suffered badly when waves of deindustrialization hit the city in the early 20th century. Wages stagnated, and families struggled. Despite a New Deal boost in the post-war era, massive federal investments in tract housing and highway construction shifted the geography and racial implications of economic growth. By the 1980s, many middle-class and white Philadelphians had left the city. Land values had plummeted, families had left, and many neighborhood blocks featured multiple vacant houses, or open fields where landlords had burned their houses to the ground for insurance money—sometimes with tenants still living in them (Medoff and Sklar, 1994; Ansfield, 2021). One neighborhood with especially prevalent vacant land was Kensington.

In the early 1990s, the North Kensington Community Development Corporation (CDC) devised an innovative approach to catalyzing development with green infrastructure. The strategy would identify a set of properties that it anticipated would become developable in 5–10 years. Then the CDC would locate all the vacant parcels that were visible from that initial property, and it would hire neighbors to clean them up: they would mow the grass, and plant trees and shrubs in the setback zones of the parcel. This careful maintenance indicated "cues to care" (Nassauer, 1995), which instilled the neighborhood with pride and respect. The green infrastructure installations were received well by the neighbors, and the CDC's landscape approach helped to stabilize the neighborhood.

The prevailing theories for green infrastructure do not explain why and how green infrastructure took on such meanings in Kensington at the turn of the millennium. Most urban green infrastructure scholarship interprets the social dimensions in an abstracted way, as occurring apart from the overall trajectory of urban development. Sociological examinations of green infrastructure make important contributions to understandings of the organizational settings for greening, and they focus on the demographic and organizational characteristics of greening agents. Their parameters center on the ecological-technical interventions and the social contexts of those interventions (i.e., Connolly et al., 2013; Locke et al., 2014). Overall, they assume the universally positive benefits of green infrastructure that occur across cities.

When broaching the topic of political economy, the scholarship overwhelmingly assumes an entrepreneurial lens toward green infrastructure. Urban entrepreneurialism refers to the practice of inter-urban competition geared toward attraction of private investment (Harvey, 1989). Since the 2000s, city

governments have been incorporating a sustainability lens to this incentivization process, turning trees, parks, and water features into opportunities to draw investors and visitors to their city. Relatively fewer scholars inquire about the political economic drivers of green infrastructure development, but political ecology scholars do investigate the often adverse social effects of green entrepreneurialism. These studies also tend to treat those constraints in plain and fixed terms. Environmental gentrification, for instance, is understood to uniformly operate in a certain way, with predictable outcomes and effects (Dooling, 2009). Likewise, neighborhood income is similarly assumed to influence green infrastructure in a consistent way across cities and landscapes.

Cities are complex and dynamic systems that rise and fall according to boom-and-bust economic cycles. The governing institutions evolve in places to respond to these unstable and variable conditions. In other words, the on-the-ground rules and norms coordinating people's behaviors differ by time and place. However, the literature on both the social dimensions of green infrastructure and political ecology treats human-environment relations in a static and fixed way. As a result, the field lacks a sharp and definitive grasp of the dynamic institutional and political economic drivers and context for urban green infrastructure.

Green entrepreneurialism, as I will argue, is only one approach to green infrastructure designed for wealthy and global cities. It does not apply to numerous poor or shrinking cities, nor does it apply to greening in low-income neighborhoods of wealthy cities. The story of Kensington reveals the embeddedness of green infrastructure in the economic fluctuations of cities. During a period of economic contraction in Philadelphia, green infrastructure in Kensington functioned to protect neighborhood pride and stabilize land values. Economic regeneration and deterioration of cities is a major factor determining the way in which a city government plans, implements, and manages green infrastructure.

This paper examines the fluctuating political economic contexts for green infrastructure implementation by comparing tree planting initiatives in three American cities (Baltimore, Boston, and Philadelphia). Based on an ethnography of the public policy processes surrounding these tree initiatives, I conclude that land markets significantly shape the ways that trees are treated as an object of management. In other words, the meaning attributed to trees in strong land markets is differs in significant ways from the meanings trees acquire in weak land markets. There is a dynamic relationship between a city government's political will for green infrastructure compared with its investment capacity to support it.

