VOLUME 10 ISSUE 4

The International Journal of the

Constructed Environment

The Paradox of Urban Greening

Does it Harm the Very People Who Need it the Most?

JULIANA MAANTAY, ANDREW MAROKO, ISABELLE ANGUELOVSKI, AND JAMES CONNOLLY

COMMON GROUND

CONSTRUCTEDENVIRONMENT.COM

THE INTERNATIONAL JOURNAL OF THE CONSTRUCTED ENVIRONMENT
https://constructedenvironment.com
ISSN: 2154-8587 (Print)
ISSN: 2154-8595 (Online)
https://doi.org/10.18848/2154-8587/CGP (Journal)

First published by Common Ground Research Networks in 2020
University of Illinois Research Park
2001 South First Street, Suite 202
Champaign, IL 61820 USA
Ph: +1-217-328-0405
https://cgnetworks.org

The International Journal of the Constructed Environment
is a peer-reviewed, scholarly journal.

Common Ground Research Networks, a member of Crossref

The Paradox of Urban Greening: Does it Harm the Very People Who Need it the Most?

Juliana Maantay,[1] City University of New York, Lehman College, USA
Andrew Maroko, City University of New York, USA
Isabelle Anguelovski, Universitat Autònoma de Barcelona, Spain
James Connolly, Universitat Autònoma de Barcelona, Spain

Abstract: Urban greening and sustainability have become well-established goals for improving the urban environment and combating the climate crisis. The greening of cities (e.g., creating new parks, converting obsolete or unused infrastructure to green spaces or productive environmental uses, transforming vacant and derelict land to community gardens, open space, etc.) is seen as an environmental benefit by cleaning up potentially contaminated lands and bringing them back into public use or for the overall public good. However, evidence from recent studies has shown that greening efforts may have unintended consequences resulting in the surrounding communities being actively harmed by or at least not benefiting from these initiatives. Using a framework of Geographic Information Science and spatial analysis, three case study examples are examined here—the social and economic impact of community gardens in Brooklyn; the creation of new city parks in Barcelona; and the repurposing of a disused rail line in New York City into an elevated park corridor. The analyses show that all three examples exhibit, to varying degrees, a propensity for spurring "green gentrification." Green gentrification refers to the process whereby existing residents of newly greened areas frequently suffer from displacement or exclusion from their communities, as well as adverse financial and cultural impacts, in favor of attracting wealthier residents to the newly greened areas. In this way, greening can disproportionately impact the most vulnerable urban communities, usually the least affluent and those with the highest proportion of ethnic or racial minority or immigrant populations. Measures can be taken by cities that may prevent or at least slow the green gentrification process, in order to mitigate its deleterious impacts on existing residents and improve equitable distribution of environmental benefits. Greening efforts and urban sustainability initiatives need to incorporate social equity goals as a major component of any project, using incentives, regulations, and policies crafted towards those ends, and "nature" must be integrated more seriously and thoroughly into all urban planning throughout the city.

Keywords: Green Gentrification, Gentrification, Urban Greening, Community Gardens, Parks, GIS, Barcelona, New York City

Sustainable and Beautiful Green Cities: Who Benefits?

In recent years, architects, urban planners, landscape designers, and sustainability scientists have promoted the goal of making cities greener and more sustainable. Municipal governments, the real estate industry, and much of the general public have applauded this strategy. The greening of cities has been seen as a win-win for everyone involved; conventional wisdom claims that it makes a city more attractive, enhances quality-of-life of its residents, improves physical and mental health, allows a densely-settled urban area to become more ecologically-friendly, may reduce burdens of air pollution and urban heat island impacts, increases tourism and investment, and helps spur the economy. So what could be wrong with it?

New greening initiatives, such as Manhattan's High Line Park, have been touted as miracles of urban design, providing enormous returns for the investments made (David and Hammond 2011; Filler 2009; Goldberger 2014; Immergluck and Balan 2018; Ouroussoff 2009), and providing green space in a part of the city that has long been deficient in parks and open space. Yet it has not gone unnoticed that areas surrounding such greening efforts have had their characters altered, and not necessarily to everyone's benefit. In the upheaval or even relatively minor changes that may accompany such greening efforts, there are unfortunately winners and losers.

[1] Corresponding Author: Juliana Maantay, 250 Bedford Park Blvd West, Earth, Environmental, and Geospatial Sciences, City University of New York, New York, NY, 10468, USA. email: juliana.maantay@lehman.cuny.edu

The International Journal of the Constructed Environment
Volume 10, Issue 4, 2020, https://constructedenvironment.com

ISSN: 2154-8587 (Print), ISSN: 2154-8595 (Online)
https://doi.org/10.18848/2154-8587/CGP/v10i04/13-37 (Article)

One might argue that this is nothing new: after all, in the mid-nineteenth century, Central Park in New York City was created in part to bring relief to the masses by creating an idyllic recreational and meditative "natural" environment in the middle of one of the busiest and most unrelenting cities on earth, but in order to effectuate the scheme, close to 2,000 poor and marginalized people in a number of established free black and Irish immigrant communities had to be uprooted and cast out in order to have a blank slate upon which to create the park. It is estimated that about 20 percent of New York's property-owning black residents were displaced by Central Park's construction (Blakinger 2016; Rosenzweig and Blackmar 1992; Williams 2018). The areas surrounding the new park quickly became and continue to be some of the most sought-after and expensive real estate in the city. Are we now in the midst of a similar conflict between the needs of the poor and the desire to beautify and enhance the quality of life in our cities? Whose city is it, and who benefits from these greening efforts the most? And are we privileging the commodification of the environment over the very lives of the people who ostensibly would stand to benefit the most from such efforts, but are typically the first casualties? Is there any way to avoid this unfair exchange?

For quite a while, turning brownfields into greenfields, or at least cleaning up the contaminated land and reusing it for a constructive purpose, was seen as a positive step in urbanism and government circles. This process took often abandoned and hazardous properties and converted them to tax-paying entities. Along with the greening and sustainability terms, we often hear words like regeneration, revitalization, reuse, and redevelopment. What is the subtext to these terms, and what are the implications and risks for city residents, especially the less affluent? Does greening of less affluent neighborhoods instigate the gentrification process? How do we even measure the gentrification phenomenon to know whether or not it is occurring?

Gentrification

Gentrification is generally defined as the process pertaining to a significant alteration of a neighborhood's built environment, as well as the cultural, sociodemographic, and economic shifts which accompany upgrades in housing, services, and physical amenities. These changes tend to result in displacement of the existing inhabitants of the community, and their replacement by more affluent residents and "upscale" businesses. The residents and businesses that are displaced are likely to consist of the less affluent, ethnic or racial minorities, immigrants, and other vulnerable populations (Galster and Peacock 1986; Bostic and Martin 2003; Barton 2014; Atkinson 2000; Clark 2010; Hwang 2016).

Overall, measuring gentrification remains a challenge, and there is no consensus or consistency on method, although many researchers use, either as individual variables or in various combinations, the metrics of longitudinal changes in income, housing values, educational levels, unemployment rates, percentages of non-minority populations, or proportion of residents engaged in professional jobs. Neighborhoods that have remained stable and above certain thresholds with respect to these variables are usually not thought of as having been gentrified in the timeframe under discussion. If neighborhoods are already, for instance, averaging a middle-class or higher income level, these areas are considered not "eligible" for future gentrification or have already been gentrified, as opposed to those areas at higher risk for gentrification (Hammel and Wyly 1996; Heidkamp and Lucas 2006; Hwang 2016). In this study we will be mainly looking at those areas "at risk" for gentrification. To unfurl the complicated role of greening in cities, we can start by examining the findings of some of the previous research on the benefits of green spaces, the uneven access to green space in cities, inequities in the quality of green spaces, the disparate prevalence of vacant and derelict land (VDL) and its adverse impacts on proximal residents, the constructive reuse of VDL, and community-led initiatives to reuse VDL and other neighborhood beautification efforts. Previous research has led to some overarching core research findings that are not usually in dispute, even though there are differences of opinion about how to interpret some of the findings. Certainly cities behave differently from one another, depending

upon size, spatial patterns, demography, economic structure, and other factors, but some findings have now been broadly accepted.

Benefits of Green Space

Tangible and even just visual access to green space is beneficial to the physical and mental health of nearby populations. Numerous studies have discussed the positive impacts of open space, including increased activity levels, leading to the potential for reducing chronic health outcomes like diabetes, obesity, and cardiovascular disease. Additionally, merely being able to view and contemplate green space can be mentally and emotionally therapeutic (Jennings, Larson, and Yun 2016; Lee and Maheswaran 2010; Triguero-Mas et al. 2017; Tsai et al. 2018). A recent study even suggests that visual access to green helps minimize cravings in intensity and frequency, thus potentially aiding in addiction recovery (Martin et al. 2019).

Another generally agreed upon concept is that access to urban green space is not equally distributed amongst all sub-populations, and this spatial inequity adversely impacts minority, immigrant, the less affluent, and other vulnerable populations that live in areas lacking sufficient green spaces (Burt et al. 2014; Estabrooks, Lee, and Gyurcsik 2003; Ferguson et al. 2018; Miyake et al. 2010; Wolch, Wilson, and Fehrenbach 2005). Even in cases where physical access to green space is available to these groups, the quality of the green space is often inferior to that available in other areas, lacking in amenities and regular maintenance (Boone et al. 2009; Hoffimann, Barros, and Ribeiro 2017; Maroko et al. 2009), and the health benefits that often accrue to populations near green spaces do not equally benefit minorities and the less affluent, even if they are near green spaces (Cole et al. 2019). Additionally, whatever green spaces are available to the populations in less affluent neighborhoods, they are usually deficient when viewed in terms of green space acreage per capita, due to generally higher population densities in these less affluent areas and typically smaller green spaces. People in more affluent neighborhoods also are more likely to have private back yards, access to private vehicles allowing out-of-town getaways to countrified areas, and even access to second homes in more bucolic surroundings, all things typically beyond the limits of less affluent and minority populations (Park and Pellow 2011).

