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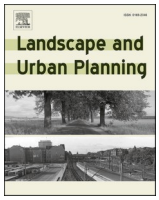

Experiences with environmental gentrification: Evidence from Chicago

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HIGHLIGHTS

- Brownfields cleanup correlated with environmental gentrification.
- Changes in overall green areas not correlated with environmental gentrification.
- More concern about environmental gentrification in Hispanic than Black neighborhoods.
- More concern about disinvestment and displacement in Black neighborhoods.
- Multi-faceted, equity-oriented strategies needed to avoid displacement.

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ABSTRACT

Environmental contamination and limited access to green spaces disproportionately burden communities of color with negative impacts on residents' health. Yet, cleaning up contamination and creating green spaces has in some cases been associated with displacing long-term residents as the neighborhood becomes desirable to more affluent, often Whiter, populations through environmental gentrification. We used mixed methods to investigate environmental gentrification in the city of Chicago, IL, USA. We examined quantitatively the relationship between green areas, brownfield cleanups, and indicators of gentrification, including race and ethnicity, income, households without children, and home ownership. We explored through qualitative interviews how key informants perceive the risk and impacts of environmental gentrification. We found that brownfields cleanup is statistically correlated with proportionately fewer Hispanic residents and more White residents. We did not find any significant correlation between green area and demographic change with the exception of an elevated rail trail linear park. These results align with a racialized process of gentrification, described by some key informants, whereby racial stereotypes lead White newcomers to feel more comfortable moving into Hispanic than Black neighborhoods. The interview results also suggested that racialized disinvestment drives the displacement of people of color, especially African-Americans, from their communities and serves as a precursor for gentrification. These results add to a growing body of evidence that interventions to prevent environmental gentrification will need to be context-specific, multi-faceted, equity-centered, and ideally occur early on within disinvested communities before gentrification takes hold.

1. Introduction

Environmental contamination disproportionately burdens neighborhoods where residents are predominantly low-income and/or racial or ethnic minorities (Mohai, Pellow, & Roberts, 2009; Roberts & Parks, 2006). These same places often lack access to green space (Wolch, Byrne, & Newell, 2014). This inequitable distribution of environmental pollution and amenities arises from economic inequality, racial capitalism, structural racism, limited enforcement of environmental and public health regulations, and land use decision-making processes that exclude vulnerable and impacted groups (Agyeman et al., 2016; Bullard, 1993; Cole & Foster, 2001; Pulido, 1996; Purifoy & Seamster, 2021). It also contributes to health disparities, such as higher rates of asthma and other respiratory illness in communities of color (Evans & Kantrowitz, 2002; Morello-Frosch & Shenassa, 2006; Payne-Sturges & Gee, 2006; Sze, 2006). Initiatives that support the cleanup of contamination and

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increase access to green spaces are critical to advance environmental justice so that everyone – regardless of race, class, gender, citizenship, and the intersections therein – has access to clean air, land, and water. However, as environmental justice advocates, city planners, and others work to reduce environmental health disparities, a compounding challenge can arise if their efforts spur "environmental gentrification," a process in which environmental improvements, such as the cleanup and reuse of undesirable land uses or urban greening interventions (e.g., parks, community gardens, green infrastructure, ecological corridors), make a neighborhood more appealing, drive up real estate costs, and contribute to the displacement or exclusion of working-class residents, thereby reproducing social-spatial inequities (Anguelovski, Irazábal-Zurita, & Connolly, 2019; Curran & Hamilton, 2012). In response, environmental justice organizing in cities is expanding from fighting toxic contamination and mobilizing for environmental amenities to also resisting environmental gentrification (Anguelovski, 2016; Krings & Schusler, 2020).

Although not an entirely new phenomenon (Checker, 2011), environmental gentrification has received growing scholarly attention in the 21st century as initiatives purporting sustainability increase within the context of the neoliberal city (Swyngedouw, 2007). Evidence of environmental gentrification has been found in a range of contexts including brownfields and other pollution cleanup (Dale & Newman, 2009; Essoka 2010; Maantay & Maroko, 2018) and the creation of parks, trails, and community gardens (Braswell, 2018; Immergluck & Balan, 2018; Lang & Rothenberg, 2017; Wolch et al., 2014). These studies, and others, illuminate the conditions under which environmental improvements catalyze gentrification, who benefits from such improvements, and how they can reinforce existing social inequities. Few studies, however, have examined perceptions around environmental gentrification, including when it may or may not be of concern. We investigated this topic through a mixed methods study in Chicago, IL, USA, which asked two related questions:

1. Are quantitative indicators of gentrification associated with environmental amenities, including increased green areas and the cleanup of brownfields (properties with known or suspected contamination) in the City of Chicago?
2. How do key informants (specialists in community development, environmental justice, affordable housing, industrial development, public health, real estate finance, and urban planning) perceive the risk and impacts of environmental gentrification in the City of Chicago?

While perceptions – including those around environmental gentrification – do not always mirror reality, they influence behaviors and thus have a real impact on neighborhoods and civic life (Nyden, Edlynn, & Davis, 2006). They can shed light on priorities for community change, including land use planning and policies. Below we provide justification for each research question, describe our mixed methods approach, report the quantitative and qualitative findings, and then discuss their implications for advancing environmental justice.