BACKGROUND

Urban environmental scholarship carries a heavily normative bias by focusing heavily on the positive dimensions of urban environmental projects. Journals publish seemingly an endless stream of work that frames research questions around the ways that greening is helpful. For decades, the dominant inquiry has examined the dimensions of urban greening within the assumption that greening is fundamentally and intrinsically good: greening alleviates the burden on gray stormwater systems; increases real estate values and reduces crime rates; is good for human health and well-being; improves concentration and reduces stress; creates recreational opportunities; provides habitat for non-human species; the list goes on (for a synthesis of the core literature, refer to Nowak, 2010).

A paper by Wolch et al. (2014) broadened the scope of urban greening conversations to address what it called the "paradoxical effects" of greening in cities. This review paper identified that greening projects often produce the effect of exacerbating already-existing social inequalities in cities. Even projects specifically targeting environmental justice neighborhoods are likely to reconstruct housing opportunities and commercial infrastructure that sideline, marginalize, or displace long-term residents in favor of new wealthier residents. Urban scholars had linked infrastructural improvements to exclusionary social processes for decades (Smith, 1987; Zukin et al., 2009), and a small number had specifically targeted environmental improvements (Dooling, 2009; Checker, 2011). Urban political ecologists had argued that cities' material environments were socially produced, and thus reflected the market driven values and strategies of capitalistic urban development (Swyngedouw and Heynen, 2003; Heynen et al., 2006).

Most specifically, Wolch et al.'s findings dovetailed with a strand of urban political ecology scholarship, which sought to place tree distribution patterns within a political economic analysis of urban dynamics. Perkins et al. (2004) study of Greening Milwaukee, at that time the city's largest not-for-profit planting program, showed that 91% of people requesting trees were homeowners, although the city at the time had a 45% rate of homeownership. Thus, tree distribution stemmed from an unequal housing market. An ensuing article by Heynen et al. (2006) conducted a simple spatial analysis of the urban tree canopy in comparison to the housing stock of Milwaukee, WI, US, and it concluded that uneven urban tree canopies reflected inherited inequalities across the city's neighborhoods.

Despite the older record of urban political ecology scholarship on the topic, Wolch et al.'s paper accelerated a new era of environmental gentrification studies, which argued that urban greening often reduces affordability, fragments social cohesion, and even displaces long-term residents. The nascent literature indicates that environmental gentrification differs from social gentrification in a few ways. Rigolon and Németh (2018) point out that many green infrastructure projects, unlike gray infrastructure, rely on non-profit leadership that often lacks the means to address affordable housing, so anti-gentrification measures should align environmental and housing non-profit organizations. Pearsall and Anguelovski (2016) shed light on the political tactics used to address environmental gentrification compared with social gentrification. While they identify significant overlap in strategies, using community organizing and direct action to pursue their goals, they also offer a few novel strategies, including a collaborative approach with multiple partners and the pursuit of complementary policies.

While green infrastructure drives exclusionary effects, it nevertheless contributes environmental, social, and economic value when implemented. However, its spatial distribution remains very highly uneven. In 2015, a slew of prominent urban ecology scholars conducted a high resolution spatial analysis of Baltimore, Los Angeles, New York City, Philadelphia, Raleigh, Sacramento, and Washington, DC in order to assess the relationship between urban tree canopy and median household income (Schwarz et al., 2015). The team found a "strong positive correlation" between the two variables (echoed by Gerrish and Watkins, 2018). Perhaps ironically, this 2015 study largely echoed Heynen, Perkins, and Roy's findings in their 2006 article.

Since that time, green infrastructure scholarship has provided nuance to this increasing attunement to issues of spatial equity. In 2019 Nesbitt et al. published a study, which provided empirical detail about the nature of the inequity. While the study also concluded the prevalence of a "strong positive correlation" between urban vegetation and higher education and income, it also identified negative correlations between racialized minority status and urban vegetation (although they were tempered by other variables, such as education, income, and population density). Parks were spatially distributed in more equitable manner than mixed vegetation and woody vegetation, indicating that low income and racialized minority neighborhoods are especially lacking in woody vegetation (Nesbitt et al., 2019).