Vacant and Derelict Land

In many less affluent and minority neighborhoods there is a disproportionate amount of vacant and derelict land, as a result of deindustrialization, landlord abandonment, and general governmental and private disinvestment in these areas (Maantay 2013). For instance, in Glasgow, Scotland, nearly 4 percent of the land is vacant or derelict, and most of this is concentrated in less affluent communities (Maantay and Maroko 2015; Scottish Government 2012) (Figure 1). Similarly, in New York City, 5 percent of the land is VDL, and again, this is located mainly in less affluent and minority neighborhoods (Maantay 2013). This VDL is often contaminated land or otherwise hazardous to health and quality of life. VDL often acts as an environmental stressor, affecting health. In addition to directly affecting health outcomes, the prevalence of VDL in any given community contributes to visual and physical blight, and thus detrimental to the residents' feeling of self-worth. Everyday exposure to blight, seen as a sign of neighborhood disorder, and the stigma attached to living in such a place, is inherently discouraging and stressful, potentially leading to serious psychological harm and poor mental health outcomes (Maantay and Maroko 2015; Bambra et al. 2014; Downey and Van Willigan 2005; Garvin et al. 2012; Litt and Burke 2002; Litt, Tran, and Burke 2002).

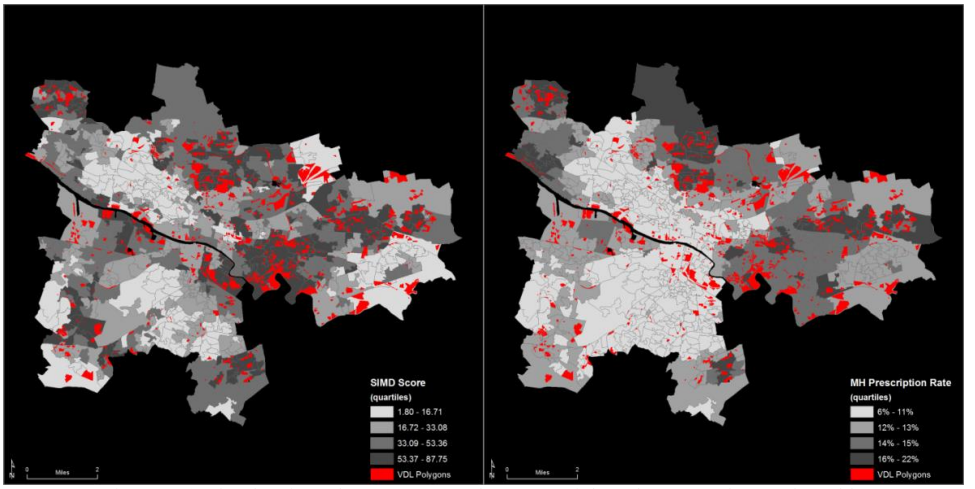

Figure 1: (Left) Showing Glasgow VDL and SIMD; (Right) Glasgow and Mental Health.
In Glasgow, Scotland, the presence of VDL closely corresponds to neighborhoods that are more deprived, as measured by the Scottish Index of Multiple Deprivation (SIMD). Additionally, these areas have a high spatial correspondence with high rates of mental health drug prescribing
Source: Maantay and Maroko 2015

Brownfields to Greenfields

Many communities have transformed some of this VDL into environmentally and socially beneficial green space. Researchers over the past two decades have discussed the benefits of community gardens (Anguelovski 2014; Camps-Calvet et al. 2016; Cumbers et al. 2017; Irvine, Johnson, and Peters 1999; Maantay and Maroko 2018; Ottmann et al. 2012; Shinew, Glover, and Parry 2004; Tanaka and Krasny 2004; Von Hassell 2002). Community gardens and other green uses converted from VDL can serve "as a locus for youth and environmental programs, cultural events, space for the performing arts, healthy food production, inter-generational activities, inter-racial cooperation, knowledge transfer, and a means of political and social empowerment and engagement for the community" (Maantay and Maroko 2018, 3). Although many community gardens are primarily used for urban agriculture, their function goes beyond food production itself—the gardens have an interdisciplinary role in promoting a sense of place or focus for communities that often have little access to safe parks or recreational space within their neighborhoods. Further, they create a center for cultural and educational activities (Maantay, Ottmann, and Grady 2010; Ottmann et al. 2012).

While transforming VDL into community gardens is obviously a positive development, it can also have devastating impacts on the very people who have tried to improve their neighborhoods by the unintended consequences of increasing private development interest and ultimately resulting in the potential for displacing those very residents who worked hard to improve their neighborhoods. In addition to formerly privately-owned vacant and derelict land, other areas are also ripe for greening projects, such as underutilized lands (e.g., old rail lines and disused utility rights-of-way, waterfront areas no longer used for shipping or other water-related activities, and government lands that have been decommissioned from original purposes). These larger initiatives are usually undertaken by governmental and private developer partnerships, and can instigate gentrification of surrounding areas even before they are finished. Even when no one is currently living in these areas earmarked for large-scope greening projects, and there is no danger of direct displacement from the development property, gentrification and displacement can still take place in the adjacent neighborhoods and adversely affect nearby populations.

Selection of Case Study Areas

In order to bring together these diverse strands of thinking, this article will discuss three examples of different types of neighborhood greening projects and analyze the extent to which the efforts have led to gentrification. The first case study focuses on community gardens in Brooklyn, New York, an example of community-led greening. The second pertains to the creation of municipal neighborhood parks in Barcelona, Spain, as an example of government-led greening. The third describes the High Line Park in Manhattan, New York, as a hybrid example of non-profit organization, private funding, and governmental collaboration.

The study areas were selected to represent the different types of "greenification" in terms of the institutional initiator of the projects, and pertaining to various physical settings, to give a more comprehensive perspective on the ways in which urban greening and gentrification are intertwined, and using diverse but congruent methodological approaches for the analyses, appropriately scaled for the particular case study under examination. For Case Study 1, network analysis and hot spot analysis were used to delineate "catchment" areas and areas of concentration for the community gardens and thus to be able to determine the potential impact the gardens may be having on the gentrification of these lower-income block groups in comparison to similar areas not proximate to the gardens. For Case Study 2, an index or scoring tool was developed to examine the influence of multiple new parks on surrounding areas and providing the ability to look at each one independently. We used global ordinary least squares (OLS) and local geographically weighted regressions (GWR) in order to see if there were significant spatial differences near the parks. Case Study 3 used fixed distance proximity analysis to compare longitudinal change to the area's socioeconomic indicators within the park's sphere of influence, and in relation to the rest of the borough.

Case Study 1: Community Gardens in Brooklyn, New York

We selected Brooklyn, NY for a case study of the relationship between community gardens and environmental gentrification because Brooklyn has a large number of community gardens, and has seen rapid gentrification over the past decades. Brooklyn is one of the five boroughs of New York City and has always been one of the most populated boroughs, currently with approximately 2.6 million residents (United States Census Bureau 2018). The proportion of minority population in Brooklyn has steadily grown since WWII, and racial segregation was and still is a defining and visible factor in the distribution of population. The decades of the 1960s and 1970s were a time of great change in Brooklyn, which saw the borough go from mainly white, working class tenement neighborhoods mixed with some middle-class and wealthy enclaves, to large portions of the borough being ghettoized into very poor, predominantly minority neighborhoods, with a few outliers of wealthy and middle class white areas (Shefter 1992). This was primarily due to "white flight" from Brooklyn to the nearby suburbs and other boroughs like Staten Island and parts of Queens, as well as the result of many major industries and corporations leaving New York during this time of severe economic hardship in the city. Landlords frequently abandoned rental properties that were no longer profitable, often setting fires to the building to collect the insurance monies, and there was wholesale governmental and private disinvestment in these communities. Brooklyn and other parts of the city became largely depopulated of white residents in many areas. For various reasons, New York City was no longer viewed as a desirable place to live; job opportunities were moving to less expensive places to do business, crime was rampant, the older housing stock was not up to par with what could be found in the suburbs, and the financial situation of the city was dire (Mahler 2006; McClelland and Magdovitz 2000; Shefter 1992; Tochterman 2017; Viteritti 2014). The federal government basically washed its hands of the responsibility of helping New York City out of its impending bankruptcy and denying any assistance, as memorialized by the famous New York Daily News headline "Ford to City: Drop Dead," referencing then-President Ford's unwillingness to do anything (Mahler 2006; McClelland and Magdovitz 2000; Shefter 1992; Tochterman 2017; Viteritti 2014).

In the wake of these events, a number of Brooklyn communities began trying to improve their neighborhoods themselves by creating community gardens out of the abandoned property lots that were left behind in the destructive process of disinvestment. The city owned much of the abandoned vacant land due to tax foreclosure, and was only too happy to lease the land to the community groups for nominal amounts, in order to prevent the neighborhoods from looking even more blighted than they might have otherwise, under the assumption that developing the lots by private investment was unlikely at this precarious time amidst the city's downfall. But the city always viewed this leasing of VDL as a temporary expedient, and expected to at some point get the properties back into "productive use," (i.e., back on the tax rolls). Therefore, this grass roots gardens movement was jeopardized in the 1980s and 90s when the economy started picking up in the city, and private developers became interested in some of these community garden lots for housing and other uses. The community gardens, by and large, had helped make these neighborhoods more attractive by reducing crime, raising property values, and beautifying the community. The city would hold auctions of these lands or sell them to developers without consideration of the community's work in cleaning them up and making them a neighborhood focal point. These auctions and sales of the community garden lands became very contentious, and the conflicts between the community garden supporters and the city government and the private developers escalated (Fainstein 2001) (Figure 2).

Figure 2: (Left) Photograph of Southside Community Garden in Williamsburg, Brooklyn;
(Right) The Maple Street Community Garden in Prospect Lefferts, Brooklyn
Source: Maple Street Community Garden Facebook Page
https://www.facebook.com/maplestreetcommunitygarden

A number of gardens were lost to such development, and were by and large turned into housing that rarely was affordable to local residents, and often was luxury housing intended for residents outside the neighborhood. One such example is the beloved "Roger That" community garden on Roger Avenue in Crown Heights, Brooklyn, which was destroyed despite the well-organized protests, petitions, community legal activism, and court case, to be replaced by luxury condominiums. There are still about 241 community gardens in Brooklyn, and the focus of development pressure has shifted from destroying the gardens themselves, to using the gardens as a selling point to the new set of "urban pioneers" who, it is thought, may be more inclined to move to some of these less affluent neighborhoods and pay top dollar, inflationary rates for housing if the neighborhood has some visible nearby environmental amenities like community gardens.