1.1. The relationship between environmental amenities and gentrification

Equitable access to environmental amenities, which include green areas as well as developed properties free from pollution and contamination, is a necessary aspect of an environmentally just city. However, the relationship between environmental amenities and environmental justice is complicated because providing amenities can initiate or amplify gentrification. This can happen in at least two ways: first, protecting or restoring a green area can create an amenity that draws in privileged households that can afford increased prices while pushing out marginalized households (Sieg et al, 2004; Checker, 2011; Pearsall & Anguelovski, 2016). Second, removing a disamenity, for example by cleaning up a brownfield, can be a precursor to redevelopment in disinvested neighborhoods (Bryson, 2012; Melstrom, Mohammadi, Schusler, & Krings, 2022). When amenities are protected or restored, neighborhoods can become more desirable to gentrifiers. Sometimes these changes are unintentional, yet often they are part of a broader redevelopment strategy, designed by urban elites to lure wealthy investors, tourists, and residents in a global competition for mobile capital and economic growth (Bryson, 2013; Checker, 2015; Quastel, 2009). Environmental gentrification can mask and sustain political processes including displacement and dispossession by making them appear "natural" (Kern, 2015; Swyngedouw, 2007) in ways that ultimately harm environmental safety and public health (Checker, 2015).

Yet, environmental improvements do not always contribute to gentrification. Neighborhood features like proximity to other gentrifying neighborhoods, downtown, or transportation amenities influence whether environmental gentrification occurs (Anguelovski, Connolly, Masip, & Pearsall, 2018; Pearsall & Eller, 2020; Stuhlmacher, Kim, & Kim, 2022). For instance, in Portland, Oregon, Eckerd (2011) found whether bordering neighborhoods are gentrifying to be a strong predictor of neighborhood gentrification but no association between gentrification and hazardous site cleanup. Howland (2007) noted that land values increase when brownfield cleanups happen in strong real estate markets but that private investment does not typically follow cleanups in weak land markets. In addition to neighborhood characteristics, the degree to which an environmental amenity fosters gentrification also can vary depending on the project's type, function, public accessibility, and ownership/management (Pearsall & Eller, 2020; Rigolon & Németh, 2020). Greening interventions most likely to spur displacement appear to be large-scale projects that create a focal point for real estate or tourism development (Anguelovski et al., 2018: Wolch et al., 2014).

Environmental improvements also can affect groups within specific communities differently. While a mainstream perception is that brownfield cleanups and greening initiatives benefit all, research demonstrates that those most vulnerable, such as the poor, elderly, children, renters, and racial and ethnic minorities, might experience displacement or exclusion (Eckerd, 2011; Melstrom, Mohammadi, Schusler, & Krings, 2022; Pearsall, 2010; Stuhlmacher, Kim, & Kim, 2022). To increase understanding about the types of environmental improvements that might contribute to gentrification and whom they affect, our first research question investigates how green areas and the remediation of brownfields are associated with gentrification and whether differential impacts occur among racial and ethnic minorities, households below the poverty line, households with children, and renters in the City of Chicago.

1.2. Perceptions around environmental gentrification and its impacts

Environmental gentrification can be controversial, in part, because it can benefit and burden existing residents at the same time. New investments, including in environmental amenities, can result in increased property values (which can benefit homeowners), upgrades in housing stock, neighborhood beautification, and improved community safety, for example. Revitalization and reinvestment also can strengthen a city's tax base, helping the government to provide services to its residents. However, new investment also can lead to increased housing costs, shifts in housing types (e.g., fewer rentals, fewer family-size units), decreased economic diversity, and the displacement or exclusion of long-term residents (Dale and Newman, 2009). While revitalization may be welcome, improvements that primarily benefit middle- and upper-income residents constitute gentrification (Thurber & Krings, 2021). Thus, environmental gentrification creates a paradox for communities, and even the same person might hold conflicting views, desiring the benefits associated with environmental cleanup and green space creation, while fearing the possibility of gentrification (Checker, 2011).

The impacts of environmental gentrification can extend beyond the processes of physical displacement explained above (see Section 1.1).

Even when people are not physically dislocated from their homes, long-term residents may feel increasingly unwelcome in their communities (Goossens, Oosterlynck & Bradt, 2020; Jelks, Jennings, & Rigolon, 2021) through, for example, escalated surveillance of youth of color (Harris, Rigolon, & Fernandez, 2020) or shifting social, political, and cultural norms as businesses, social services, and community-based organizations increasingly serve the interests of the neighborhood's newcomers (Krings & Copic, 2021). As within gentrification more broadly, these shifts can produce tensions between existing residents and gentrifiers relating to control over the community's identity (Nyden et al., 2006). These tensions are often racialized. While gentrifying neighborhoods are not solely inhabited by people of color and new residents are not always White, people of color are more likely to live in places vulnerable to these processes and be disproportionately burdened by gentrification's negative impacts (Thurber et al., 2021). The long-term residents of gentrifying communities (who may vary in their race or ethnicity, socioeconomic class, homeowner or renter, tenure in neighborhood, etc.) also can experience gentrification differently with respect to its impacts on their social networks, cultural identity, political power, and housing and, thus, hold differing opinions about gentrification's precursors and impacts (Twigge-Molecey, 2014). Our second research question explores how key informants who work or volunteer in relevant fields (such as environmental justice, community development, housing affordability, public health, or urban planning) perceive the risk of environmental gentrification and its impacts in the City of Chicago.