These two currents of socio-environmental inquiry—examining exclusionary effects and spatial equity—emphasize a fixed relationship between wealth, as measured by housing stock or household income, and tree distribution. The environmental gentrification and urban political ecology literatures continue to focus narrowly on greening as a causal agent, within a larger frame of capitalistic development. The institutional and governing context for green infrastructure is assumed to reflect capitalistic values. As a result, scholars turn to investigate apparent thresholds for greenness (see Wolch et al., 2014), beyond which neighborhoods invariably marginalize and displace their residents. In so doing, they assume the backdrop for urban greening efforts to be passive and static, while they imbue greening interventions with a magical quality to regenerate their localities and cities.

There is a critical need to examine not only the political effects of green infrastructure, but the political drivers that regulate these effects. Scholars and practitioners need to grasp the political alliances, mechanisms, and terms that are determining the volume and distribution of green infrastructure installations and honestly evaluate their effect. This absence is both a theoretical and a methodological opportunity. Theoretically, there is an opportunity to probe the relationship between capitalism and green infrastructure by examining institutional arrangements

around green infrastructure in different economic settings. Studies of green infrastructure on vacant land give a preliminary sense of the institutions supporting green infrastructure outside of high market conditions. Foo et al. (2014a,b) conducted a series of focus groups with neighborhood organizations to assess attitudes and capacities shaping environmental governance in core Boston neighborhoods. While the study affirmed the therapeutic benefits of green infrastructure, it also concluded that adverse social conditions may temper or reverse these therapeutic effects. The presence of public-civic partnerships and civic organizations improve vacant land stewardship. Land ownership and vacant land access is a critical factor shaping green infrastructure perceptions (see also Gobster et al., 2020).

To study this requires special methods. Green infrastructure studies have often run into a methodological problem in which "scientists merely [deploy] objective technology and methods to produce replicable, abstract results" (Evans, 2011, p. 226). As Evans argues, the NSF Long-Term Ecological Research (LTER) sites in Baltimore and Phoenix fall into this trap: "Rather than shuttling between the ethnographic specificity and scientific generality as the Chicago School did, the Baltimore and Phoenix teams use a comparative method to put localism to the service of abstraction" (2011: 229). Whereas the 19th sanitarians developed place-based knowledge in order to influence the administration of the city, 21st century green infrastructure experiments—as defined by the LTER sites—turn the city into a type of lab, characterized by a set of feedback loops. They incorporate crucial decisions of urban governance into understanding of ecological behaviors themselves, which eliminates any investigation into the choices made by institutions and individuals, which reflect social values and ethics.

An ongoing shift toward regenerative development and design prompts a shift toward more systematic and nuanced studies of environmental and human health in places, which integrate specific behaviors into cultural, historical, and geographic systems. The purpose of regenerative development is "not only to reverse the degeneration of the earth's natural systems, but also to design human systems that can co-evolve with natural systems— evolve in a way that generates mutual benefits and greater overall expression of life and resilience" (Mang and Reed, 2020). Rather than isolate specific instances of harm reduction, regenerative development investigates the net impact of human actions on environmental and ecosystem health. Regenerative cities provide an integrative framework for considering the technology of green infrastructure within the living, breathing, and agitating spaces of cities.

The wider lens of regenerative development holds a big tent and evaluates the cultural and social values espoused by groups of people in undertaking social and environmental projects. Thus it may better support nuanced studies that deal with "intimate knowledge of place and interpretive skill" (Evans, 2011, p. 226). Ethnographies of green infrastructure projects may provide insight into the ways that they take root in places, owing to layered and complex causes, and then in turn affect those and other places. Institutional ethnographies enable the study of cities as not only laboratories for environmental intervention, but as the important contexts that both drive and are affected by those interventions. Ethnographies in multiples places may likewise provide a glimmer of insight into the net impact of sustainability or climate adaptation strategies on cities and how they function.