Case Study 1: Methods and Analysis

Given the above historical explanation of what has taken place, how does this match up to current reality? Our analysis aimed to find out, by asking the question "Is proximity to community gardens in less affluent neighborhoods associated with an increased likelihood of gentrification?" We used the change in per capita income from 2010–2015 (adjusted to constant 2015 dollars) as a proxy for the presence/occurrence of gentrification, to serve as an uncomplicated, basic metric for measuring potential gentrification, in lieu of creating an index with many other possibly causative factors, such as race/ethnicity or education, all of which are usually correlated. We then extracted for analysis the census block groups that were "eligible" for gentrification—i.e., block groups in 2010 that had below the per capita income of Brooklyn as a whole, and were therefore at a higher risk for gentrification, with the understanding that block groups with higher than the borough-wide per capita incomes had already gentrified or were affluent from the start (Figure 3).

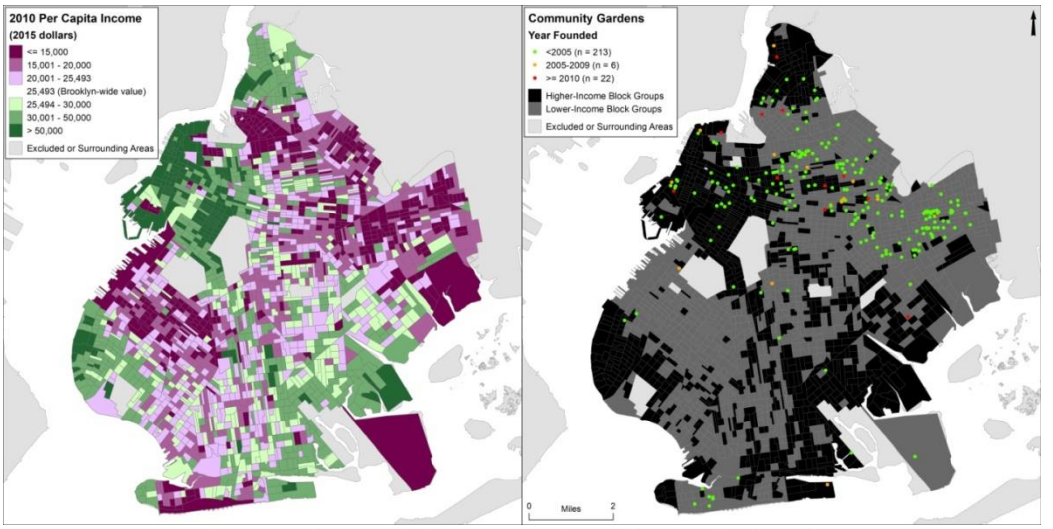

Figure 3: (Left) Per capita income (2010) in Brooklyn, NY showing values below (purple shades) and above (green shades) the per capita income of Brooklyn (Right) Locations and year of founding of community gardens and census block groups stratified by low- or high-income in 2010
Source: Maantay and Maroko 2018

The location of each community garden was mapped, and differentiated by the year of the garden's founding. We had three categories for the analyses: all gardens, regardless of when they were founded; gardens founded between 2005 and 2010; and those founded after 2010. The year gardens were founded was used to distinguish communities with any historical involvement with community gardens, including long-standing community engagement, from those with more recent activity, in case this had a bearing on the gentrification process.

We then conducted two separate analyses using Geographic Information Science: proximity analysis at the block group-level, and a hot spot analysis, to explore the possible impact of community gardens on lower-income block groups. Proximity to the gardens was conceptualized by creating a one-fourth mile (402 meters) network buffer around each garden, indicating the actual walking distance as per the street network required to access the garden. This catchment area was then used to overlay the census block groups to see for each block group how many community gardens were within the one-fourth mile walking distance (Figure 4).

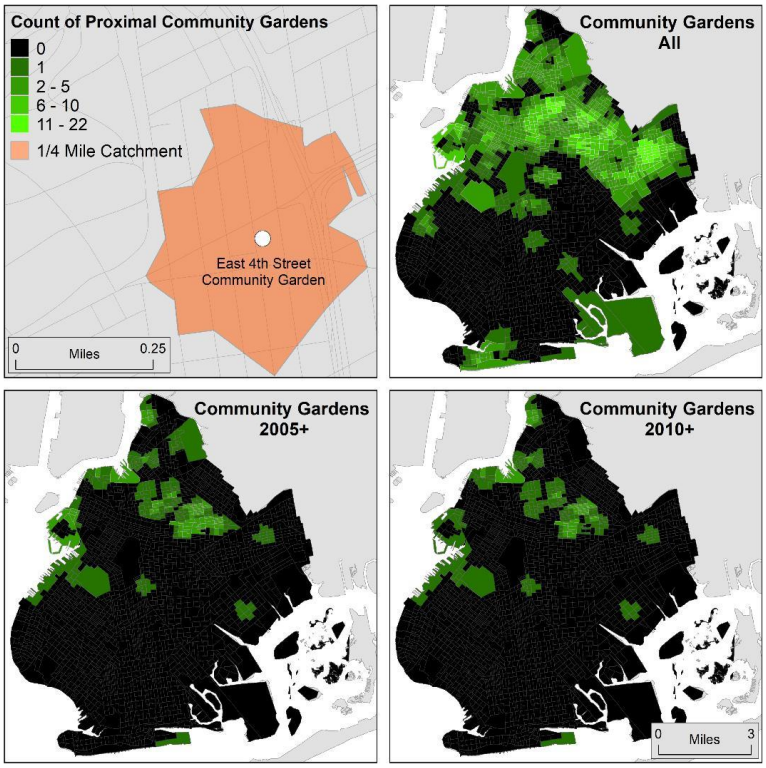

Figure 4: (Top Left) A 1/4 mile network-based pedestrian-accessible catchment area around one community garden; (Top Right) Counts of community gardens (founded any year) within the block group catchment area; (Bottom Left) Counts of community gardens founded in 2005 or later within the block group catchment area; (Bottom Right) Counts of community gardens founded in 2010 or later within the block group catchment area
Source: Maantay and Maroko 2018

Hot spots of block groups with comparatively high numbers of nearby community gardens were then calculated using the Getis–Ord Gi* statistic (Ord and Getis 1995) (Figure 5). A one-fourht mile distance was selected as a threshold to be consistent with the pedestrian network analysis and capture the spatial process of interest. The hot spots characterize community garden access/proximity less granularly than the block group proximity analysis.

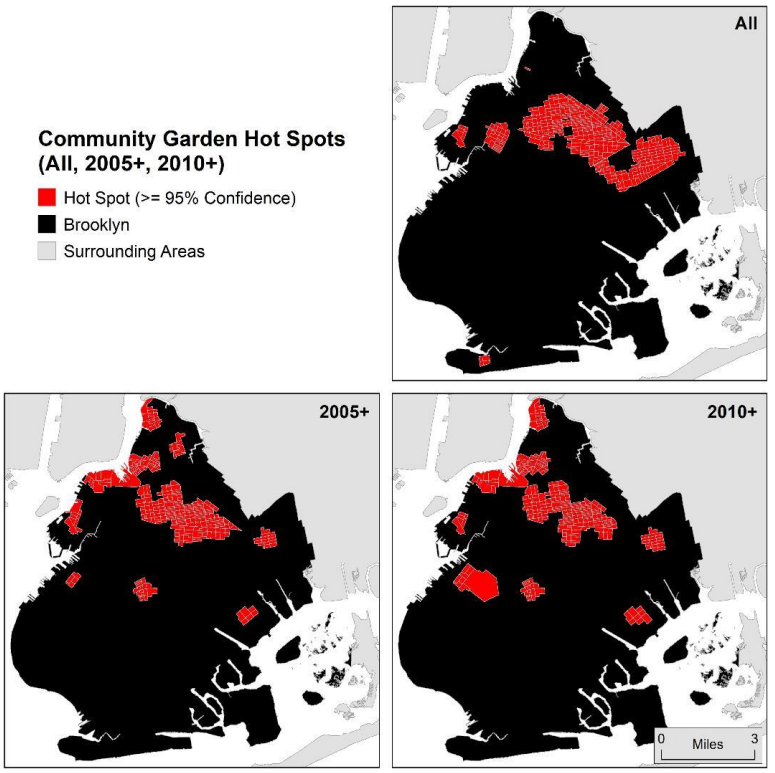

Figure 5: (Upper Right) Hot Spots Based on Number of
Proximal Community Gardens Founded Any Year;
(Lower Left) Community Gardens Founded in 2005 or Later;
(Lower Right) Community Gardens Founded in 2010 or Later
Source: Maantay and Maroko 2018

Case Study 1: Results

The block group analysis results indicate that proximity to community gardens is associated with per capita income increases between 2010 and 2015. This increase is suggestive of areas which are at some point in the gentrification process. The most notable per capita income increases were block groups that had one or more community gardens nearby. However, proximity to more gardens (five or more and ten or more) shows a far more subtle increase. When only more recently founded gardens were analyzed, the per capita income increase was not significant. This may be due to newer gardens not having existed for enough time to spur gentrification, or it may indicate differences in neighborhood activism or resistance to gentrification in the communities with more recently established gardens (Figure 6).

The hot spot analysis shows the relationship between the clusters of lower-income block groups with a high number of community gardens within one-fourth mile and changes in per capita income. The results were not significant when all community gardens were included, suggesting that changes in per capita income were similar in block groups inside hotspots compared to those outside the hot spots. However, when only newer gardens were considered, the analysis did show meaningfully higher per capita income increases in the hot spots. The apparent disagreement between the hot spot and block group analysis findings may be a function of multiple factors, including the scale of analyses, differences in the operationalization of "proximity," and variations in neighborhood social capital.

