An Update of the Literature Supporting the Economic Benefits of Plants: Part 3 – The Downside of Increased Housing Prices

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—————————————————————— **Abstract** ——————————————————————

This paper provides a review of the key research efforts that provide evidence of one of the more prominent economic externalities associated with plants and improved landscaped areas. These potential externalities stem from improved property values and the resulting possibility of green gentrification that arises from them. Ironically, the promise of improved property value may persuade reluctant residential homeowners to purchase plants and improve their landscapes, aid municipal leaders and policymakers in justifying green infrastructure-related funding decisions, and provide grounds for the landscape and general construction industries for using biophilic design principles to ensure the built environment offers opportunities for beneficial green space interactions. However, policy measures must be included in the planning stages of green infrastructure projects so that detrimental green gentrification does not occur. In this way, the green industry can play a pivotal role not only in providing quality plants for these applications, but in educating stakeholders regarding the equitable distribution of economic benefits discussed herein. This research should also be strategically incorporated into both industry-wide and firm-specific marketing messages that highlight the quality-of-life value proposition in order to maintain the industry's sense of value and relevance to residential homeowners and municipalities of the future. If implemented effectively, the demand for plants and green industry services may be affected positively and equitably.

Index words: Green gentrification, socio-economic changes, gentrification indicators.

Significance to the Horticulture Industry

This article is the third of a series that provides a review of the substantial body of peer-reviewed research that has been conducted regarding the economic benefits of green industry products and services, with this article focusing on the socio-economic variables related to the prediction of green gentrification, as well as the implications and suggestions for the policy-making process for preventing it. A previous series documented the health and well-being benefits including emotional and mental health benefits, physiological health benefits, the benefits that plants provide to society at large and the role they play in addressing critical societal issues, and an overview of resources available for green industry firms to find more detailed information on these plant-related health and well-being benefits. Industry firms should be armed with the economic benefits described in this new series to strategically incorporate these benefits into both industry-wide and firm-level marketing messages that highlight how local and regional economies are affected in order to enhance the perceived value and relevance of green industry products for municipal leaders and gardening and landscaping consumers in the future.

Introduction

In 2011, Hall and Dickson published a forum article in the Journal of Environmental Horticulture (JEH) that summarized

the economic, environmental, and health and well-being benefits associated with people-plant interactions based on research completed prior to 2011. The proposition put forth in that article was that green industry firms needed to focus on these types of functional benefits in their marketing messages to consumers rather than simply base their value proposition on the features and benefits of the plants themselves (e.g., aesthetic characteristics, insect and/or disease resistance, cold or heat tolerance, salt tolerance, drought resistance, etc.). By doing so, the end consumer would better understand the inherent ways in which plants improve the quality of their lives and begin regarding plants to be a necessity in their lives rather than a mere luxury they might cast aside during economic downturns, as they did during the "Great Recession" of 2008-2009 (BEA 2021, Hall et al. 2011).

Since 2011, there have been numerous additional research studies conducted regarding these functional plant benefits. A total of 1,606 citations were compiled in total and about two thirds of those studies have been conducted since 2011. This new series of forum articles attempts to update the findings summarized in the original article by Hall and Dickson by focusing on a subset of the research (a total of 270 citations) that specifically addresses the economic benefits of plants and improved landscapes.

The term "landscape improvement" refers to a physical betterment of real property or any part thereof, consisting of natural or artificial landscapes, including but not limited to grade, terrace, body of water, stream, flowers, shrubs/hedges, mature trees, path, walkway, road, plaza, wall, fence, step, fountain, or sculpture. This new economic-related information provides the basis for even more innovative green industry marketing efforts, which, in turn, may positively influence the price elasticity of demand for plants in general (Hall 2010).

This series is particularly timely given the Research Roadmap (Owen et al. 2019) recently developed in 2019 by the Horticultural Research Institute (HRI) through a Research Roundtable summit. By analyzing industry-defined attributes

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of success along with the strengths and challenges of the current state of the industry, advisors from the industry identified four areas of focus for future research that will best assist industry profitability. Over the next few years, HRI will prioritize research funding in these four main areas to achieve the stated desired outcomes (Owen et al. 2019).

The first of these, *Quantifying Plant Benefits*, focuses on research that quantifies and validates the benefits of plants on ecosystems, on human health, and on society. Armed with this information, industry firms will be able to create value propositions that boost sales of horticultural products and services and increase interest in horticultural careers. Each of the articles in this series focuses on different dimensions of economic benefits, with this third one exploring the measures to predict and mitigate potential green gentrification that may result from the contribution of green spaces, public parks, and urban forests to the increase in property values and resulting property taxes.