1.3. Study context

We investigated whether environmental gentrification is a concern in Chicago, a city of 2.7 million people located on the shore of Lake Michigan and the ancestral lands of the Three Fires Confederacy (Potawatomi, Odawa, and Ojibwe Nations) and other Tribal Nations. Chicago is characterized by high racial and economic segregation (Metropolitan Planning Council, 2017) due to historical policies and practices, such as redlining and contract buying (Moore, 2016), and continued discrimination in lending practices (Lutton et al., 2020). Chicago also manifests racial disparities in pollution exposure (Geertsma, 2018) and access to green space (Liu, Kwan, & Zan, 2021). Organizers in communities of color have long sought to resist gentrification in Chicago neighborhoods with varying degrees of success (e.g. Curran, 2018). As environmental justice advocates have won campaigns to clean up contamination and bring amenities like parks into their communities, they are increasingly organizing anti-displacement campaigns in response to concerns around environmental gentrification (Kern & Kovesi, 2018).

Chicago has at least one prominent example that can be described as environmental gentrification. A 2.7 mile linear park, "The 606" involved

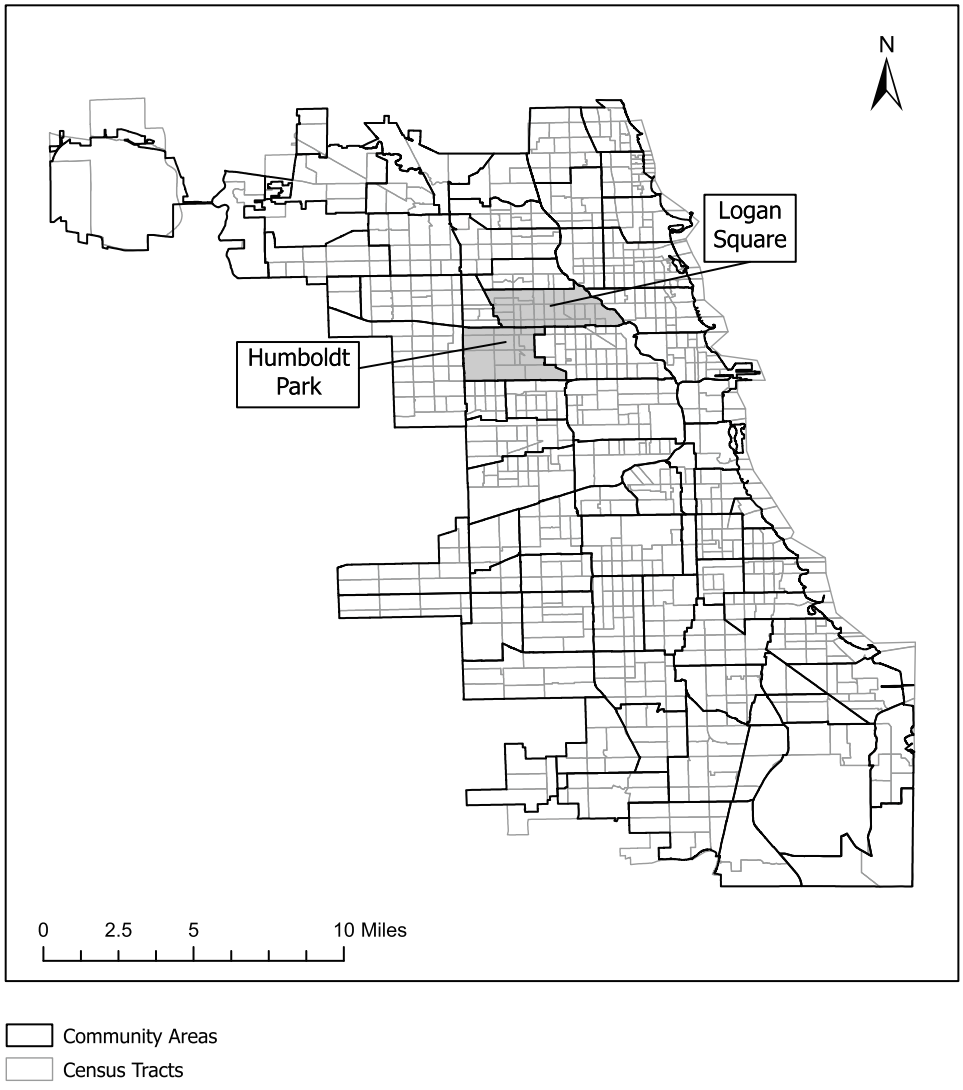

Fig. 1. Chicago's community areas and census tracts.

conversion of an abandoned railroad track into an elevated recreational trail that connected four neighborhoods on Chicago's northwest side, including the then predominantly Mexican, Cuban, and Puerto Rican community areas of Humboldt Park and Logan Square (Fig. 1). In the two years following the trail's 2013 groundbreaking, these two neighborhoods, which had lower-valued real estate markets, experienced a 48.2% increase in housing prices, compared to 13.8% in the majority White, higher-valued real estate markets along the trail and 23.4% across Chicago as a whole. Community members in these neighborhoods already had concerns around affordability and displacement (Smith et al., 2016). Additionally, Latine users of The 606 have reported feelings of exclusion and discrimination (Harris, Rigolon, & Fernandez, 2020; Harris, Schmalz, Larson, Fernandez, & Griffin, 2020).