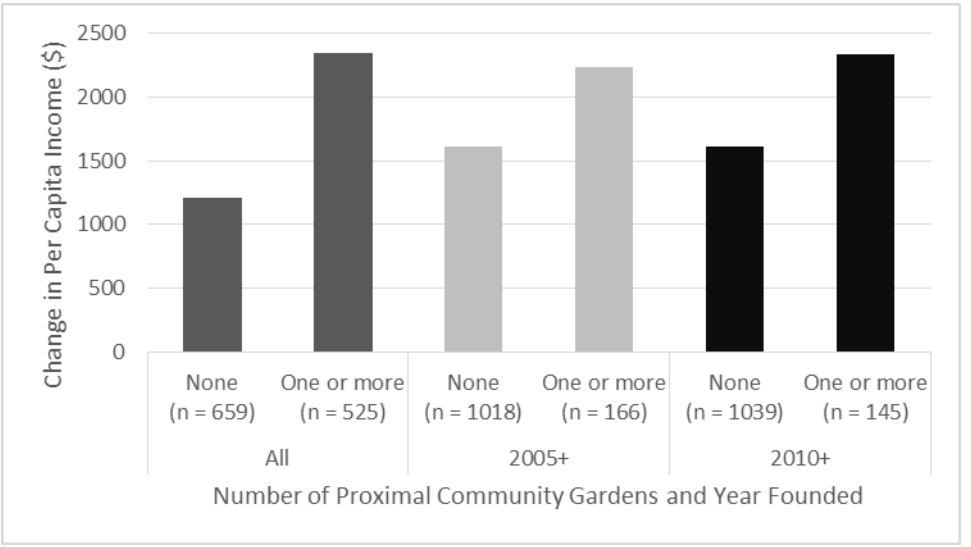

Figure 6: Change in per capita income between 2010 and 2015 (population-weighted averages) and proximity to one or more community gardens by year founded. Community gardens were categorized as founded in any year (all), those founded in 2005 or later (2005+), and those founded in 2010 or later (2010+)
Source: Maantay and Maroko 2018

Although statistically significant, the correlation between community gardens and gentrification is moderate. Nevertheless, community gardens can have an adverse impact on environmental justice due to the tendency for current residents who are from less affluent and minority populations to be displaced by gentrification. Despite the need for lower-income communities to reduce environmental burdens in order to live in more health promoting surroundings, cleaning up environmentally burdensome sites may end up backfiring on the residents. Community-led improvements often have the unfortunate side-effects of improving neighborhoods and raising property values, thus creating interest amongst property developers, and stimulating the gentrification process and the consequent displacement of the original residents, which are undesirable outcomes and counter-productive to the goal of improving life for the community residents. Creating "green" amenities in less affluent neighborhoods, even if community-instigated, may result in environmental gentrification. "Community gardens may be a contributing factor to changing socioeconomic characteristics of the neighborhood, for instance increases in income, which is considered to be one indicator of gentrification" (Maantay and Maroko 2018, 13).

Case Study 2: Greening Barcelona's Deprived Neighborhoods

During the Franco dictatorship (1939–1975), Barcelona's population grew exponentially, with the arrival of hundreds of thousands of internal migrants from poorer parts of the country such as Andalucía and Galicia who took jobs in Barcelona's numerous industries (Anguelovski 2014). Yet, settling in Spain's second city meant a high exposure to air and water pollution as well as little access to health services, public transportation, water and sanitation, and green space (Sauri, Parés, and Domene 2009). Much of this deficit was remediated by the first progressive, democratic governments who developed neighborhood urban plans prioritizing the creation of green space for the most deprived neighborhoods (Ajuntament de Barcelona 2010). During the 1980s, much municipal emphasis was put on small and large green spaces (i.e., Parc Joan Miró 1992) as recreational assets for families and elderly residents (Sauri, Parés, and Domene 2009). In the following period, which many define as the 1992 Olympic Games preparation and branding, the City of Barcelona embedded the creation of green space within the construction of infrastructure for

the games and the larger redevelopment of neighborhoods (e.g., Sant Martí, Sants Montjuic). This period was characterized by a stronger participation of developers and the private sector and a much weaker presence of neighborhood groups for the design of green space (and other planning processes more generally) (Anguelovski 2014; Monclús 2003; Montaner 2004), resulting in large-scale, flagship green spaces such as the Port Olympic Park (1992) (Figure 7, left).

Figure 7: (Left) Port Olímpic Park (1992); (Right) Diagonal Mar Park (2002).
Source: Anguelovski 2014; Barcelona City Council

In the post-Olympic games period, the City of Barcelona vowed to build on its new international fame and attraction and on alliances with private investors, dedicating substantial resources to larger extent redevelopment of working-class neighborhoods (Marshall 2004), such as the northeastern section of the Diagonal street in Sant Marti (called 22@ project), and to the construction of architect- and developer-driven parks, e.g., Parc de Diagonal Mar 2002 (Figure 7, right). While such new parks provided access to large-scale green spaces, their construction also erased much of the local architectural fabric and historic memory, prompting residents to protest their construction and denounce the extreme marketization and for-profit-driven new green ventures supported and/or planned by the City of Barcelona (Anguelovski 2014). Diagonal Mar, for example, was embedded in the construction of a global capital-financed series of new luxury skyscrapers and represented an architectural and socio-cultural departure from previous urban projects.

Case Study 2: Methods and Analysis

In view of such shifts over the course of just two decades, we conducted a spatial and quantitative analysis to understand who benefits from new green spaces in the working-class neighborhoods of Barcelona. We focused on the historically less privileged and socially/economically vulnerable neighborhoods of Barcelona in recognition of the episodes of redevelopment that have occurred in there. We operationalized a multi-variate approach to understanding social change and gentrification in the city and focus on large, municipally-funded parks.

As a way to assess whether the provision of new green spaces offered amenities to long-term residents or contributed to green gentrification processes, we analyzed changes in population and housing price trends around the eighteen new official municipal parks and gardens built in the most socially-deprived neighborhoods of the city from 1992 to 2004 (Figure 8) (Anguelovski et al. 2018). We chose this as a stable growth and development period for Barcelona, for which demographic and economic analysis was not at risk of being skewed, for example, by the context of the 2007 financial and housing crisis, which hit Barcelona particularly strongly. We also could not conduct analysis for the 1980s period because of poor data availability from this time. In the city, the social groups we identified as socially vulnerable were: Lower-income residents, non-college educated residents, residents over 65 living alone, and residents who emigrated from the Global South.

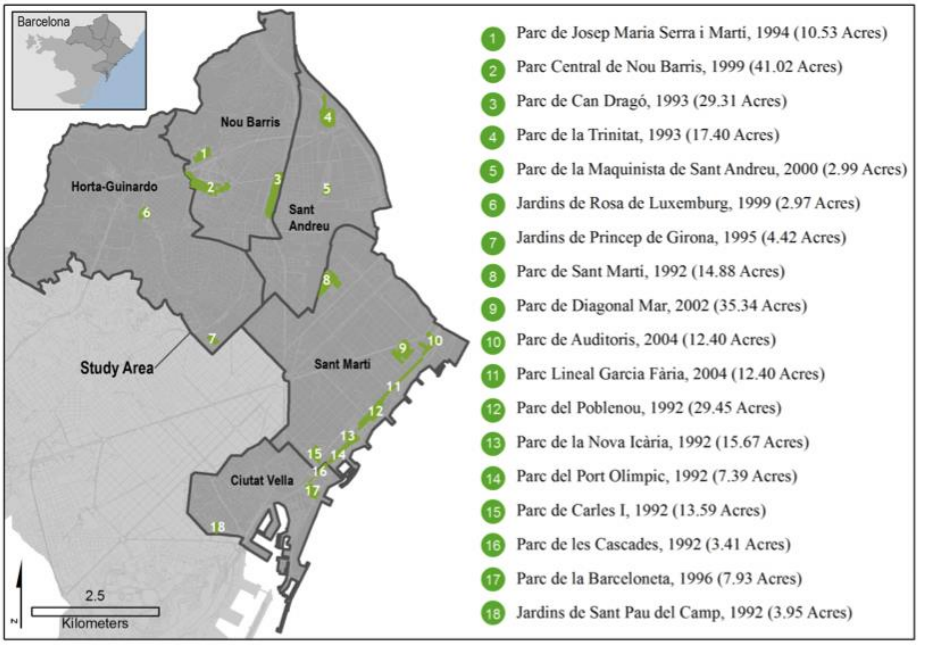

Figure 8: Municipal Parks and Gardens built from 1992 to 2004 in Barcelona's Most Deprived Districts
Source: Anguelovski et al. 2018

From an analytical standpoint, we did a park-by-park analysis where we compared demographic and housing price trends for the small standardized census areas within 500m of parks (e.g. Parc Central de Poble Nou) to trends within the larger district containing the park (e.g. the Sant Marti district for Parc Central de Poble Nou—there are five districts in our study area). We examined these changes for a period of 4–12 years (depending on data structure and availability) after the construction of each park. We also used global ordinary least squares (OLS) and local geographically weighted regressions (GWR) in order to verify that there were significant spatial differences near the parks.

To calculate the magnitude of green gentrification trends, we built a scoring tool (from 1 to 4) where each significant indicator of gentrification (e.g., college-educated residents) was assigned a score of 1 for a specific park (See Table 1). For both residents with a college-degree and for residents over sixty-five living alone, we identified those buffer areas with greater increases in that indicator compared to the district over the time period 4–12 years post green space creation. For the variable immigrants from the Global North variable, we identified parks with above average increases in residents from the Global North and below average increases in residents from the Global South populations. Finally, because of missing data for income or home values for some parks, we first use income and then, if income is unavailable for the years analyzed, home values, as a proxy for changes in local economic power and affordability. We then computed all results for all indicators, with scores ranging from 0 (for no trends of green gentrification) to 4 (for strong trends of green gentrification) (Table 1).

Table 1: Green Gentrification Indicator Scores for Parks built between 1992 and 2004 in Study Area

Park Name (Year Built)	District	Bachelor's Degree	65 or Older Living Alone	Global North	Income	Home Sales	Total
Jardins de Sant Pau del Camp (1992)	Ciutat Vella	0	0	0	0	0	0
Parc de la Barceloneta (1996)	Ciutat Vella	1	1	0	**0**	0	2
Jardins Princep de Girona (1995)	Horta-Guinardó	0	1	1	**0**	1	**3**
Jardins de Rosa de Luxemburg (1999)	Horta-Guinardó	1	0	0	0	**0**	1
Parc de Can Dragó (1993)	Nou Barris	1	0	0	0	1	2
Parc Josep M. Serra i Martí (1994)	Nou Barris	0	0	0	**0**	1	1
Parc de Nou Barris (1999)	Nou Barris	1	0	0	1	**0**	2
Parc de la Trinitat (1993)	Sant Andreu	1	0	0	1	1	2
Parc de la Maquinista (2000)	Sant Andreu	1	1	0	0	**0**	2
Parc de Sant Martí (1992)	Sant Martí	0	0	0	0	0	0
Parc del Poblenou (1992)	Sant Martí	1	1	1	1	0	**4**
Parc de Diagonal Mar (2002)	Sant Martí	1	1	0	1	**0**	**3**
Parc del Port Olimpic[1] (1992)	Sant Martí	1	1	1	1	0	**4**

Source: Anguelovski, Connolly, Masip, and Pearsall 2018).