Background Regarding Green Gentrification

Historically, there have been instances of unbalanced distributions of negative environmental externalities, implying that people may experience different levels of environmental hazards based on where they live (e.g., Mohai et al. 2009, Bryant and Mohai 1992). For example, in 1982, Warren County, North Carolina, was chosen as a landfill site for dumping 120 million pounds of soil contaminated with polychlorinated biphenyls (PCBs), largely because it was home to predominantly low-income communities, including a significant African American population and other people of color (Mohai et al. 2009, Banzhaf et al. 2019). This case led researchers to recognize that certain groups in society were disproportionately affected by pollution and environmental contamination, an idea that was inconceivable to most people in the United States at that time (Bryant and Mohai 1992).

In addition to these unbalanced distributions of pollution and environmental hazards, recent attention also been given to the equality of access to the positive benefits of green spaces. Urban green spaces provide a variety of environmental and personal/community health benefits (e.g., Lin et al. 2015, Wolch et al. 2014, World Health Organization 2016). Sufficient and equitable access to urban green spaces is crucial for adequate living conditions and a healthy environment in urban areas. However, access to green spaces is often unequally distributed in both developed and developing countries (Wüstemann et al. 2017, Nesbitt et al. 2019, Jennings 2012). For instance, a recent paper found an uneven distribution of urban green spaces and parks in Mexico City, with the most marginalized municipalities having fewer and smaller green spaces, highlighting environmental injustice (Ayala-Azcarraga et al. 2023). The study shows that municipalities with better access to green spaces have lower rates of obesity and diabetes, while those with fewer green spaces experience significantly higher rates, leading to uneven health outcomes.

A 1987 report titled "Toxic Wastes and Race in the United States," was the first national study to examine the link between hazardous waste site locations and the racial and socioeconomic makeup of nearby communities (Bryant and Mohai 1992). In response to the report and growing public awareness, the U.S. Environmental Protection Agency (EPA) began to recognize and address the issue of environmental justice (EJ) (United Church of Christ Commission for Racial Justice 1987). The EPA defines EJ as "ensuring that no group should bear a disproportionate share of the negative environmental impacts resulting from industrial, governmental, and commercial operations." Furthermore, EJ emphasizes that all people, regardless of race, color, national origin, or income, should have meaningful participation in the development, implementation, and enforcement of environmental laws and policies (Banzhaf et al. 2019).

Considerable effort has been made to improve environmental quality in low-income minority neighborhoods through EJ policies such as Superfund site cleanups and initiatives like green spaces provisions in urban areas. For instance, there were 1,881 Superfund sites as of February 1999, which are closed and abandoned hazardous waste sites designated for cleanup. By the end of 2023, 456 of these had been completely cleaned up (U.S. EPA 2023). Moreover, many major cities worldwide have implemented tree planting programs and established different forms of urban green spaces such as urban community gardens (Pataki et al 2021), both of which contribute to enhanced environmental quality and community well-being (Guitart et al. 2012; Pincetl et al. 2013). However, these policies and movements may also raise concerns about environmental gentrification.

Environmental, or green, gentrification refers to the process where environmental quality improvements lead to the displacement of lower-income residents when these environmental enhancements increase property values and attract wealthier residents, often pricing out the original inhabitants, often minority or low-income, within these communities. For instance, Essoka (2010) evaluated urban brownfield redevelopment projects within four EPA regions and revealed that gentrification is often a consequence of brownfields redevelopment. Maantay and Maroko (2018) explained that while vacant or undeveloped land in lower-income areas can be improved through the creation of community gardens, these greening efforts can paradoxically spur gentrification and lead to displacement of local residents.

Our focus in this paper is on these potentially negative consequences of urban green spaces on low-income communities, a concept similarly referred to as "ecological gentrification" introduced by Dooling (2009). While ecologically-based development promotes environmental ethics, it often leads to the displacement or exclusion of the most economically vulnerable populations. Dooling also highlighted the inherent contradictions in creating green spaces that improve environmental quality and aesthetics but simultaneously marginalize and displace the populations who could benefit most from such improvements. Over time, the term has evolved to include various names, such as green gentrification and environmental gentrification, all stemming from the perspective of environmental justice.

Building on the "Pyramid of Environmental Gentrification" proposed by Banzhaf and McCormick (2012), we elucidate the mechanisms through which green gentrification can occur. The relationship between urban green space distribution and demographics is well-documented in the EJ literature (e.g., Wolch et al. 2014, Jennings et al. 2019). When policymakers and city planners introduce additional urban green spaces in

low-income communities, the improvement in environmental quality is often capitalized into housing prices. As a neighborhood becomes greener and more attractive, the demand for housing increases. Households make their residential choices based on their budget constraints. Wealthier households, who can afford higher housing prices, move to areas with better access to urban green spaces. This, in turn, displaces poorer residents who cannot afford the rising rents or property taxes, leading to initial shifts in the neighborhood's demographic composition.