In the present study, we sought to understand trends related to environmental gentrification across city neighborhoods and how key informants perceive its risk and impacts. We used mixed methods to understand broader citywide trends as well as local perceptions.

2. Methods

To examine how environmental gentrification may differentially affect populations in Chicago and explore people's perceptions about it, we used a mixed methods triangulation design convergence model (Creswell & Plano Clark, 2007). This research design involves collecting and analyzing quantitative and qualitative data independently and then comparing and contrasting the results in order to arrive at interpretations. Specifically, we examined quantitatively the relationship between green areas, brownfields cleanup, and indicators of gentrification in the city of Chicago. We also explored qualitatively how key informants perceive the risk and impacts of environmental gentrification. We then compared and contrasted these results. This design allows us to capitalize upon the strengths of quantitative (trends, generalizability) and qualitative (depth, nuance) methods.

2.1. Quantitative methods

To understand perceived relationships between environmental improvements and gentrification, we collected data on neighborhood demographics, green areas, and the cleanup of brownfields. We then calculated correlation coefficients between the percent change in demographic variables, percent change in green area, and the number of remediated brownfields over ten year periods. We did not use these demographic or environmental data to classify individual neighborhoods as gentrifying per se. Rather, we used the direct correlations between demographics and the two measures of environmental change to look for patterns that matched with the process of environmental gentrification described in Section 1.1 above.

Our analysis explores two definitions of neighborhood (Fig. 1). First, we used census tract boundaries determined by the U.S. Census Bureau. In 2010, Chicago census tract populations ranged from 0 to 11,309, with an average of approximately 3,400. Although census tracts have been used to report population data in the city since the 1920s, boundaries can change from decade to decade as the Census Bureau splits or aggregates tracts, depending on whether population is growing or declining in an area. We used boundaries based on the 2010 decennial census. Second, we used Chicago's 77 officially designated community areas (Keating, 2008). In 2010, community area populations ranged from 2,876 to 98,514, with an average of 34,654. Community area boundaries tend to align with tract boundaries in that nearly all tracts nest within a community area. Data on tract demographics came from 2010 and 2020 decennial censuses published by the Census Bureau. From these data we calculated percent changes between 2010 and 2020, $X_{2020}/Total_{2020} - X_{2010}/Total_{2010}$, where X is one of six demographic variables, including the number of Hispanic, Black and White residents, the number of persons below the poverty line, the number of households with children, and the number of households who rent, and $Total_{2020}$ is either total population or total households. The group Hispanic includes all race groups. The groups Black and White include non-Hispanic Black and non-Hispanic White individuals, respectively. We then used these data to calculate the community area demographic changes. Table 1 presents summary statistics of these variables.

We collected data on "green" areas using the National Neighborhood Data Archive, which reports land cover by census tract (Melendez et al., 2020). We defined green area as land cover classified as open space, forest, shrub, herbaceous, or wetland. We aggregated these land cover types and calculated the percentage change between 2005 and 2015. We offset the land cover from the demographic changes by five years because gentrification patterns residents and stakeholders interpret as linked (i.e. that environmental improvements cause the economic and demographic changes they observe) are likely driven by before-after comparisons that span many years. Residents could perceive their neighborhood demographics in 2020 (around the same time as our interviews) as the result of moves they observed or knew about since 2010, which they could attribute to amenity changes between 2005 and 2015. In addition to measuring green areas, we also generated an indicator for the tracts adjacent to The 606 trail. We included this indicator in the correlation analysis to examine whether demographics changed in surrounding neighborhoods following the construction of The 606 as commonly thought.

Finally, we collected data on the number of remediated brownfields in each tract. These data came from the Illinois EPA's Site Remediation Program (SRP), which provides technical assistance and certification to property owners that clean up brownfields. Owners receive a No Further Remediation (NFR) letter certifying that the property is no longer a threat to human health if they undertake remedial actions directed by the Illinois EPA or if no contamination is found. NFR letters are often necessary to secure financing and insurance to redevelop brownfields (Illinois Environmental Protection Agency, 2001). Properties receiving an NFR letter are typically less than an acre. We used the date and location recorded in NFR letters to determine how many brownfields were cleaned up in each tract between 2005 and 2015. During this time, tracts experienced an average of about one cleanup, with a range from zero to 13 (Table 1).

2.2. Qualitative methods

To explore how key informants perceive the risk and impacts of environmental gentrification, we interviewed 27 individuals between October 2019 and April 2020 whom we purposefully selected (Patton, 2002) because of their deep practical knowledge gained through professional and/or lived experience in one or more of these areas: community development, environmental justice, affordable housing,

Table 1
Summary statistics of percent change in select demographic variable between 2010 and 2020, as well as the percent change in green area, the presence of the 606, and the number of brownfield cleanups between 2005 and 2015 in Chicago census tracts.