Case Study 2: Results

Our results reveal that some parks in Sant Marti—those built during the Olympic games redevelopment process in the city (Parc de Poblenou Par, Parc de Nova Icària, Pac Carles I, Parc del Port Olímpic)—experienced strong, visible environmental gentrification. Meanwhile, some more recently built parks (Parc Diagonal Mar, Parc de Auditoris, and Parc Garcia Fària) experienced moderately-high gentrification. Outside of this district, parks which saw occurrences of gentrification are the Cascades Park (in Ciutat Vella—rating of 4 out of 4) and Princep de Girona (in Horta—rating of 3 ouf of 4). Our GWR analysis confirms these findings by revealing that distance to green space is a significant predictor of the given gentrification indicator in the area of te parks that scored highly on our ranking. In contrast, some other parks from the northwestern section of the city and from most of the old town Ciutat Vella district did not show signs of green gentrification trends (1 or 2 out of 4 rating)—at least not based on the indicators we measured (see Figure 9 for a summary of our analysis).

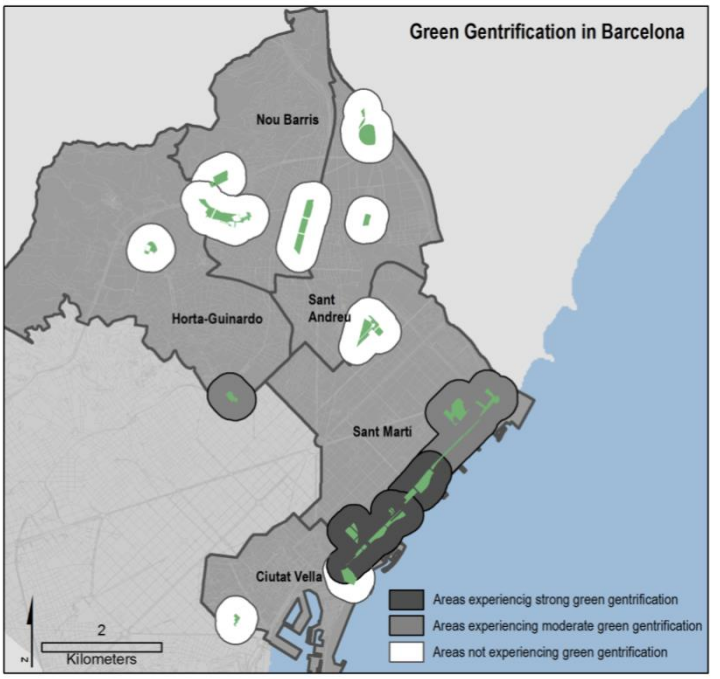

Figure 9: Areas Where Strong, Moderate, and No Green Gentrification seem to be Occurring
Source: Anguelovski et al. 2018

In sum, green gentrification trends from municipality-created green spaces are strongly present in Barcelona, occurring in approximately half of the parks of our study. However, green gentrification is not a uniform trend, nor is it occurring at the same magnitude throughout the city. Green gentrification is the strongest in districts such as Sant Marti, where much of the former industrial neighborhoods were redeveloped during or after the Olympic Games, where much foreign capital was invested in luxury housing development, and where much of the preserved housing stock was desirable for investors. Linear, continuous parks near the sea also seem to be the type of parks most affected by green gentrification. In contrast, new parks in long-term, dense, working class districts such as Nou Barris and Sant Andreu do not exhibit signs of green gentrification. On the contrary, they have gained a more socially vulnerable population over time. Yet, while this population has gained new access to green space and benefits from greater park equity, the housing stock of these neighborhoods also tend to be of lower quality, and some of the parks are surrounded by poor environmental conditions. This is the case for the Parc de la Trinitat, for example, which is enclosed by highways. In that sense, park equity does not necessarily translate into broader environmental equity and/or quality.

Case Study 3: High Line Park, Manhattan, New York

The High Line Park in Manhattan, New York, is one of the best-known examples of converting a disused piece of infrastructure to a public park. The High Line was originally built in 1934 as an elevated freight rail line to service the lower west side of Manhattan, which at that time was a major locus of warehouses, shipping, laboratories, and industrial facilities. It ran parallel to the Hudson River, about one block east of the river itself, which at that time still contained a bustling port. The railroad was elevated above street level, and in some instances ran right through the second and third floors of industrial buildings, making loading and unloading very convenient. In other places there were spurs and sidings to facilitate freight deliveries. The line was therefore not directly above the street. It ran about 2 miles, from the southern end of the line at Spring

Street, just north of Canal Street, to West 35th Street, and this southern viaduct section was part of the old West Side Line of the New York Central railroad system (Robbins 1934). The neighborhoods it ran through, from south to north, are what are known today as Soho, the Far West Village, the Meatpacking District, Chelsea, and Midtown West. The High Line was a replacement for the original street- or grade-level tracks that were in place from the mid-nineteenth century, but as the city grew in density, the grade-level railroad proved to be increasingly dangerous, and the elevated railroad was constructed. North of West 34th Street, the West Side Line currently carries passenger trains to and from Penn Station.

After WWII, this area began changing drastically. The port of New York moved across the Hudson River to New Jersey, which could better accommodate the deeper draught container ships and space for unloading and storing the containers, since break bulk shipping was for the most part no longer used. As well, other industries were leaving Manhattan due to space constraints and other logistical and financial concerns. Much of the area was re-zoned to encourage residential development, although it was still sparsely settled until the late 1970s–early 1980s, when property tax incentives were instituted to facilitate many loft building conversions to dwelling units, and some public housing projects had been built. There had been a number of nineteenth century rowhouses in the neighborhood, many of which had been carved up into rooming houses, as well as some pre-war apartment buildings, and these had been occupied primarily by working-class people up until mid-twentieth century, often dock-related workers and others involved in the shipping industry. When the neighborhoods began attracting more residential uses, small restaurants and bars also began to spring up. After the warehouse loft conversions, some purpose-built high-end apartment buildings were constructed, and the neighborhood began experiencing significant demographic shifts.

Meanwhile, the elevated freight railroad line was barely used anymore by the 1960s. The section from Spring Street to Bank Street in Soho and the West Village was demolished in the 1960s and the next section from Bank to Gansevoort Streets was demolished in the 1980s. The line was abandoned and derelict, and although it was a bit dangerous, it was used illicitly by New Yorkers who could access it and enjoy the privacy and the views, and it was romanticized by many in its ruinous yet "natural" seeming state. The idea of preserving the elevated railroad began when the remaining sections were threatened with demolition in 1999. Two local activists, Joshua David and Robert Hammond, proposed turning the High Line into a linear park, an "aerial greenway." The Far West Village and Chelsea were notorious for their lack of open space, and it was thought that the creation of a park would alleviate the congestion and give the local populations some breathing room high above the city streets. The idea gathered momentum, and was generally approved of by Far West Village residents. The two activists formed a non-profit organization called Friends of the High Line, and they enlisted some celebrity help in promoting the idea. They held a design competition which garnered international interest. After several years of activism, creation of the non-profit to shepherd the project, political maneuvering, coalition building between the city, the communities, and the non-profit, and assembling the funding, the first phase of the park opened in 2009 to wide acclaim, the second phase opened in 2011, and the third phase in 2014, with a smaller section called "the Spur" opening just recently in June 2019 (David and Hammond 2011; Littke, Locke, and Haas 2015; Lopate 2011; Reichl 2016) (Figure 10).

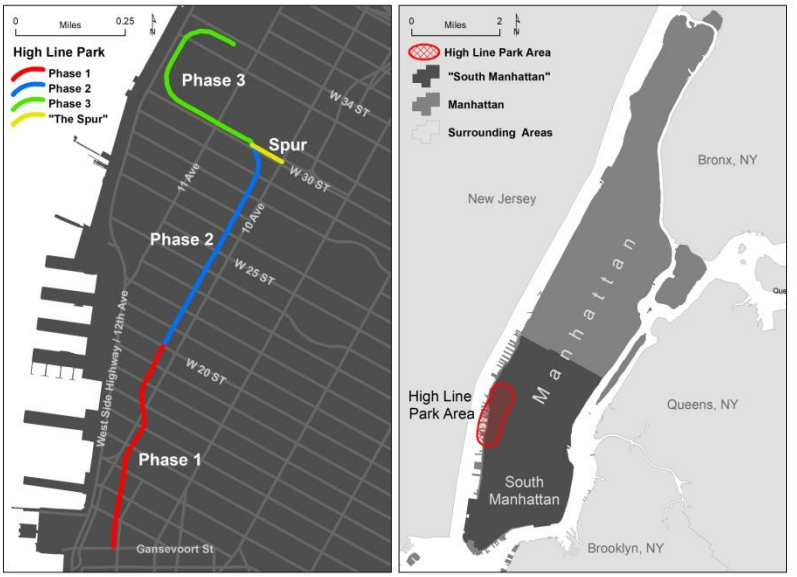

Figure 10: (Left) The three main construction phases of the High Line Park. (Right) The location of the High Line Park study area and its geographic relationship to south Manhattan (below 59th Street) and the entirety of the island of Manhattan.
Source: Maantay et al. 2019

A major design feature of the park was the use of native plantings integrated with the remnants of its past industrial use in the creation of a serene atmosphere, composed primarily of passive spaces for strolling and relaxing, and enjoying the scenery of the park as well as the views of the NYC streetscape below. Because the park is fairly narrow, there was never any real contemplation of providing more active recreational uses of the space. When it was originally conceived and built, the park was hailed as a great example of innovative design and considered a welcome addition to the neighborhood (Filler 2009; Goldberger 2014; Ouroussoff 2009) (Figure 11).