Moreover, environmental quality and access to green spaces in an area are often correlated with the provision of other local amenities, such as public safety (e.g., fire and police services), schools, and other public services. Limited access to green spaces and poorer green space quality can signal a lack of investment and care, further undermining the provision of other local services, often referred to as the so-called "broken windows" effect (Jennings et al. 2019). Conversely, improved environmental amenities may attract more investments in other local amenities. Additionally, different demographic groups shape neighborhood environments based on their preferences and economic capacity. When wealthier residents move into a neighborhood, they attract different types of retail (Jennings et al. 2019) and may have more capacity to support higher-quality amenities, such as improved public services. These improvements in local amenities can lead to further increases in housing prices, exacerbating segregation and the displacement of existing low-income households.

The primary objective of this paper is to provide a comprehensive review of the existing literature regarding indicators of green gentrification, predictive factors, and mitigation policy choices. The discussion will begin with an exploration of the various signs and evidence of green gentrification such as rising property values and demographic and socio-economic shifts. To better understand and predict where and when gentrification might occur, we will introduce predictive models and case studies from different urban settings based on previous research. Finally, this paper will discuss mitigation policies and strategies that have been proposed or implemented to address green gentrification, aiming to balance environmental improvements with social equity.

Signs of Green Gentrification

Property value changes. Property value changes due to increased access to urban green spaces can be seen as an important sign or leading indicator of green gentrification. As stated previously, urban green spaces can be capitalized in housing prices, and existing literature has shown that the creation of urban green spaces may increase housing values (e.g., Black and Richards 2020, Bottero et al. 2022, Immergluck and Balan 2018). These increases can range from small percentages, such as a 3% in Australia due to general green space proximity (Bottero et al. 2022), to significant double-digit increases, like the 30.1% rise near New York's High Line Park (Black and Richards 2020).

This wide variation highlights the diverse impacts that green spaces can have on property values. One factor that can influence the capitalization of urban green spaces into housing prices is the types of urban green spaces (e.g., urban forests and neighborhood parks). The existing literature suggested that certain types of urban green spaces are valued more highly than others (e.g., Czembrowski and Kronenberg 2016, Dell'Anna et al. 2022). Additionally, urban landscapes that combine various natural elements, like parks and waterfronts, typically boost property values more than areas with only one type of green space (Bockarjova et al. 2020). The initial introduction or even the planned introduction of a park to an area without any existing green spaces has the most statistically significant impact on increasing home prices.

Moreover, the proximity of urban green spaces to housing properties is correlated to the level of their capitalization (Bockarjova et al. 2020). The perceived value of urban green spaces diminishes as the distance from housing properties increases. Immergluck and Balan (2018) and Black and Richards (2020) found that housing price increases are significant only for homes in close proximity to parks, with the effect diminishing as distance increases. Similarly, Bockarjova et al. (2020) also noted that houses located further from urban nature experience a lower "green premium" than houses closer to nature, supporting the idea of diminishing returns with increased distance. For instance, the change in property price due to a 100-meter decrease in distance to urban nature can range between -7% to -13.5% globally. A more detailed discussion on the relationship between housing prices and urban green spaces provision was summarized by Fetchel and Hall (2023).

However, environmental gentrification is a multifaceted process that involves various considerations such as rising property values, new construction, and changes in residents' socioeconomic status. While the increase in urban green space suggests a rise in housing prices, whether this impact leads to neighborhood demographic changes and displacement of existing residents remains ambiguous (Banzhaf and McCormick 2012). For instance, Li (2023) highlighted that although the Million Trees NYC program resulted in higher housing values, the overall gentrification effects were relatively small, with minimal changes in community demographic compositions.

Some literature only studied the effects on housing values when exploring the impact of public green space provision on gentrification (Black and Richards 2020, Donovan et al. 2021, Immergluck and Balan 2018). In this paper, we expand on this discussion by summarizing findings on how regional demographic changes and the composition of local populations by socio-economic status evolve following the introduction of green spaces. This approach provides a more complete picture of the gentrification effects resulting from an increased supply and usage of urban green spaces.

Demographic and Socio-Economic Changes

The studies that have examined the socio-economic dimensions of green space impacts identified key indicators that provide a comprehensive picture of the socio-economic changes in affected neighborhoods (e.g., Anguelovski et al. 2018, Rigolon and Németh 2018, Glaeser et al. 2018). First, increased household income levels in a community can be seen as a sign of green gentrification, as it might suggest the displacement of existing lower-income residents (Anguelovski et al. 2018, Rigolon and Németh 2018). For instance, the median household income around the 606 urban park and trail system in Chicago

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(www.the606.org) increased by $14,682 compared to the city's average increase of $3,557 (Rigolon and Németh 2018, Sharifi et al. 2021) revealed that between 1996 and 2006, 45 neighborhoods in the Melbourne area experienced gentrification, characterized by an increase in relative income exceeding 10%. This indicates that the average income in these neighborhoods grew by more than 10% compared to other areas, marking significant socioeconomic changes during this period.