Demographic change	Mean	St. Dev.	Minimum	Median	Maximum
Percent Hispanic residents	1.599	7.766	−26.514	1.346	35.292
Percent Black residents	−2.876	6.060	−37.522	−0.671	6.821
Percent White residents	−1.327	6.039	−19.229	−0.328	25.047
Percent in poverty	−4.225	9.113	−45.953	−3.733	37.669
Percent with children	−4.902	9.749	−39.606	−4.217	22.835
Percent that rent	1.730	9.591	−30.698	1.527	32.957
Green area	−0.130	0.387	−5.197	0.000	0.971
The 606	0.020	0.142	0.000	0.000	1.000
Cleanups	0.908	1.489	0.000	0.000	13.000

industrial development, public health, real estate finance, and urban planning. We recruited participants from across public, private, and community-based organizations and prioritized those working in communities experiencing environmental racism, rapidly gentrifying neighborhoods, or neighborhoods where flagship environmental improvements had recently occurred or been proposed. We also included some key informants whose work spanned across the city. We identified individuals through our professional networks, news media, or online research who met these sampling criteria and sent them up to three email invitations to participate in the study. In some instances, we followed up with a phone call. We used snowball sampling to identify additional participants by asking respondents to suggest others who met the study criteria. In all, we invited 48 individuals to take part in an interview of whom 27 agreed. Participants were compensated for their time with a $50 gift card. Most key informants lived in Chicago for over a decade, if not their entire lives. They worked in neighborhoods with varying socio-economic and real estate market characteristics, and they themselves held varied racial and ethnic identities (Table 2). Thus, they spoke to the interview questions from diverse standpoints.

During the interviews, as part of a broader conversation around land use in Chicago (Copic, Schusler, & Krings, 2020), we asked whether environmental gentrification is a concern in Chicago (for those with a citywide focus, such as urban planners) or their specific neighborhood (for those speaking about a precise community, such as environmental justice organizers) and why or why not. We also asked respondents to expound upon their experiences and observations associated with environmental improvements. Interviews occurred in person or by telephone and were audio-recorded with respondents' permission, transcribed, and imported into NVivo 12 (https://www.qsrinternational.com/).

Our analysis process began immediately following each interview through analytic memos written to document our initial interpretations. We also carefully analyzed each transcript through two iterative rounds of coding, categorizing, and constant comparison to identify themes across the interviews. We maintained an audit trail throughout the analytic process to document the evolution of our codebook. We identified two codes deductively based upon our research and interview questions: "Extent Concern about Environmental Gentrification" and "Perceived Impacts." Additional codes emerged inductively from the interview data (Patton, 2002). These included sub-codes under "Extent Concern …" for "Strong Real Estate Markets" and "Weak Real Estate Markets." Other inductively generated codes were "Environmental Gentrification Dilemma" and "Disinvestment" along with its sub-codes "Perceived Impacts" and "Precursor to Gentrification."

Table 2
Interview respondents possessed diverse racial or ethnic identities plus familiarity with distinct Chicago real-estate markets. Most had lived in Chicago for over a decade.

Self-identified race or ethnicity (grouped by U.S. census categories)	Number of respondents
Demographic characteristic	
Hispanic, Latine, Mexican or Mexican-American	12
White	7
Black, African-American or Ugandan-American	4
Mixed race or ethnicity	2
Asian or Indian-American	2
TOTAL	27
Real estate market where respondent lives or works*	
High-cost	3
Moderate-cost and high-cost	2
Moderate-cost	2
Lower-cost and moderate-cost	3
Lower-cost	9
Not applicable (respondent works city-wide)	8
TOTAL	27
Length of residency in Chicago	
Lifelong resident	16
11–20 years	7
2–10 years	4
TOTAL	27

* Based on designations by the City of Chicago in its 2019–2023 Housing Plan (City of Chicago, n.d.).

2.3. Assessing convergence

After members of our research team independently completed the quantitative and qualitative data analyses, we met on multiple occasions to compare and contrast those results. Below we note the findings that overlap and others that at first seem to contradict, but upon further examination help to illuminate some of the nuances of environmental gentrification.

3. Results

We next describe the quantitative correlations between green areas, brownfields cleanup, The 606, and the demographic indicators of gentrification followed by key informants' perceptions of environmental gentrification risks and impacts.

3.1. Quantitative correlations

The correlation analysis shows that brownfield cleanup and The 606 are associated with demographic changes consistent with environmental gentrification. Table 3 presents the correlation matrix based on tract-level changes while Table 4 presents the correlation matrix based on community area changes. The last three rows in these tables show correlations between demographic change, green area change, construction of The 606, and the number of cleanups. Correlations are generally small and close to zero in Table 3 except between The 606, cleanup, and two race variables. Construction of The 606 is significantly correlated with a decrease in percent Hispanic and an increase in percent White, while cleanup is significantly correlated with a decrease in percent Hispanic. There is also a significant negative correlation between these two groups—i.e. an increase in percent Hispanic is associated with a reduction in percent White and vice versa. Correlations are similar or slightly more pronounced in Table 4, including evidence of a significant positive correlation between cleanup and percent White. These patterns are consistent with concerns among community advocates in predominately Hispanic neighborhoods that environmental improvements are followed by move-in of predominantly White individuals and displacement of existing residents (see Section 3.2). There is also a significant negative correlation between changes in percent Black and White. However, neither cleanup nor The 606 are significantly correlated with a reduction in percent Black.