Figure 11: Photographs of the High Line Park
Source: Maantay et al. 2019

It quickly became an important stop on the itinerary of planners, landscape architects, horticulturalists, urbanists, and others from all around the world, who routinely sung the park's praises, and it soon attracted attention from ordinary tourists as well, wanting to experience NYC's newest wonder. It was the spot to be seen and to people-watch, but one would need to go to the High Line Park either very early in the day or late at night to avoid the throngs of people on nice days. However, even being there on off-hours was no guarantee of being able to walk about freely or find a place to sit quietly in contemplation. The park was becoming a victim of its own success, and many locals found it unpleasantly crowded and unwelcoming to the nearby community residents (Lindner and Rosa 2017). Criticism, questioning, and a growing sense of disaffection and dissatisfaction with the High Line Park began to seep into the discussion of the previous accolades from urban designers and planners (Loughran 2014). Nevertheless, despite doubts on the part of the community and professionals alike, shortly after the park's design was finalized and even more so once the park was inaugurated, it started to impact the surrounding areas and inspire significant real estate interest (Bliss 2017; Millington 2015; Sacco et al. 2019).

Some of this was augmented by the new trendy hotels and the new Whitney Museum that were built around the same time or soon after, as well as several luxury high-rise apartment buildings designed by celebrity architects. An important factor in the public-private partnership that ushered in the High Line Park was the re-zoning the city undertook that enabled developer buy-in to the project. The re-zoning allowed for a densification of the area around the High Line, including a mechanism for transferring development rights to adjacent areas to preserve the light, air, and views from the High Line itself, and other developer-friendly regulations that would be incentives for developers not to obstruct the project. In general, this easing and modification of existing regulations for developers' benefit justified the substantial financial contributions that the city, state, and federal governments made to create the park. No one would deny that the High Line Park was instrumental in instigating a building boom and increasing property values, rents, and new construction in areas near the park.

> Many of these buildings, on or adjacent to the line itself, have now seen their values skyrocket as developers move in to cash in on the proximity to the new park.…It has driven commercial and residential property development and is seen as a key driver for the regeneration of Manhattan's Chelsea and Meatpacking Districts. (Ascher and Uffer 2015, 1)

These neighborhoods would probably be experiencing some amount of gentrification even without the High Line Park, but the park has likely exacerbated and accelerated the process. In order to determine how the neighborhood has changed between the time before the High Line Park opened and afterwards, our analysis compared two time periods: the first from 2005–2009 prior to the opening of the High Line Park, and the second one covering the period a few years after the first and second phases of the Park were completed, from 2011–2015. Keep in mind that this area's population has been changing in terms of its socio-demographics since the 1960s, when major portions of the Lower West Side were rezoned from manufacturing to lighter manufacturing, mixed use, and residential (Maantay 2001, 2002). However, the degree of change in the periods immediately before and after the creation of the High Line Park is quite dramatic.

Case Study 3: Methods and Analysis

The first and second phases of the High Line Park were mapped using Parks Department data obtained from NYC Open Data. The per capita income at the census block group level using five year estimates from 2005–2009 ("before") and 2011–2015 ("after") were mapped based on data via NHGIS.org (Manson et al. 2019). Income amounts from 2009 were converted to 2015 dollars using a conversion factor of 1.1069 as per the US Bureau of Labor Statistics. A one-fourth mile fixed-distance buffer was generated around the High Line Park to approximate the areas of local influence, and census block groups that intersect the buffer were selected as the High Line Park

study area. Then population-weighted averages of per capita income were calculated for both time periods within the study area, outside the study area, South Manhattan, and borough-wide. The comparisons are shown in Table 2.

Table 2: Comparison of Study Area to Other Parts of Manhattan before (2009) and after (2015) the High Line Park

	Population, 2009	**Population, 2015**	**Per Capita Income, 2009 (adjusted)**	**Per Capita Income, 2015**	**Change in Per Capita Income**	**Percent Change in Per Capita Income**
High Line Park Study Area (Phases 1 & 2)	42,690	43,391	85,308	96,330	11,022	12.92
South Manhattan Excluding Study Area	562,245	568,623	77,379	80,184	2,805	3.62
South Manhattan	604,935	612,014	77,939	81,329	3,390	4.35
Manhattan Excluding Study Area	1,578,272	1,586,116	65,950	64,136	-1,814	-2.75
Manhattan	1,620,962	1,629,507	66,460	64,993	-1,467	-2.21

Source: Maantay et al. 2019

Case Study 3: Results

The borough of Manhattan as a whole saw a drop in per capita income between the two time periods of nearly $1,500 (2.21% decrease) when using dollars adjusted to 2015. The borough, exclusive of the High Line Park study area, showed a greater decrease in per capita income ($1,814 decrease, -2.75%). When looking at Manhattan below Central Park (59th Street) there was an increase in per capita income of $3,390 (4.35% increase). This was slightly more modest when the High Line Park study area was excluded from the calculations (increase of $2,805, 3.62%). However, the block groups within one-fourth mile of the High Line Park (Phases 1 and 2) showed a dramatic increase of over $11,000 (a nearly 13% increase).

There was a substantial change in per capita income in the High Line Park study area between the time periods before Phase 1 of the High Line Park was built and afterwards. (Figure 12) Per capita annual income in 2015 adjusted dollars increased by over $11,000, far exceeding the increase in South Manhattan (Manhattan below 59th Street), or in Manhattan as a whole (which actually saw a slight decrease in per capita annual income during the same time period). This dramatic increase in per capita income in the High Line Park study area is indicative of a marked change in socio-economics of the proximate population, consistent with rapid gentrification. This outcome was not envisioned by the two activists who spearheaded the creation of the Park. The original intent was to create a new park that could be enjoyed mainly by the local residents, and would be welcomed by them, since the neighborhood has a dearth of publicly-accessible green space. Although the park design was driven by community needs and plans, it seems that popularity and economic value added does not mean that the existing local population is benefitting from the new park as a useful amenity—it has been noted that local residents make up a small proportion of those using the park and that long-term business owners are either being displaced or under threat of having to close down. Thus, not only is the

proximate population not benefitting from the Park as originally intended, but based on the analysis, the neighborhood itself appears to be changing, possibly as a function of the green gentrification (Littke, Locke, and Haas 2015; Loughran 2014; Millington 2015; Reichl 2016).

Figure 12: High Line Park study area showing Phases 1 and 2 of the Park, with per capita income for the two time periods (Left) before the Park was opened in 2009; (Right) after Phases 1 and 2 were opened. Note that block group boundaries changed between the study periods, and the map on the right in Figure 13 includes the finger piers as part of the populated block groups, although the piers have no population.
Source: Maantay et al. 2019

Discussion and Conclusion

The three case studies presented in this article—community gardens in Brooklyn, city parks in Barcelona, and the High Line Park in Manhattan—all show a propensity for spurring green gentrification, to varying degrees and as demonstrated using different spatial analysis tools. These three case studies represent a range of greening initiatives: community-led, municipal-led, and a public-private partnership hybrid form. However, regardless of the project leadership and funding sources, urban greening frequently results in gentrification impacts, but this is usually an unintended consequence. Although greening and environmental clean-ups are definitely desirable and necessary, we must recognize that in many cases the people who benefit from these improvements are not the people who need the greening the most. In addition to the direct displacement that may be caused by gentrification, these greening efforts often don't benefit the original residents or other vulnerable populations at all, and may even alter the character of the neighborhood to the detriment of the existing community.

Cities, as opposed to suburban or exurban communities, are the best hope we have to live sustainably, and there are many innovative methods being tested in cities around the world to help bring this to fruition. Urban greening is an important facet of sustainability; however, we must make sure that the greening does not disproportionately adversely affect the most vulnerable urban populations. We find that this is sometimes the case, which highlights one essential question for efforts to leverage cities for increased sustainability—under what circumstances is greening implicated as a driver of gentrification, and under what circumstances is it not?

Policy and Planning Recommendations

Rather than viewing green gentrification and its adverse consequences as inevitable and a natural outcome of development and environmental improvements, there are feasible mitigation measures that can be applied through policies and regulations which can be taken by cities to prevent or at least slow the gentrification process. This would help to reduce the deleterious impacts of gentrification on existing residents and improve equitable distribution of environmental benefits. Greening efforts and urban sustainability initiatives need to incorporate social equity goals as a major component of any project, using incentives, regulations, and policies crafted towards those ends.

Government at all levels must significantly contribute to the effort towards social equity by instituting and implementing policies that stabilize communities and prevent rapid gentrification, such as developing anti-gentrification rental controls and affordability protections for residents and businesses; creating accommodation within zoning ordinances to prevent new development inappropriate to the existing context of the neighborhood; encouraging conscious restorations and rehabilitation of existing older housing stock rather than demolition; providing financial incentives for homeowners and landlords to make the necessary upgrades to their properties, with built-in protections for existing residents; putting in place schemes to increase taxes on high or luxury income developments that can then be transferred to a fund for developing and protecting public or social housing; developing mixed use zoning districts and human-scaled buildings; encouraging smaller development projects at scattered sites, rather than permitting large mega-projects; promoting new housing types geared toward existing family structures (e.g., larger dwelling units, fewer studio and one-bedroom apartments); rewarding the development of limited equity cooperative housing, rather than speculative co-op models; supporting the development of community-land trusts and other community-scale housing rights models; and very importantly, incorporating "nature" more seriously into all urban planning, in all parts of the city, and not just as an after-thought or as part of a profit-making scheme.

REFERENCES

Ajuntament de Barcelona. 2010. "El Verd: Plantejament i Diagnosis" [The Green: Approach and Diagnosis] Accessed July 25, 2019, http://www.biofund.org.mz/wp-content/uploads/2018/11/1543410536-F1987.___ANNEX%202_EL%20VERD%20PLANTEJAMENT%20I%20DIAGNOSI_____%20Barcelona_%20maig%202010%20_Annex%20Diagnosi%20Verd%20Bcn.Pdf.

Anguelovski, Isabelle. 2014. *Neighborhood as Refuge*: *Environmental Justice, Community Reconstruction, and Place-Remaking in the City*. Cambridge, MA: MIT Press.

Anguelovski, Isabelle, James J.T. Connolly, Laia Masip, and Hamill Pearsall. 2018. "Assessing Green Gentrification in Historically Disenfranchised Neighborhoods: A Longitudinal and Spatial Analysis of Barcelona." *Urban Geography* 39 (3): 458–91. https://doi.org/10.1080/02723638.2017.1349987.