Second, educational attainment often correlates with household income and reflects the influx of more highly educated individuals into areas with new green spaces, indicating a socio-economic shift in the resident demographic (Anguelovski et al. 2018, Rigolon and Németh 2018). The percentage of residents holding a bachelor's degree or higher can be considered a significant socio-economic change brought about by the introduction of parks. For instance, Anguelovski et al. (2018) found that the percentage of residents with at least a bachelor's degree increased by nearly 28% on average across the three nearby buffer areas around the parks in Barcelona over 15 years, compared to only a 7.59% increase for the district as a whole. In the analysis of the 606 urban park and trail system, the percentage of people with a bachelor's degree surrounding the 606 park and trail system in Chicago increased by 6.95% compared to the city's average increase of 4.35% (Rigolon and Németh 2018).

Third, changes in racial compositions can be seen as another sign of green gentrification. The racial composition of a community often correlates with median household income levels. With the provision of green spaces, areas may experience significant racial turnover, such as an increase in white residents or a reduction in diverse minority communities, signaling gentrification (Pearsall and Eller 2020). For example, Rigolon and Németh (2018) showed that the percentage of Non-Hispanic White residents surrounding the 606 park and trail system increased by 4.83%, compared to the city's average increase of 0.56%.

Fourth, changes in age and family structure are also evident in areas experiencing green gentrification. According to Anguelovski et al. (2018), there has been a decrease in the proportion of elderly residents (65 years and older) living close to parks in certain areas. For example, the percentage of elderly residents living alone near the Poblenou park in Barcelona decreased by 2.97% compared to a district average increase of 1.82%. This trend suggests that elderly residents may be particularly vulnerable to displacement.

Additionally, certain types of families, particularly those with young children, working-class families, single-parent families, and non-nuclear families, are vulnerable to neighborhood displacement (Oscilowicz et al. 2020). Fifth, changes in local business activities and patterns often correlate with the introduction of green spaces (Lang and Rothenberg 2017, Pearsall 2012, Glaeser et al. 2018). While it is common to use public data such as the U.S. Census to examine neighborhood composition changes, such data can be delayed or limited in reflecting the current situation of neighborhoods. Glaeser et al. (2018) introduced another way to measure gentrification using Yelp data, which can provide real-time information on how neighborhoods change by examining local business activities. The authors found that gentrifying areas attract more Yelp reviewers, highlighting how changes in local business activity can precede demographic shifts.

In summary, previous studies have consistently demonstrated that neighborhoods with new green spaces tend to attract wealthier, more educated, and predominantly white households (e.g., Anguelovski et al. 2018, Rigolon and Németh 2018, Pearsall and Eller 2020). By analyzing changes in socio-economic indicators rather than solely focusing on property values, researchers can gain a deeper understanding of green gentrification and its multifaceted effects. This shift towards incorporating a broader range of socio-economic indicators, not only addresses the limitations of relying exclusively on hedonic pricing models to understand gentrification patterns but also enriches the analysis of green gentrification. In doing so, it ensures that the diverse impacts of urban green spaces on different populations are accurately captured and addressed in urban planning and policy.

Predicting Green Gentrification

Detecting and diagnosing socio-economic factors. Recent research has focused on ways to proactively identify and measure the occurrence and extent of gentrification (e.g., Chapple et al. 2017, Bates 2013), which has often been observed in areas originally characterized by lower incomes, a higher proportion of people of color, and lower education levels (Anguelovski et el. 2018, Black and Richards 2020). Detecting these factors in advance to assess whether an area is vulnerable to gentrification can help predict its occurrence. Proactive prediction of green gentrification is crucial because policymakers' ability to mitigate the displacement of residents through interventions becomes significantly limited once gentrification is deeply established (Snow et al. 2003). By the time obvious signs of gentrification appear, the green gentrification process is already in full flow, with housing prices rising so rapidly that poor or working-class people have no choice but to leave (Gardiner and Dong 2021).

Therefore, identifying indicators to proactively predict green gentrification is becoming increasingly important, and such discussions often refer to the indicators of general gentrification. These indicators include income, education levels, and proportions of minorities in areas, as well as economic indicators such as unemployment and poverty rates, which are used to predict green gentrification (e.g., Bengtsson and Kopsch 2019, Chapple et al. 2017). For instance, according to the Voorhees Center at UIC (2024), the Chicago Gentrification Index provides scores for community areas based on 13 indicators, including median household income, percentage of the population with a college degree, median rent, poverty rate, unemployment rate, public assistance rate, and racial/ethnic composition, to measure how much a neighborhood's wealth or poverty has changed.