Aside from The 606 analysis, our results provide little evidence that increases in green area can shift neighborhood demographics from predominantly Black and Hispanic to White. The correlations between green area and the racial percentages are all close to zero in Table 3 and Table 4. These patterns suggest that changes in green area may not be strongly associated with gentrification patterns, at least those based on an influx of White households and displacement of minority households. Furthermore, there are no significant correlations between percent Black and any of the environmental amenity variables. The latter pattern aligns with a few statements made during our interviews that the effects of amenities on the risk of gentrification differ in predominantly Black than Hispanic neighborhoods in Chicago (see Section 3.4).

What about changes in other neighborhood demographics? Tables 3 and 4 provide mixed evidence that environmental amenities affect the composition of poverty status, presence of children, and percent of renters. There is a significant correlation between The 606 and a lower percentage of households in poverty; however, the amount of poverty is not significantly correlated with cleanups or increases in green area. These results suggest that, in Chicago, environmental improvements

Table 3
Correlations of demographic change (2010–2020), change in green area (2005–2015), the 606 (construction completed in 2015), and brownfield cleanups (2005–2015) across Chicago census tracts.

Demographic change	Hispanic residents	Black residents	White residents	Households in poverty	Households with children	Households that rent
Percent Hispanic residents	1.000					
Percent Black residents	−0.610*	1.000				
Percent White residents	−0.521*	−0.280*	1.000			
Percent in poverty	0.122*	0.094*	−0.250*	1.000		
Percent with children	0.003	−0.157*	0.221*	0.139*	1.000	
Percent that rent	−0.083*	0.017	0.070*	0.208*	0.013	1.000
Green area	−0.027	−0.005	0.024	0.009	0.002	0.015
The 606	−0.295*	0.040	0.312*	−0.083*	−0.019	−0.029
Cleanups	−0.070*	0.036	−0.014	−0.053	0.032	0.024

* Indicates correlation coefficient is statistically significant at 0.05 level.

Table 4
Correlations of demographic change (2010–2020), change in green area (2005–2015), the 606 (construction completed in 2015), and brownfield cleanups (2005–2015) across Chicago community areas.

Demographic change	Hispanic residents	Black residents	White residents	Households in poverty	Households with children	Households that rent
Percent Hispanic residents	1.000					
Percent Black residents	−0.464*	1.000				
Percent White residents	−0.577*	−0.367*	1.000			
Percent in poverty	−0.204	−0.050	−0.271*	1.000		
Percent with children	0.086	−0.305	−0.263*	0.154	1.000	
Percent that rent	−0.227*	0.220	−0.058	0.277*	−0.002	1.000
Green area	−0.029	−0.114	0.152	0.097	−0.012	−0.089
The 606	−0.290*	−0.111	0.387*	−0.147	0.043	−0.158
Cleanups	−0.299*	−0.083	0.252*	−0.103	0.178	−0.057

* Indicates correlation coefficient is statistically significant at 0.05 level.

have little effect on displacement of low-income households. Correlations between green areas, The 606, cleanup, and the percent of households with children are insignificant and generally close to zero. Correlations between the environmental amenity variables and the percent of renters are also statistically insignificant from zero, although all three correlations in Table 4 are negative, which would imply that neighborhoods with more environmental amenities tend to shift from renter to owner occupied housing.

3.2. Qualitative Perceptions: High concern about environmental gentrification

In reporting the interview findings, we include illustrative quotes. To provide context about each speaker's standpoint, we note the neighborhood they spoke about, their professional or volunteer role, and their race or ethnicity (in parentheses). The latter was self-identified; thus, descriptors are not always consistent.

Key informants who expressed the most concern about environmental gentrification referenced neighborhoods already experiencing gentrification to varying degrees: Logan Square, Pilsen, Little Village, and Albany Park. Populated largely by European immigrants from the late 19th to mid-20th centuries, these neighborhoods were predominantly immigrants from Latin America (and also Asia in the case of Albany Park) by the 21st century. At the time of this study, each was again transitioning in ethnic composition as gentrification occurred and all but one (Little Village) had become moderate or high cost real estate markets (City of Chicago, n.d.). In each, the creation of multi-use trails for biking and walking was recently completed (The 606 in Logan Square) or in progress (El Paseo Trail in Pilsen and Little Village, Chicago River Trail in Albany Park). A community organizer (Asian) in the multi-racial community of Albany Park explained:

> … there's a new river trail coming in … as these amenities are uplifted in Albany Park and the events surrounding them, you know, who are these events for? Definitely, I would associate that with gentrification, as a reason that people would move here, as something exciting to access, and also something that is now causing rents to go up, an amenity that is making it less viable for long-term residents to live here.

Key informants in these neighborhoods who engaged in community-based efforts to improve their local environments felt conflicted about the consequences. They discussed a paradox in that immigrants and working class residents who make their neighborhoods better through community gardens, business development, and the arts also make the neighborhood more appealing to gentrifiers. A community organizer (Mexican) in Logan Square said, "I'm just afraid of improving my neighborhood even more, because of what comes with it." The coordinator of a community garden in Pilsen (Mexican) shared: "It makes us feel like we are part of the problem, because we're beautifying … we're making it more attractive for developers and investors [but] greenspace shouldn't be an amenity; it should be a right." While these findings may initially appear to contradict our quantitative green area results, in each neighborhood where respondents expressed this dilemma, their local greening efforts had been eclipsed by city initiatives to develop linear trails (The 606, El Paseo Trail) or a high profile park (Big Marsh Bike Park). Several key informants felt that community advocacy for environmental amenities had been co-opted by city officials and real estate developers who used green amenities in branding to attract external investors, wealthier residents, and tourists.