Ascher, Kate, and Sabina Uffer. 2015. "The High Line Effect." In *Council on Tall Buildings and Urban Habitat (CTBUH) Conference Proceedings, New York Conference 2015*. 224–29. https://global.ctbuh.org/resources/papers/download/2463-the-high-line-effect.pdf.

Atkinson, Rowland 2000. "Measuring Gentrification and Displacement in Greater London." *Urban Studies* 37 (1):149–65. https://doi.org/10.1080/0042098002339.

Bambra, Clare, Steve Robertson, Adetayo Kasim, Joe Smith, Joanne M. Cairns-Nagi, Alison Copeland, Nina Finlay, and Karen Johnson. 2014. "Healthy Land? An Examination of the Area-level Association between Brownfield Land and Morbidity and Mortality in England." *Environment and Planning A* 46 (2): 433–54. https://doi.org/10.1068/a46105.

Barton, Michael. 2014. "An Exploration of the Importance of the Strategy used to Identify Gentrification." *Urban Studies* 53 (1): 92–111. https://doi.org/10.1177/0042098014561723.

Blakinger, Keri. 2016. "A Look at Seneca Village, the Early Black Settlement Obliterated by the Creation of Central Park." *New York Daily News*, May 17, 2016. https://www.nydailynews.com/new-york/manhattan/seneca-village-black-town-razed-central-park-article-1.2639611.

Bliss, Laura. 2017. "The High Line's Next Balancing Act." *City Lab,* February 7, 2017. https://www.citylab.com/solutions/2017/02/the-high-lines-next-balancing-act-fair-and-affordable-development/515391.

Boone, Christopher G., Geoffrey L. Buckley, J. Morgan Grove, and Chona Sister. 2009. "Parks and People: An Environmental Justice Inquiry in Baltimore, Maryland." *Annals of the Association of American Geographers* 99 (4): 767–87. https://doi.org/10.1080/00045600903102949.

Bostic, Raphael W., and Richard W. Martin. 2003. "Black Homeowners as a Gentrifying Force? Neighborhood Dynamics in the Context of Minority Home-ownership." *Urban Studies* 40 (12): 2427–49. https://doi.org/10.1080/0042098032000136147.

Burt, Thomas A., Xiaoqui Feng, Suzanne Mavoa, Hannah M. Badland, and Billie Giles-Corti. 2014. "Do Low Income Neighborhoods have the Least Green Space? A Cross-sectional Study of Australia's Most Populous Cities." *BMC Public Health* 14*:* Article 292. https://doi.org/10.1186/1471-2458-14-292.

Camps-Calvet, Marta, Johannes Langemeyer, Laura Calvet-Mir, and Erik Gómez-Baggethun. 2016. "Ecosystem Services Provided by Urban Gardens in Barcelona, Spain: Insights for Policy and Planning." *Environmental Science & Policy* 62:14–23. https://doi.org/10.1016/j.envsci.2016.01.007

Clark, Erik. 2010. "The Order and Simplicity of Gentrification—A Political Challenge." In *A Gentrification Reader*, edited by Elvin K. Wyly, Tom Slater, and Loretta Lees, 24–29. New York: Routledge.

Cole, Helen, Margarita Triguero-Mas, James J.T. Connolly, and Isabelle Anguelovski. 2019. "Determining the Health Benefits of Green Space: Does Gentrification Matter?" *Health and Place* 57*:*1–11. https://doi.org/10.1016/j.healthplace.2019.02.001.

Cumbers, Andrew, Deirdre Shaw, John Crossan, and Robert McMaster. 2017. "The Work of Community Gardens: Reclaiming Place for Community in the City." *Work, Employment, and Society* 32 (1):133–49. https://doi.org/10.1177/0950017017695042.

David, Joshua, and Robert Hammond. 2011. High Line: The Inside Story of New York City's *Park in the Sky*. New York: Farrar, Straus, Giroux.

Downey, Liam, and Marieke Van Willigan. 2005. "Environmental Stressors: The Mental Health Impacts of Living near Industrial Activity" *Journal of Health and Social Behavior* 46 (3): 289–305. https://doi.org/10.1177/002214650504600306.

Estabrooks, Paul A., Rebecca E. Lee, and Nancy C. Gyurcsik. 2016. "Resources for Physical Activity Participation: Does Availability and Accessibility Differ by Neighborhood Socioeconomic Status?" *Annals of Behavioral Medicine* 25 (2): 100–04. https://doi.org/10.1207/s15324796abm2502_05.

Fainstein, Susan S. 2001. *The City Builders: Property Development in New York and London, 1980–2000*, 2nd ed. Lawrence: University Press of Kansas.

Ferguson, Mark, Hannah E. Roberts, Rosie R.C. McEachan, and Martin Dallimer. 2018. "Contrasting Distributions of Urban Green Infrastructure across Social and Ethno-racial Groups." *Landscape and Urban Planning* 175: 136–48. https://doi.org/10.1016/j.landurbplan.2018.03.020.

Filler, Martin. 2009. "Up in the Park: Designing the High Line." *The New York Review of Books*, August 13, 2009. https://www.nybooks.com/articles/2009/08/13/up-in-the-park.

Galster, George, and Stephen Peacock. 1986. "Urban Gentrification: Evaluating Alternative Indicators." *Social Indicators Research* 18 (3): 321–37. https://doi.org/10.1007/BF00286623.

Garvin, Eugenia, Charles Branas, Shimrit Keddem, Jeffrey Sellman, and Carolyn Cannuscio. 2013. "More than Just an Eyesore: Local Insights and Solutions on Vacant Land and Urban Health." *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 90 (3): 412–26. https://doi.org/10.1007/s11524-012-9782-7.

Goldberger, Paul. 2014. "The Final Segment of the High Line is Stunningly Refreshing." *Vanity Fair,* September 22, 2014. https://www.vanityfair.com/culture/2014/09/high-line-final-segment-new-york.

Hammel, Daniel J., and Elvin K. Wyly. 1996. "A Model for Identifying Gentrified Areas with Census Data." *Urban Geography* 17 (3): 248–68. https://doi.org/10.2747/0272-3638.17.3.248.

Heidkamp, C. Patrick, and Susan Lucas. 2006. "Finding the Gentrification Frontier Using Census Data: The Case of Portland, Maine." *Urban Geography* 27 (2): 101–25. https://doi.org/10.2747/0272-3638.27.2.101.

Hoffimann, Elaine, Henrique Barros, and Ana Isabel Ribeiro. 2017. "Socioeconomic Inequalities in Green Space Quality and Accessibility-Evidence from a Southern European City." *International Journal of Environmental Research and Public Health* 14 (8): 916. https://doi.org/10.3390/ijerph14080916.

Hwang, Jackelyn. 2016. *Gentrification without Segregation: Race and Renewal in a Diversifying City.* Cambridge, MA: Harvard Joint Center for Housing Studies.

Immergluck, Dan, and Tharunya Balan. 2019. "Sustainable for Whom? Green Urban Development, Environmental Gentrification, and the Atlanta Beltline." *Urban Geography* 39 (4): 546–62. https://doi.org/10.1080/02723638.2017.1360041.

Irvine, Seana, Lorraine Johnson, and Kim Peters. 1999. "Community Gardens and Sustainable Land Use Planning: A Case Study of the Alex Wilson Community Garden." *Local Environment* 4 (1): 33–46. https://doi.org/10.1080/13549839908725579.

Jennings, Viniece, Lincoln Larson, and Jessica Yun. 2016. "Advancing Sustainability through Urban Green Space: Cultural Ecosystem Services, Equity, and Social Determinants of Health." *International Journal of Environmental Research and Public Health* 13 (2): 196–96. https://doi.org/10.3390/ijerph13020196.

Lee, A.C.K., and R. Maheswaran. 2010. "The Health Benefits of Urban Green Spaces: A Review of the Evidence." *Journal of Public Health* 33 (2): 212–22. https://doi.org/10.1093/pubmed/fdq068.

Lindner, Christoph, and Brian Rosa, eds. 2017. *Deconstructing the High Line: Postindustrial Urbanism and the Rise of the Elevated Park*. New Brunswick, NJ: Rutgers University Press.

Litt, Jill S., and Thomas A. Burke. 2002. "Uncovering the Historic Environmental Hazards of Urban Brownfields." *Journal of Urban Health: Bulletin of the New York Academy of Medicine* 79 (4): 464–81. https://doi.org/10.1093/jurban/79.4.464.

Litt, Jill S., Nga L. Tran, and Thomas A. Burke. 2002. "Examining Urban Brownfields through the Public Health 'Macroscope.'" *Environmental Health Perspectives* 110 (2): 183–93. https://doi.org/10.1289/ehp.02110s2183.

Littke, Hélène, Ryan Locke, and Tigran Haas. 2016. "Taking the High Line: Elevated Parks, Transforming Neighbourhoods, and the Ever-changing Relationship between the Urban and Nature." *Journal of Urbanism: International Research on Placemaking and Urban Sustainability* 9 (4): 353–71. https://doi.org/10.1080/17549175.2015.1063532.

Lopate, Phillip. 2011. "Above Grade: On the High Line." *Places Journal*, November 2011. https://placesjournal.org/article/above-grade-on-the-high-line.

Loughran, Kevin. 2014. "Parks for Profit: The High Line, Growth Machines, and the Uneven Development of Urban Public Spaces." *City & Community* 13 (1): 49–68. https://doi.org/10.1111/cico.12050.

Maantay, Juliana A. 2001. "Zoning, Equity, and Public Health." *American Journal of Public Health* 91 (7): 1033–41. https://doi.org/10.2105/ajph.91.7.1033.

———. 2002. "Industrial Zoning Changes in New York City and Environmental Justice: A Case Study in 'Expulsive' Zoning.'" *Projections: the Planning Journal of Massachusetts Institute of Technology (MIT):* 63–108. http://dusp.mit.edu/project/projections-3-planning-environmental-justice.

———. 2013. "The Collapse of Place: Derelict Land, Deprivation, and Health Inequality in Glasgow, Scotland." *Cities and the Environment (CATE)* 6 (1): 1–52. http://digitalcommons.lmu.edu/cgi/viewcontent.cgi?article=1130&context=cate.