Chapple et al. (2017) introduced the UrbanSim model (UrbanSim, Inc.), which is an urban simulation system designed to model the dynamics of urban development and the impacts of various policies and infrastructure investments on cities and regions. This model predicts changes in urban components by outputting information on household distribution by income, age, and size, as well as employment by industry, and expected prices for residential and non-residential properties. The authors reported that this model demonstrated

an accuracy of 50% to 86% in predicting gentrification and displacement. This model can also be customized according to regional characteristics; for instance, the Los Angeles model evaluates gentrification risk by adding variables that represent changes in rent and housing density, while the Bay Area model uses indicators that consider risk factors in the built environment to assess gentrification risk, demonstrating the model's flexibility and applicability (Chapple et al. 2017). Besides diagnosing such socio-economic indicators, researchers have emphasized the importance of tracking changes over time (Easton et al. 2020, Bates 2013, Chapple et al. 2017).

Researchers commonly distinguished the stages of gentrification as early, mid, and late stages, connecting changes in socio-economic factors with each stage (Bates 2013, Chapple et al. 2017). Bates (2013) explained that in the early stage of gentrification, property values are still low or moderately-low, and demographic changes indicating gentrification have not yet occurred, especially in renter, low-income, and minority communities. Similarly, Chapple et al. (2017) found minimal displacement in the early stage but noted increased amenities for higher income residents, with property values increasing by 20% over ten years and rents by 5% annually.

In the mid-stage, there is a common view among researchers that gradual displacement of low-income residents occurs and that there is a significant increase in property values. Chapple et al. (2017) provide evidence of significant real estate investment in terms of new home construction and sales of existing homes, with investments rising by 50% and homeownership by 30% in the mid-stage. On the other hand, Bates (2013) suggest that while property values may have increased over the past decade, the absolute level of property values could still be low or moderate during this period.

In the late stage, there are high property values, a predominance of higher-income households, and substantial displacement of original residents, with high-income households increasing by 25% and 40% of low-income households relocating (Chapple et al. 2017). As this situation continues, vulnerable populations are no longer commonly found in the area, and the remaining vulnerable households may be in precarious situations (Bates 2013).

Indicators such as the rate of housing price increases and displacement rates can present different characteristics at each stage of green gentrification. Although there are no exact thresholds for identifying the stages of gentrification, the concept of stages is important for the selection and success of policy strategies. For example, in the early stages of green gentrification, policy focus tends to prioritize housing rehabilitation and vacant property redevelopment rather than expanding affordable housing (Levy et al. 2007). These strategies help revitalize the city while also maintaining affordable housing stock to prevent future displacement because property values are still low or moderate, and gentrification has not yet become severe in this early stage. However, as green gentrification progresses, the demand for constructing affordable housing increases. In the late stage, since housing prices have already skyrocketed and there is little affordable housing or developable land available, strategies like property tax assistance for existing homeowners may prove to be more effective (Levy et al. 2007).

Capturing changes in local business patterns. Previous studies have emphasized monitoring market activity trends and changes in residential and commercial construction as a means of predicting green gentrification (e.g., Glaeser et al. 2018, Banzhaf et al. 2019). An increase in business licenses in an area is a common variable used to predict gentrification, as wealthier neighborhoods might attract more businesses if affluent residents spend more at local shops or are willing to pay extra to save travel time, leading to a higher concentration of businesses in those areas (Glaeser et al. 2018). When wealthier people move to an area where green spaces and improved landscapes are introduced, they may shape the neighborhood environment according to their preferences or financial means, potentially attracting different types of retail (Banzhaf et al. 2019).

The increase in well-known branded shops, such as Starbucks, has often been cited as a factor in predicting green gentrification in previous studies (e.g., Banzhaf et al. 2019, Papachristos et al. 2011), often referred to as the "Starbucks effect," a phenomenon where the presence of a Starbucks coffee shop in a neighborhood is associated with an increase in property values (e.g., Carapetian 2017, Donner and Loh 2019). As a continuously expanding and profitable chain, Starbucks opens new stores in areas that are beginning to grow and develop residentially (Carapetian 2017). Glaeser et al. (2018) found that the presence of a Starbucks and the number of Yelp reviews it receives can predict housing price increases. Specifically, they discovered that each additional Starbucks opening each year is associated with a 0.5% increase in housing prices. Another similar example is the opinion that it is a good time to invest in property just before a Whole Foods opens, as the rising demand for organic groceries signals that the area is potentially gentrifying due to an upward trend in income levels and property values (Donner and Loh 2019). These insights are particularly useful for detecting green gentrification early, as the increase in businesses like cafes and upscale establishments can serve as indicators of future gentrification trends.