Those who expressed concern that environmental improvements hasten gentrification feared the displacement of long-term residents through the loss of naturally occurring (i.e., unsubsidized) affordable housing as, for example, two- and three-flat buildings were converted into single-family homes. They also noted that even when *not* displaced, long-term residents can begin feeling like outsiders in their own community as fewer legacy businesses survive, social services for low-income people disappear, youth of color feel targeted for the policing of their behavior, and—in the words of a community-based developer (White)—"you start to lose the fabric of the community that people count on."

3.3. Qualitative Perceptions: Low concern about environmental gentrification

On the other hand, key informants living and/or working in neighborhoods characterized as lower cost real estate markets expressed concern not about gentrification but rather *disinvestment* driving displacement within these communities. "To be totally ignored and not invested in. I really think that's the worst scenario," said an environmental justice advocate (Hispanic) from a highly industrialized, multi-racial neighborhood. A community organizer (African-American) in a predominantly Black neighborhood explained:

> The driver that many people think of is not being able to afford an area. Sure, that's a huge piece but in the case of Englewood, we also have a lot of schools that have shut down … if your child has to travel X amount of miles to get to the closest open school and if you have the means, maybe you can relocate … Food is a huge piece, too. If you aren't able to access quality food or sustain yourself or feed your family, then you have to make decisions. Maybe we can't stay in this area … The list goes on as far as factors that contribute to displacement … environment and jobs … so many things contribute.

Multiple key informants reported that disinvestment in communities of color, most notably Black communities, has resulted in poor access to employment, education, transit, healthy foods, retail outlets, and other public and private services, which in turn leads some families to seek improved living conditions elsewhere.

3.4. Perceptions about environmental amenities within processes of displacement

The key informants who were most concerned about the prospect of environmental amenities contributing to displacement had experienced or observed changes in predominantly Hispanic neighborhoods consistent with environmental gentrification in real estate markets that had become moderate or high cost by the time of our study. However, they described environmental improvements within a *matrix* of factors – such as access to transit and proximity to employers, health care providers, schools, and grocery stores – that attract wealthier and often White residents to gentrifying communities. A few respondents also suggested that social stigmas grounded in racial prejudice affect the perceived desirability of Chicago neighborhoods. An urban planner (Mexican-American) observed, "Latinos are basically the buffer between White people and Black people. And so White people are just more hesitant to move into primarily Black neighborhoods."

Key informants in Black or multi-racial communities with low cost real estate markets were not concerned about environmental gentrification in the near term. Rather, they identified disinvestment as a primary threat to the stability of their communities and would welcome investment to clean up contaminated sites or convert vacant lots to other desirable uses. Yet, some worried that environmental improvements could catalyze gentrification over a longer timeframe. For instance, the community organizer who described how disinvestment has driven displacement in the Black community of Englewood (see Section 3.3) also explained, "A lot of the land that is vacant is owned by people who don't live in the community … The owners of the parcels of land are waiting for the neighborhood to become more economically viable and to be more profitable and then they'll do something with that piece or sell." She identified environmental amenities as having potential to catalyze gentrification in the future: "We have a 1.5 or so mile abandoned elevated train line that has been unused for maybe 30 years similar in nature to The 606 before it was developed. I know a lot of neighborhood residents are like, 'Okay, what's going to be done with this? How will that impact us and our community?'" Other key informants in disinvested communities expressed concern about environmental gentrification over a long-term time period if highly contaminated former industrial sites along the lakefront were to be cleaned up and transformed into parks or other recreational uses per proposals for mixed used redevelopment.

4. Discussion

Greater pollution exposure and fewer environmental amenities within low-income communities and communities of color contribute to lower quality of life outcomes for residents; yet, contamination cleanup and urban greening—whether led by community organizations, external non-profits, developers, or city governments—can reproduce social injustices if these improvements in environmental quality initiate or hasten gentrification. Using mixed methods, we investigated whether quantitative indicators are associated with environmental amenities (brownfields cleanup, increased green areas) in the City of Chicago and how key informants from relevant fields (e.g., environmental justice, housing affordability, community development) perceived the risk and impacts of environmental gentrification. Our results suggest that environmental gentrification in Chicago may be occurring mainly in association with two situations: (1) cleaning up abandoned industrial and commercial properties in neighborhoods with larger numbers of Hispanic residents and (2) recreation-oriented greening projects that become a focal point for development. Our results also suggest that displacement in some communities is driven by disinvestment rather than gentrification.

The quantitative analysis focused on three types of environmental improvements: brownfields cleanup, green areas, and a major rail-to-trail linear park known as The 606. We expected that these improvements would correlate with demographic changes associated with gentrification and displacement of vulnerable residents. Our correlation analysis showed that cleanups and the location of The 606 are both statistically associated with decreases in percentage of Hispanic residents and increases in percentage of White residents, though not in the percentages of Black residents, households with children, nor renters. The 606 alone is associated with decreases in the percent of households in poverty. Aside from The 606, we found no evidence that an increase in green area correlates with demographic changes consistent with gentrification. The qualitative analysis also indicated that respondents perceive the greatest risk of environmental gentrification in predominantly Hispanic neighborhoods and around high profile trail projects, such as The 606, El Paseo Trail, and the Chicago River Trail.