Maantay, Juliana A., and Andrew R. Maroko. 2015. "'At-risk' Places: Inequities in the Distribution of Environmental Stressors and Prescription Rates of Mental Health Medications in Glasgow, Scotland." *Environmental Research Letters* 10 (11): 115003. https://doi.org/10.1088/1748-9326/10/11/115003.

———. 2018. "Brownfields to Greenfields: Environmental Justice versus Environmental Gentrification." *International Journal of Environmental Research and Public Health* 15 (10): 2233. https://doi.org/10.3390/ijerph15102233.

Maantay, Juliana A., Michele Ottmann, and Kristen Grady. 2010. "Urban Agriculture, Green Infrastructure, and Urban Ecology: A Case Study of the South Bronx, NYC." *Cities and the Environment* 3 (1): 20. https://digitalcommons.lmu.edu/cate/vol3/iss1/20.

Mahler, Jonathan. 2006. *The Bronx is Burning: 1977, Baseball, Politics, and the Battle for the Soul of a City*. London: MacMillan.

Manson, Steven, Jonathan Schroeder, David Van Riper, and Steven Ruggles. 2019. *IPUMS, National Historical Geographic Information System: Version 14.0*. Minneapolis: IPUMS. http://doi.org/10.18128/D050.V14.0.

Marshall, Tim. 2004. *Transforming Barcelona*. New York: Routledge.

Martin, Leanne, Sabine Pahl, Mathew P. White, and Jon May. 2019. "Natural Environments and Craving: The Mediating Role of Negative Affect." *Health & Place* 58:102160. https://doi.org/10.1016/j.healthplace.2019.102160.

McClelland, Peter D., and Alan L. Magdovitz. 2000. *Crisis in the Making: The Political Economy of New York State since 1945*. Cambridge: Cambridge University Press.

Maroko, Andrew R., Juliana A. Maantay, Nancy L. Sohler, Kristen L. Grady, and Peter S. Arno. 2009. "The Complexities of Measuring Access to Parks and Physical Activity Sites in New York City: a Quantitative and Qualitative Approach." *International Journal of Health Geographics* 8 (1): 34. https://doi.org/10.1186/1476-072X-8-34.

Millington, Nate. 2015. "From Urban Scar to 'Park in the Sky': Terrain Vague, Urban Design, and the Remaking of New York City's High Line Park." *Environment and Planning A: Economy and Space* 47 (11): 2324–38. https://doi.org/10.1177/0308518X15599294.

Miyake, Keith K., Andrew R. Maroko, Kristen L. Grady, Juliana A. Maantay, and Peter S. Arno. 2010. "Not Just a Walk in the Park: Methodological Improvements for Determining Environmental Justice Implications of Park Access in New York City for the Promotion of Physical Activity." *Cities and the Environment* 3 (1): 1–17. https://doi.org/10.15365/cate.3182010.

Monclús, Francisco J. 2003. "The Barcelona Model: An Original Formula? From 'Reconstruction' to Strategic Urban Projects (1979–2004)." *Planning Perspectives* 18 (4): 339–421. https://doi.org/10.1080/0266543032000117514.

Montaner, Josep Maria. 2004. “La Evolución del Modelo Barcelona (1979-2002)” [The Evolution of the Barcelona Model]. In *Urbanismo en el Siglo XXI : Una Visión Crítica : Bilbao, Madrid, Valencia, Barcelona* [Urbanism in the 21st Century: A Critical Vision: Bilbao, Madrid, Valencia, Barcelona], edited by J. Borja, Z. Muxí, and J. Cenicacelaya, 203–22. Barcelona: Escola Tècnica Superior d’Arquitectura de Barcelona.

Ord, J.K., and Arthur Getis. 1995. “Local Spatial Autocorrelation Statistics: Distributional Issues and an Application.” *Geographic Analysis* 27:286–306. https://doi.org/10.1111/j.1538-4632.1995.tb00912.x.

Ottmann, Michelle M.A., Juliana A. Maantay, Kristen Grady, Nério Cardoso, and Nilce Nazareno da Fonte. 2010. “Community Gardens: An Exploration of Urban Agriculture in the Bronx, New York City.” *Cities and the Environment* 5 (1): 13. https://pubmed.ncbi.nlm.nih.gov/21874150.

Ouroussoff, Nicholai. 2009. “On High, a Fresh Outlook.” *New York Times*, June 9, 2009. https://www.nytimes.com/2009/06/10/arts/design/10high.html.

Park, Lisa Sun-Hee, and David Pellow. 2011. *The Slums of Aspen: Immigrants vs. The Environment in America’s Eden*. New York: New York University Press.

Reichl, Alexander J. 2016. “The High Line and the Ideal of Democratic Public Space.” *Urban Geography* 37 (6): 904–25. https://doi.org/10.1080/02723638.2016.1152843.

Robbins, L.H. 1934. “Transforming the West Side: A Huge Project Marches on.” *New York Times*, June 3, 1934.

Rosenzweig, Roy, and Elizabeth Blackmar. 1992. *The Park and the People: A History of Central Park.* Ithaca, NY: Cornell University Press.

Sacco, Pier Luigi, Maria Tartari, Guido Ferilli, and Giorgio Tavano Blessi. 2019. “Gentrification as Space Domestication: The High Line Art Case.” *Urban Geography* 40 (4): 529–54. https://doi.org/10.1080/02723638.2018.1502515.

Sauri, David, Marc Parés, and Elena Domene. 2009. “Changing Conceptions of Sustainability in Barcelona’s Public Parks.” *Geographical Review* 99 (1): 23–36. https://doi.org/10.1111/j.1931-0846.2009.tb00416.x.

Scottish Government. 2012. “Vacant and Derelict Land Survey.” *Statistical Bulletin Planning Series* Edinburgh: A National Statistics Publication for Scotland.

Shefter, Martin. 1992. *Political Crisis/Fiscal Crisis: The Collapse and Revival of New York City*. New York: Columbia University Press.

Shinew, Kimberly J., Troy D. Glover, and Diana C. Parry. 2004. “Leisure Spaces as Potential Sites for Interracial Interaction: Community Gardens in Urban Areas.” *Journal of Leisure Research* 36 (3): 336–55. https://doi.org/10.1080/00222216.2004.11950027.

Tanaka, Laura S., and Maryanne E. Krasny. 2004. “Culturing Community Development, Neighborhood Open Space, and Civic Agriculture: the Case of Latino Community Gardens in New York City.” *Agriculture and Human Values* 21:399–412. https://doi.org/10.1007/s10460-003-1248-9.

Tochterman, Brian L. 2017. *The Dying City: Postwar New York and the Ideology of Fear*. Chapel Hill: University of North Carolina Press.

Triguero-Mas, Margarita, David Donaire-Gonzalez, Edmund Seto, Antònia Valentín, David Martínez, Graham Smith, Gemma Hurst, et al. 2017. “Natural Outdoor Environments and Mental Health: Stress as a Possible Mechanism.” *Environmental Research* 159:629–38. https://doi.org/10.1016/j.envres.2017.08.048.

Tsai, Wei-Lun, Melissa R. McHale, Viniece Jennings, Oriol Marquet, J. Aaron Hipp, Yu-Fai Leung, and Myron F. Floyd. 2018. “Relationships between Characteristics of Urban Green Land Cover and Mental Health in U.S. Metropolitan Areas.” *International Journal of Environmental Research and Public Health* 15 (2): 340. https://doi.org/10.3390/ijerph15020340.

United States Census Bureau. 2018. "QuickFacts Kings County." https://www.census.gov/quickfacts/kingscountybrooklynboroughnewyork.

Viteritti, Joseph P., ed. 2014. *Summer in the City: John Lindsay, New York, and the American Dream*. Baltimore: Johns Hopkins University Press.

Von Hassell, Malve. 2002. *Struggle for Eden: Community Gardens in New York City.* Westport, CT: Greenwood Publishers.

Williams, Keith. 2018. "Uncovering the Ruins of an Early Black Settlement in New York." *New York Times,* February 7, 2018. https://www.nytimes.com/2018/02/07/nyregion/uncovering-the-ruins-of-new-yorks-first-free-black-settlement.html.

Wolch, Jennifer, John P. Wilson, and Jed Fehrenbach. 2005. "Parks and Park Funding in Los Angeles: An Equity-Mapping Analysis." *Urban Geography* 26 (1): 4–35. https://doi.org/10.2747/0272-3638.26.1.4.

ABOUT THE AUTHORS

Juliana Maantay, Ph.D., M.U.P.: Professor and Director of Geographic Information Science Graduate Program, Department of Earth, Environmental, and Geospatial Sciences, City University of New York, Lehman College, Bronx, New York, USA; and Professor, CUNY Graduate Center, Geography Doctoral Program, New York, NY, USA

Andrew Maroko, Ph.D.: Associate Professor, Department of Environmental, Occupational, and Geospatial Health Sciences, City University of New York Graduate School of Public Health and Health Policy; and Associate Professor, CUNY Graduate Center, Geography Doctoral Program, New York, NY, USA

Isabele Anguelovski, Ph.D.: ICREA Research Professor, Director Barcelona Lab for Urban Environmental Justice and Sustainability (BCNUEJ), Universitat Autònoma de Barcelona (UAB), Institute for Environmental Science and Technology (ICTA), and Medical Research Institute—Hospital del Mar (IMIM), Barcelona, Spain

James Connolly, Ph.D.: Research Scientist, Co-Director Barcelona Lab for Urban Environmental Justice and Sustainability (BCNUEJ), Universitat Autònoma de Barcelona (UAB), Institute for Environmental Science and Technology (ICTA), and Medical Research Institute—Hospital del Mar (IMIM), Barcelona, Spain

The International Journal of the Constructed Environment publishes broad-ranging and interdisciplinary articles on human configurations of the environment and the interactions between the constructed, social, and natural environments. The journal brings together researchers, teachers, and practitioners. The resulting articles weave between the empirical and the theoretical, research and its application, the ideal and the pragmatic, and spaces that are in their orientations private, public, communal, or commercial.

As well as papers of a traditional scholarly type, this journal invites presentations of practice—including experimental forms of documentation and exegeses that can with equal validity be interrogated through a process of academic peer review. This might, for instance, take the form of a series of images and plans, with explanatory notes that articulate with other significantly similar or different and explicitly referenced places, sites, or material objects.

The International Journal of the Constructed Environment is a peer-reviewed, scholarly journal.

ISSN 2154-8587