METHODS

I employ an institutional ethnography of the public policy processes around urban greening and vacant land in Boston, Philadelphia, and Baltimore. Developed by sociologist Dorothy Smith, Institutional Ethnography attempts "to uncover the macro foundations of a microsociology" (Smith, 2005, p. 32). Often through a combination of participant-observation and interviews, it illuminates the ways that individuals are "connected into the extended social relations of ruling and economy and their intersections" (Smith, 2005, p. 29). It approximates anthropologist George Marcus' ethnography in/of the world system, which sought to ask "macrosocial questions about the causes of events or the constitution of major systems and processes" (Marcus, 1995, p. 168).

For the purposes of the study, vacant land is used to indicate land market strength. I examined tree planting initiatives and vacant land management in three historical cities in the forested northeastern United States: Baltimore, MD; Boston, MA; and Philadelphia, PA. These cities are relatively densely populated, segregated, and racially and ethnically diverse. They also feature several active community organizations. The prevalence of vacancy varies widely. Baltimore (92 mi^2) and Boston (90 mi^2) possess similar land areas, but Boston has ∼7,000 vacant parcels, whereas Baltimore has 30,000 vacant properties. While Philadelphia (141.6 mi^2) has 150% of the land area of the other cities, it has about 40,000 vacant parcels.

These methods aimed to characterize the strategies used by environmental policy networks to plant trees and increase land values in changing market conditions. To this end, I conducted 3 months of participant-observation per city and 94 interviews in a research design approved by an IRB. I selected sites of participant observation for analytical and logistical reasons: how important was an organization to the governing coalition? What position did it hold in relation to other organizations? What opportunities of access were available? From the perspective of the comparative study, I also considered overall exposure to different partners so that I could learn about the workflow from multiple cross-sector perspectives.

Participant-observation sites included the Baltimore Recreation and Parks department, the Boston Mayor's Office, and the USDA Forest Service Philadelphia Field Station. The Baltimore Recreation and Parks department was the central authority for that city's tree planting initiative, and it also gave insight into the inner workings of a municipal parks department. The Mayor's Office in Boston permitted the best access to institutional partners, and access was given through a Radcliffe/Rappaport Public Policy Fellowship. The Philadelphia Field Station provided access to a federal agency that has driven urban forest scholarship and governance. Participant-observation spanned diverse activities, which included tree care trainings, community- based trainings, publicity events,

neighborhood-based tree plantings, city-wide community meetings, and neighborhood-based community meetings.

The content of the semi-structured interviews varied by interviewee, and specific questions depended on the position, experience, and expertise of the interviewees. Interviews were conducted with a range of cross-sector policy stakeholders across the public, civic, and academic sectors, with public sector interviews spanning municipal, state, and federal agencies. The number of interviews per person also depended on his or her knowledge and experience, and they averaged one to two interviews per interviewee. In total, I carried out ninety-four (94) interviews, of which eleven (11) were second interviews. Interview topics spanned: (1) administrative practices (for each initiative, related to other governmental programs, and through cross sector partnerships); (2) the roles of different parties enacting these practices; (3) the rules and norms associated with these practices; (4) the amount of agreement about these rules and norms; (5) the direction(s) of influence among the entities.

Green Infrastructure on Vacant Land: A Brief History

Like most older cities in the United States, all three cities lost significant chunks of their population after the 1950 census due to a familiar host of reasons: economic deindustrialization, massive federal investments in the suburbs and divestments from cities, sanctioned and informal discriminatory lending and home purchasing practices. The 1960–1980s were dark periods for all three cities. At the height of urban crises, extensive swaths of the urban landscape had become abandoned, with prevalent dumping on vacant land and indicators of widespread arson. Boston began to turn around in the 1990s, Philadelphia in the 2000s, and Baltimore has just recently stabilized.