How Should We Provide Green Spaces?

Just green enough movement. The concept of "just green enough" (JGE) has been advocated by many as a way to introduce and implement new green spaces without displacing long-term, working-class residents (e.g., Curran and Hamilton 2012, Rigolon and Németh 2020). The JGE strategy focuses on providing green spaces for cleanup of hazardous waste sites for the existing working-class population and industrial land users, rather than necessarily for the purpose of new development (Curran and Hamilton 2012). The concept is crucial because, while creating new green spaces to address environmental justice issues can improve the health of an area and make it more attractive, it can also lead to increased housing costs and property values (Wolch et al. 2014). Finding a balance between social and environmental factors to reduce inequality and prevent eco-gentrification using "just green enough" strategies is essential (VanderWilde 2017), as an exclusive focus on the sufficiency of green spaces can lead to unintended consequences, such as rapid housing cost increases or displacement if not properly managed.

The JGE strategy generally involves planners and local stakeholders designing green space projects based on community concerns rather than market-driven or ecological approaches (Wolch et al. 2014). By involving multiple stakeholders, the process of green space development can ensure a fair distribution of benefits. This approach allows decision-makers to consider the needs of all parties equally (Zhong 2024).

For example, Curran and Hamilton (2012) discuss how the JGE strategy was applied in Greenpoint, Brooklyn, a neighborhood significantly impacted by decades-old oil spills. The JGE approach focused on environmental cleanup to benefit existing working-class residents without triggering large-scale gentrification or displacement. Both long-term residents and recently arrived wealthier individuals collaborated with activists to block upscale developments and actively participated in community meetings and policy-making, seeking to achieve environmental remediation while preserving industrial uses and blue-collar jobs.

In addition, it has been suggested that small-scale, dispersed green space interventions may be helpful in providing green spaces without leading to significant green gentrification (Wolch et al. 2014, Li 2023). Existing research has suggested that when public services are concentrated in certain areas rather than dispersed, the likelihood of gentrification increases (Sieg et al. 2004, Smith et al. 2004).

However, the effectiveness of small-scale, dispersed green spaces remains controversial. Rigolon and Németh (2020) analyzed a JGE approach that includes multiple strategies, such as creating smaller parks intended to serve long-term residents and coupling park development with proactive interventions to preserve and produce affordable housing and jobs (Curran and Hamilton 2012, Wolch et al. 2014). Their analysis of new parks built between 2000 and 2015 in ten major US cities found no significant correlation between park size and gentrification outcomes, challenging the idea that small, dispersed parks are less likely to promote green gentrification than large parks. They concluded that when new parks are located near urban centers, they tend to trigger gentrification regardless of their size and function. Despite these debates, there is a consensus that the JGE approach to urban development can be an option to consider when seeking to balance environmental improvements with social justice, maintaining economic diversity, and preventing the negative effects of gentrification.

Policy Tools and Implications

To effectively counter the adverse impacts of green gentrification, various approaches have been proposed to develop policy tools to mitigate its harmful effects (Derickson et al. 2021). These approaches aim to build community resilience by reducing the risk of displacement of low-income people, controlling housing costs, and ensuring that affordable housing is included in new urban developments (e.g., Rigolon 2019, Mukhija et al. 2010). Establishing approaches to involve multiple stakeholders in the development process is crucial for achieving economic equity and mitigating the risk of green gentrification (Curran and Hamilton 2012, Derickson et al. 2021).

Community benefits agreements. Community Benefits Agreements (CBAs) have been proposed as a tool to address the potential negative impacts of development projects, such as the displacement of long-term, low-income residents. They are designed to foster collaboration and partnerships among various stakeholders, including nonprofits, developers, and community organizations, within urban development projects (Krings and Thomas 2017, Derickson et al. 2021). A CBA is a documented contract that specifies the commitments a private developer makes to gain political support from local residents and other stakeholders interested in the future of a development area (Wolf-Powers 2010).

However, there is ongoing debate among scholars regarding the feasibility and effectiveness of CBAs (Purcell 2020). Supporters argued that creating CBAs can empower the community by giving them more decision-making power, emphasizing the importance of public participation in policy decisions (Baxamusa 2008). Additionally, CBAs can be effective because they address multiple issues simultaneously and engage a broad spectrum of people, leading to more sustainable decisions than those focused on a single issue. This makes CBA a valuable tool for tackling the challenges that may arise from the introduction of green spaces. For example, offering job training opportunities to existing residents has been a common outcome of a CBA aimed at making cities resilient to green gentrification. Curran and Hamilton (2012) emphasize economic development strategies that preserve industrial activities and blue-collar jobs, thereby supporting the existing workforce.