Each city's pivot from despair to hope began with green infrastructure. Residents gathered neighbors together and organized cleanup campaigns, removing trash from sidewalks, mowing vacant lots, and working to hold companies accountable for illegal large-scale dumping on vacant land. These cleanup campaigns marked crucial steps that turned the tide of deterioration toward renewal. In other words, green infrastructure on vacant land marked a turning point across the three cities (Medoff and Sklar, 1994; Walczak, 2002; Interview 38; Interview 75).

Boston: Vacant Land Greening in a Strong Land Market

The number of vacant parcels in Boston neighborhoods increased as the population contracted between the 1950–1980s. They were spatially concentrated in red-lined neighborhoods, which had experienced discriminatory lending practices and severe economic divestment. Greening in the neighborhoods began as grassroots efforts by neighbors, who were fed up with the rampant illegal dumping in their neighborhoods and determined to turn the neighborhood around. In the 1980-1990s, clean-up campaigns spurred the development of community development corporations and other community institutions in two neighborhoods in Roxbury and Dorchester.

Nubian Square (formerly Dudley Square) in Roxbury was the earliest and strongest of the neighbor-led clean-up campaigns. In 1984, its organizers created the Dudley Street Neighborhood Initiative (DSNI), which would buy vacant land and construct affordable housing, parks, playgrounds, and gardens for people in the neighborhood. DSNI holds eminent domain authority within its territory of the Dudley Triangle, so it reviews the Boston Redevelopment Authority's proposals are reviewed by DSNI before they are approved by the city. DSNI grew into Dudley Neighborhood, Inc., which it evolved as a land trust to further guide land development in the neighborhood area.

Nubian Square's history has been documented in the book and documentary of the same name, "Holding Ground," and DSNI regularly hosts tours by school and other groups from around the country, but its influence in the city of Boston has been limited. Culturally, Boston considers itself an Irish and Italian city, although it is home to a significant number of non-white ethnicities. Historically it has not regarded the predominantly Black planning districts with a comparable esteem as the downtown districts. In the early days, neighborhood organizers had a very difficult time gaining the attention of politicians in City Hall. They petitioned their representatives to hold companies accountable for extensive dumping that was leaving piles of large electronic and industrial items in their neighborhood. But they simply could not get their attention. One organizer threatened to bag up some trash and leave it on the steps of City Hall for the issue to gain visibility. This idea, while simply a gesture, is very telling about the social relationships in the city. City Hall was a mere 3 miles from Nubian Square, but organizers could not get a hold of their representatives (Medoff and Sklar, 1999).

The 2000s witnessed a lot of development on Boston's vacant lots, leaving mostly small and oddly shaped parcels. These parcels have remained concentrated in Roxbury, Dorchester, and Mattapan, which bore the brunt of discriminatory lending practices. The appearance and care of this land has been consistently important to people living and working in the neighborhoods, but for a long time they had to go through big ordeals in order to gain access to the land. The Department of Neighborhood Development (DND) manages all city- and state-owned land parcels, and it is widely understood to be understaffed in doing so (Interview 88). While it has changed in recent years, DND has historically tended to restrict access by the public to its properties because its final goal is to offload the properties and minimize its liabilities. It has mainly used economic criteria to parcel out vacant land for open space development, and the entities who have created open space have tended to be professionalized non-profit organizations.

For the most part, however, City Hall has pursued land development through its vacant land parcels. One policy stakeholder noted, "I wouldn't say the City of Boston has any really coherent and particularly sophisticated way of thinking about how to dispose of public land, except when it's in the service of a bigger redevelopment effort… [By controlling strategic parcels] it could tell developers, "if you want to develop that block, you have to buy our piece of land, and you have to do x, y, or z in order to buy it" (Interview 92). This stakeholder's

critique was that the city opened to use real estate to guide large development efforts, rather than zoning or comprehensive planning. From the perspective of downtown Boston, and Boston City Hall, vacant parcels are largely instruments to be manipulated to influence economic development processes.