Major cities such as Washington, D.C., and San Francisco have launched projects to provide job training and future employment opportunities in the construction and maintenance of new parks, with the goal of sustaining or enhancing the earnings of long-time, low-income residents (Rigolon 2019). Since those most affected by land-use decisions—particularly people of color and low-income communities—should have the right to influence the outcomes of those decisions (Schlosberg 2007); involving multiple stakeholders has been emphasized as crucial for making neighborhoods resilient to green gentrification and preventing the displacement of existing low-income residents (Zhong 2024, Lubell 2016).

Conversely, critics argue that CBAs are often ineffective due to a lack of regulation or accountability, which undermines their role as tools for achieving equality and mitigating the risk of gentrification (Purcell 2020). For instance, Buitelaar (2019) noted a significant gap between agreements and implementation due to inadequate communication due to developers structuring their communication channels poorly, thereby limiting direct contact with, and feedback from, community representatives. This hindered effective community engagement and led to a disconnect between the developers' initiatives and community needs. Further research is needed to examine the effectiveness of CBAs and how to better use this tool to mitigate the risk of green gentrification when providing urban green spaces.

Government policies and programs have been proposed as strategies to prevent displacement of existing residents resulting from rising housing costs. These strategies include rent control, alleviating the property tax burden on homeowners, and affordable housing and zoning policies.

Rent control. Rent control policies are designed to directly limit price increases in growing housing markets and enable tenants to continue living in existing privately-owned rental units (Rigolon 2019, Borck and Gohl 2021). Such policies have been implemented in parts of the U.S. for decades and have remained a significant policy tool in countries like Spain, the Netherlands, and Germany (Borck and Gohl 2021). Diamond et al. (2019) explained that rent control effectively prevents the forced displacement of tenants, particularly racial minorities, especially in the short term. However, this effect may diminish over time. In a case study of San Francisco, they found that eight years after rent control was implemented, 4.5% of affected tenants were still able to stay in the city because of the policy. Five years later, however, this number dropped to 3.7%. Moreover, concern exists that low-income households may not receive significant benefits from rent control and could even face greater disadvantages due to the distortions in the housing market caused by these policies (Achtenberg 2017, Rigolon 2019). Borck and Gohl (2021) argued that rent control is not exclusively beneficial to low-income households; it can also reduce rents for wealthier renters in gentrifying urban areas, rapidly accelerating gentrification (Borck and Gohl 2021). Additionally, Rigolon (2019) noted that rent control is sometimes prohibited in certain cities due to state laws intended to limit government intervention in the housing market, based on the argument that such controls can reduce housing supply and discourage new construction. Consequently, in cities where rent control is restricted or banned, additional policies beyond rent control may be necessary to adequately support tenants.

Alleviating property tax burden. Rising property values caused by expanding the number of, and access to, green spaces can also negatively affect homeowners due to increased property tax burden (Yeganeh et al. 2024). Low-income homeowners who currently live in the community may be forced to move because of their inability to pay their property tax. To prevent this, researchers have suggested ways to enhance the resilience of homeowners, such as limiting property tax increases, implementing tax deferment programs, and providing property tax reductions for landlords of affordable housing (Yager et al. 2016, Immergluck and Balan 2018). However, existing studies suggested property tax limitations do not necessarily protect long-term homeowners in these areas (Martin and Beck 2018). Therefore, further studies are needed to determine whether these policies can effectively protect homeowners and prevent the displacement of low-income citizens in the aftermath of greening efforts.

Affordable housing and zoning policies. Both policymakers and researchers have emphasized the need to provide affordable housing in areas surrounding new parks to protect residents in high-risk areas from gentrification (Rigolon 2019, Arogundade 2021). Affordable housing generally refers to housing that lower-income individuals can afford when they cannot find suitable options at regular market prices, with the goal of improving housing affordability through government initiatives (Winston and Pareja Eastaway 2008, Gan et al. 2017). To fund affordable housing projects, *new tax districts* can be created by the local government in areas where parks are being developed (Rigolon 2019). These tax districts generate funds for public investments, such as affordable housing, within those areas.

This approach was utilized in the Atlanta's Beltline project to mitigate the potential gentrification effect from green space establishments (Immergluck and Balan 2018). The Atlanta Beltline is a comprehensive redevelopment project in Atlanta, aimed at transforming a 22-mile loop of former railway into a multi-use trail system that encircles the city. The Atlanta City Council mandated that 15% of all proceeds from Beltline Tax Allocation District (TAD) bonds be allocated to a Beltline Affordable Housing Trust Fund, specifically designated for financing or developing affordable housing within the TAD (Immergluck and Balan 2018).