Philadelphia: Greening in a Changing Land Market

In Philadelphia, the New Kensington neighborhood drove transformative clean-up campaigns in northeastern Philadelphia. Vacant lot clean-up efforts in that neighborhood spurred the establishment of the New Kensington Community Development Corporation (NKCDC). The NKCDC conducted a survey in the late 1990s that identified vacant land as a major concern for residents in the neighborhood (Interview 38), and it sought—and won—eminent domain control over land in the neighborhood (Interview 45). The NKCDC developed a novel landscape approach to neighborhood stabilization via a network connecting it to the Pennsylvania Horticultural Society (PHS), Department of Housing and Urban Development (HUD), and multiple city agencies. Through the efforts of this coalition, New Kensington served as a pilot site for a HUD Empowerment Zone award and then a municipal Neighborhood Transformation Initiative, which experimented with temporary greening strategies on vacant land (Interview 45).

Using this "clean and green" model, PHS exported it to other neighborhoods across the city through extensive partnerships with community development corporations across the city. This program identifies land parcels next to target development sites; it installs perimeter tree plantings, mown grass, and post-and-rail fences; and hires residents in the neighborhood to maintain the properties over time. The "clean and green" program based on interim landscape approaches to holistically direct neighborhood change. This land-based approach to neighborhood stabilization and revitalization has become a prominent model (i.e., see Schilling and Logan, 2008).

Since 2003, Philadelphia city government incorporated this program into its general operating funds, and HUD has contributed up to 15% of its costs (Interview 38). Over the same time period, PHS developed a tree tenders program, which works with volunteer-based community groups to plant trees, and this program developed into a national model for community-based urban tree care. Although historically it had become known as a well-established gardening association, PHS thus acquired expertise and authority in the realm of tree plantings, which it extended to the management of urban vacant land.

In 2014, the City of Philadelphia authorized creation of the Land Bank and hired Interface Studio to construct its strategic plan. Although the strategic plan recognizes open space as a type of "productive use," it concentrates attention on land purchases for economic development (Philadelphia Land Bank, 2014). Community organizations that had provided feedback for the strategic plan were concerned that the city would not honor civic interests and would overly prioritize profit generation by external investors in its management of vacant land. In 2017, Angel Rodriguez was hired as the first Executive Director to run the agency. The agency was understaffed when he came on board in 2017, and Rodriguez claims that it remains understaffed, although he is proud of what it has accomplished. However, in 2021, the Philadelphia Coalition for Affordable Communities produced a report, which criticized the Land Bank "for both the slow pace of sales and not directing more vacant land toward land trusts, community gardening groups, or other public goods" (Briggs, 2021). The report concluded that only one out of three publicly-owned vacant lots disposed of by the City went to affordable housing, while one in 10 went to a community garden or public open space (Philadelphia Coalition for Affordable Communities, 2021). While Philadelphia had previously formulated a non-market approach oriented toward neighborhood well-being and stabilization, the rebounding land market has placed ongoing pressure on its vacant land development.

Baltimore: Greening in Weak Land Market

For Baltimore, it was a neighborhood in West Baltimore whose cleanup drove new greening methods for the city. In the late-1980s, the creatives and self-employed residents of West Baltimore decided to tackle the widespread debris and unkempt appearance of the neighborhood's vacant land. One by one, they began to pick up trash, mow weeds, and plant trees around the neighborhood. Through these clean-up efforts, residents connected with the University of Baltimore Extension, which provided compost for nascent gardens. Through this connection, the Yale School of Forestry & Environmental Studies (F&ES) became interested in the neighborhood's efforts as an example of neighborhood forestry, which a faculty member research had studied extensively in Southeast Asia. Yale students subsequently developed outreach materials supporting these grassroots forestry efforts, and the Citizens Planning and Housing Association and Neighborhood Design Center disseminated these materials widely across the city.

The enduring community forestry support provided by Yale F&ES developed into the Urban Resources Initiative (URI), which was created through cooperation with the Baltimore Recreation & Parks Department, the Parks & People Foundation, and even the city's mayor's office. The URI's first intern, Morgan Grove, situated his career with the USDA Forest Service in Baltimore after his graduation from Yale. He aggressively pursued funding from a wide range of sources to establish the Baltimore Ecosystem Study (BES), which would grow into a foundational model for urban ecology scholarship over the coming decades (Interview 73). BES has provided longitudinal support to the planning, implementation, and maintenance of green infrastructure in Baltimore City in several capacities. Notably, it provided funds to staff a full-time position within the Baltimore Office of Sustainability dedicated to vacant lands (Interview 83), and this work produced the "City of Baltimore Green Pattern Book: using vacant land to create greener neighborhoods" (Interview 67).

Baltimore City has prioritized vacant land at the mayoral level through multiple initiatives. Mayoral efforts include the 2011 Vacants-to-Value campaign and 2014 Growing Green Initiative of the Stephanie Rawlings-Blake administration. But effective management of vacant land, including greening efforts, remains crippled by the extremely fragmented ownership of public-owned

properties. One staff person in a relevant city office informed me: "There may be a list [of all of the properties], but I wouldn't even know where to look for one" (Interview 94).

Parks and People Foundation (PPF), a non-profit organization focused on building green infrastructure for residents in Baltimore City, stands out as a primary driver of open space on vacant land. Similar to the Boston Natural Areas Network in Boston and the PHS in Philadelphia, the Parks and People Foundation stepped in to help manage vacant land when Baltimore City was rapidly accumulating abandoned properties and overwhelmed with the prospect of managing them all. PHS and PPF continue to play major roles in maintaining green infrastructure through the oversight of basic landscape strategies to keep neighborhoods clean, green, and stable. But Philadelphia's growing economy has shifted the management of its public properties to the Land Bank, whereas Baltimore still strains to provide essential services. In this context, the PPF is funding and driving long-term visioning process for the city and region's green infrastructure. It has developed a vision for enveloping Baltimore City itself into One Park, in order to improve public and environmental health, unify communities, boosting landscape aesthetics, leveraging natural assets, and expand programming (Parks People Foundation, 2020). In spring 2021, PPF announced the grand opening of three parks, which contribute to the 27 acres of park space created by the non-profit organization.

For its part, the Recreation and Parks Department has also maintained active and innovative programming, including the opening of a forest school in Leakin Park in Fall 2021. In Spring 2021, the National Park Service announced that it considering a possible project on a large vacant lot in West Baltimore that includes former Supreme Court Justice Thurgood Marshall's elementary school. Thus the continuing prevalence of vacant land has contributed to creative efforts by public interest institutions to support the health and well-being of Baltimore residents.

Protecting and Growing Green Infrastructure Through Fluctuating Land Markets

These cases show that green infrastructure intersects with urban regeneration in several different ways. First, city greening programs can build environmental equity into their design. Philadelphia P&R measures tree canopy progress by neighborhood. Vacant land policies also affect greening access. A city's vacant land policies heavily regulate people's access. Restrictions on vacant land access eased in all three cities, although significant barriers still existed in Boston, Philadelphia's Land Bank has been heavily contested, and Baltimore has streamlined and facilitated access. While some may want to build on vacant land, many times neighbors and community organizations prefer to expand green infrastructure to enhance and beautify their neighborhood. Allowing access to vacant land creates opportunities to build green infrastructure, while building neighborhood pride and rebuilding trust in the government.

Second, the presence of state and federal agencies in a city may affect green infrastructure in a city. State laws can also heavily

influence green infrastructure. Maryland has among strictest conservation laws in the country, whereas the Pennsylvania and Massachusetts have much more lax laws regarding tree conservation. Also, federal agencies, when located in an urban center, may play a role in advancing green infrastructure there. The presence of a USDA FS urban field station also supports local tree planting as well: the Philadelphia Field Station and Baltimore Field Station have supported strong tree planting programs in those cities, compared to the absence of a presence in Boston and weaker tree planting initiative in that city. On the other hand, sustainability offices are relatively disconnected from green infrastructure programming, apart from assistance with marketing and gathering data for sustainability metrics. They tend to be brand new offices without long-standing ties within and across city departments, so their influence on green infrastructure tends to be limited.