However, this plan revealed weaknesses in the commitment to housing affordability. Beginning in 2007, as real estate values declined, it became increasingly difficult to secure funding through the bond market, leading to reduced resources for affordable housing. At the same time, the development of additional trails and parks along the Beltline attracted real estate investors, accelerating green gentrification (Immergluck and Balan 2018) in certain areas. Since relying solely on tax districts to fund affordable housing can lead to financial difficulties when economic conditions shift and resources become scarcer, it is important to use multiple funding sources rather than just one to keep projects viable (Dewar et al. 2020, Immergluck and Balan 2018). As another policy tool for mitigating the risk of green gentrification, *inclusionary zoning* can increase the supply of affordable housing and ensure its equitable distribution across the city (e.g., Derickson et al. 2021, Been et al. 2007). Inclusionary zoning requires developers to set aside a portion of units for low- and moderate-income households (Dooling 2009). This approach helps combat green gentrification by allocating a portion of affordable housing units in any new development around new green spaces (Moore 2021). Since green gentrification may displace individuals of certain income levels, races, cultures, or religions, inclusionary zoning provides these individuals with the opportunity to remain in the city, ensuring sustainable diversity and environmental equity (Maneval 2003).

Inclusionary zoning has proven effective at creating affordable housing without relying on direct public subsidies (Been et al. 2007, Meda 2009). However, policymakers need to carefully consider the thresholds for affordable housing requirements. If the requirements are too high, it could cause green space developers to move their business elsewhere (Quinton et al. 2024). In Los Angeles and Orange Counties, inclusionary zoning programs typically require developers to set aside between 10% and 15% of the units in new residential developments as affordable housing (Mukhija et al. 2010). However, the structure and details of inclusionary zoning programs may vary widely across jurisdictions, reflecting local differences in green spaces, policy goals, and housing market conditions (Been et al. 2007).

Past experiences have shown that inclusionary zoning significantly increases the overall production of affordable housing, sometimes resulting in twice as many affordable units as would have been constructed without such policies (Mukhija et al. 2010). An unpredictable development environment is often a major obstacle to housing production, but mandatory programs like inclusionary zoning provide

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developers with clear rules and expectations (Brunick 2004). This clarity helps developers plan and build necessary affordable housing, playing a crucial role in mitigating green gentrification. By integrating affordable housing into developments near new green spaces, inclusionary zoning can help prevent the displacement of lower-income residents that often accompanies urban greening efforts.

Conclusion

This paper reviews recent literature on green gentrification, focusing on the signs of gentrification, the mechanisms for predicting gentrification, and policies and tools to mitigate the risk of gentrification. It highlights the importance of balancing the benefits of urban greening and the risks of resident displacement. While urban green spaces are widely recognized for their role in improving environmental quality and public health, providing green spaces in low-income minority communities that that previously lacked access to green amenities can lead to unintended consequences, such as higher property values, shifts in socio-economic demographics, and ultimately, the displacement of existing lower-income and marginalized communities. These outcomes are particularly concerning because they often affect those who, arguably, most need the health benefits that green spaces provide.

As the literature suggests, detecting and predicting the signs of green gentrification — such as changes in housing prices, socio-economic indicators, and shifts in local business patterns— enables policymakers to implement timely interventions that can mitigate its negative impacts before they become deeply settled. It is important to make a city "just green enough" by developing green spaces that meet the needs of existing residents without triggering widespread displacement. This approach is crucial to ensuring that urban greening efforts do not harm the communities they are intended to benefit.

Furthermore, this review discussed several policy tools that can be applied to mitigate the risk of green gentrification. First, it is essential to involve multiple stakeholders in the planning and implementation of green spaces. Through community benefits agreements, effective collaboration can be established between community members, policymakers, and developers for achieving equitable outcomes while implementing new green space construction projects. In addition, government programs and policies such as inclusionary zoning, rent control, and tax districts can be important for controlling rising housing costs and providing affordable housing units to low-income residents after the development of new green spaces. These policies have the potential to mitigate the risk of displacement and ensure that the benefits of urban greening are more evenly distributed across different socio-economic groups. However, further research is needed to examine the effectiveness of these policies and tools and explore how to better implement them to address green gentrification concerns.

Lastly, while urban greening initiatives have great potential for advancing environmental justice, they must be developed with careful consideration of their potential social impacts. The insights from this review highlight the necessity of integrating social equity into urban planning processes to ensure that green spaces contribute to both environmental sustainability and social inclusion. As cities continue to face the challenges of environmental degradation and social inequality,

the lessons from green gentrification provide valuable guidance for future policy and planning. By balancing environmental and social objectives, urban planners and policymakers can make cities that are not only greener but also more just and inclusive, ultimately leading to more resilient and equitable urban environments.

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