Third, within and across cities, partnerships with NGOs and academic institutions can supplement government support during times of a weak market. In Philadelphia, the Pennsylvania Horticultural Society played an instrumental role in helping to stabilize neighborhoods in the 1990s, and it continues to occupy a prominent space in coordinating programming with the Philadelphia Parks & Recreation Department. In Baltimore, the Parks and People Foundation has similarly played a critical role in innovating and delivering programs, which are occasionally adopted by the City. Also, academic partnerships were crucial to Baltimore's tree planting initiative in a period of financial austerity, and partnerships with Yale and NSF/USDA Forest Service brought important funds to the city supporting green infrastructure.

Fourth, a city's gentrification policies shape the way that green infrastructure will marginalize or possibly displace residents. Philadelphia, for example, implemented a cap on property tax for long-term residents in 2013, whereas Boston has enacted no significant anti-gentrification laws, and Baltimore's land market has not yet grown strong enough to become exclusionary.

Counter-Cyclical Relationship

These cases point to the possibility of a counter-cyclical relationship between the political will and economic capacity to carry out green infrastructure projects (Foo, 2017). This may be related to the opportunity of civic environmental coalitions to grow during weak land markets. Both PHS in Philadelphia and PPF in Baltimore acquired their properties during periods of economic contraction, and they turned these lands into environmental resources for urban residents. While the cities were shrinking, each of the city governments relied heavily on environmental organizations, academic institutions, federal agencies, and state agencies in order to turn unwanted land into environmental amenities and green infrastructure for urban residents. These coalitions carry a legacy over time, and the strong civic partners in Philadelphia and Baltimore keep city agencies on their toes, competing with the city to provide services, and piloting ideas for new public programs.

The Boston Natural Areas Network likewise became powerful through accrual of vacant land, but it limited its partnerships with the City of Boston and instead allied with the Trustees of

Reservations, which is a wealthy land preservation organization with properties across the Commonwealth of Massachusetts. In Boston, environmental priorities have been eclipsed by an entrepreneurial mindset focused on economic growth. Green infrastructure, to the extent that it has been a priority, has mainly succeeded as a component of large development projects.

Weak land markets seem to create the possibility for increased political participation of environmental actors and for the installation of green infrastructure for the primary purpose of community health and well-being. However, the increased strength of environmental civic coalitions appears negatively correlated with the city's economic capacity to fund greening projects without support from the business community. These dynamics suggest a counter-cyclical relationship between the political will for urban greening and the investment capacity to pay for it.

Regenerative Green Infrastructure

These diverse conditions suggest that green entrepreneurialism fails to describe the dynamics and impact of urban green infrastructure. Instead, green infrastructure strategies differ by land market. While strong land markets possess the financial capacity for greening, the tendency is to internalize greening into development projects, which sidelines low market neighborhoods. Weak land markets are characterized by a strong political will for equitable green infrastructure, but they lack the financial capacity to carry them out. Thus, different logics mediate the meaning and impact of green infrastructure projects in cities and localities. This variability carries implications for understanding the role of green infrastructure in regenerative cities.

Greening strategies, especially those that are volunteer driven, represent low-cost strategies to stabilize and enhance land values. The physical beautification of vacant land has not only an instrumental value of tidying urban landscapes, but it also reveals a re-territorialization of neighborhoods after decades of abandonment and neglect. The way that green infrastructure becomes articulated in the urban landscape determines which actors, visions, and strategies become amplified and which are

made invisible. The case of the Philadelphia Land Bank expresses multiplicity of expressions that green infrastructure may take. Depending on which actors take precedence and gain control over the network of vacant land, green infrastructure may become absorbed into development projects, benefitting the real estate market in strategic parts of the city; it may be set aside for preservation; or it may be turned into diverse values for community health and well-being.

The analysis of green infrastructure in different land markets demonstrates that green infrastructure is deeply embedded in the particular historical and geographical legacies of cities. Further study into the politics of green infrastructure will yield insight into the distinct cultures of green infrastructure development, and the ways that different cultures contribute to degenerative or regenerative urban change.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/supplementary materials, further inquiries can be directed to the corresponding author/s.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by IRB at Clark University. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

The author confirms being the sole contributor of this work and has approved it for publication.

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