Previous research provides insight into the processes that might be shaping some puzzling statistical associations, including why Hispanic residents appear more likely to move away following a brownfield cleanup as compared with Black residents. Hispanic residents might experience brownfields cleanup as a greater risk factor for displacement as compared with Black residents because, as some of our interview respondents suggested, racial stereotypes lead White residents to feel more comfortable moving into Hispanic communities. Support for this explanation can be found in Anderson and Sternberg's (2012) study comparing the gentrifying Chicago neighborhoods of Bronzeville (predominantly African-American) and Pilsen (predominantly Mexican and Mexican-American). Reporting non-White gentrification in Bronzeville and an influx of White newcomers into Pilsen, they suggest that "negatively charged conceptions of Black poverty" foster fear of Black neighborhoods while more positive conceptions of Hispanic neighborhoods encourage their "ethnic consumption" by non-Hispanic consumers and investors.

Our quantitative findings regarding brownfield cleanups align with a nationwide assessment that found statistically significant White population increases and Latino population decreases, but no Black population change, following brownfield redevelopment (Becerra, 2022). However, they differ from another national study that reported both Black and Latino displacement following brownfield cleanups (Essoka, 2010). Our results also are consistent with previous research on residential mobility and brownfields cleanup in Chicago, which found that White households are significantly more likely to move into

neighborhoods with brownfield cleanups and a large share of Hispanic residents compared with Black residents. However, that study also found that environmental improvements in Chicago contribute to displacement of Black residents (Melstrom, Mohammadi, Schusler, & Krings, 2022), a pattern that may be hidden and underappreciated in our correlation analysis (as opposed to a causal analysis; see Section 4.2). Although environmental gentrification pressure in Black neighborhoods appears to be less intense citywide, exceptions may exist in specific situations or over longer time periods. For example, in the Black neighborhoods of Woodlawn and South Shore, residents concerned about gentrification in conjunction with construction of the Obama Presidential Center in Jackson Park have advocated for a Community Benefits Agreement designed to help protect housing affordability (Quig, 2022). Future research should more explicitly examine the racialized processes through which environmental improvements might contribute to gentrification.

Another puzzling question raised by our results is why cleanups correlate with race and ethnicity but not poverty. Neither brownfield cleanup nor an increase in green area was correlated with the displacement of the lowest income residents—i.e. households in poverty—a finding inconsistent with the conventional understanding of gentrification. This does not mean that displacement is not occurring. It is possible that changes in environmental amenities contribute little to changes in the percentage of households in poverty because moving and displacement in this group may already be high in many areas. However, that cleanups correlate with race and ethnicity but not poverty reinforces that environmental gentrification is an intersectional problem extending beyond income inequality.

Similar to other research in Chicago examining green space and indicators of gentrification (Stulmacher et al., 2022), we found no significant demographic changes correlated with increased green area. Only in the analysis of The 606 did we find a statistically significant increase in percentage of White households and decreases in percentage of Hispanic households and households in poverty. Key informants who worried about environmental gentrification spoke about The 606 and other high profile projects that involved repurposing abandoned lands for recreational use, which they perceived as designed to benefit users outside of the neighborhood and attract newcomers to it. Our quantitative results regarding green area contradict a simplified explanation of environmental gentrification but are consistent with other studies noting that the risk of greening spurring gentrification varies with the project's type (e.g., function, ownership, accessibility) and the presence of other facilitating neighborhood factors (Anguelovski, Connolly, Masip, & Pearsall, 2018; Pearsall & Eller, 2020; Rigolon & Németh, 2020; Stuhlmacher, Kim, & Kim, 2022). Future research should continue to examine the contextual conditions that enable environmental gentrification to occur.

Finally, displacement pressure can result from gentrification, but our interviews revealed that displacement pressure is also present in non-gentrifying communities. Many of our key informants had observed residents in their communities moving due to decades of disinvestment. According to Elevated Elevated, 2018, "historic patterns of racialized disinvestment are causing depopulation and displacement, particularly of African American residents, who leave their neighborhoods and relocate, sometimes outside of the city or state, in search of greater safety and access to opportunities and services" (p. 4). This raises important implications for the timing of anti-displacement interventions (see Section 4.1).

4.1. Implications for urban planning and public policy

Our results suggest the need for context-specific, proactive approaches to ensure that efforts to improve environmental quality do not reproduce racial inequities. Key informants' concern about the risk of environmental gentrification varied depending on whether they referred to a gentrifying or currently disinvested neighborhood; yet, in both contexts, respondents had observed displacement from their communities. Whereas gentrification can price people out of their community or alter the community's social fabric so dramatically that people no longer feel welcome, disinvestment also can drive displacement as residents move in search of improved infrastructure, public services, and safety. Key informants from disinvested neighborhoods called for multiple forms of investment, including in schools, businesses, health care, infrastructure, and environmental cleanup. On the other hand, respondents in gentrifying neighborhoods where such investments were underway reported displacement catalyzed by those investments. Some described direct experiences with environmental gentrification and many spoke about environmental improvements as one form of investment within a matrix of factors contributing to gentrification. These results highlight the need to recognize dynamics between disinvestment and gentrification. Disinvestment can create conditions that support market speculation and profit-oriented (versus community-oriented) investment, thereby encouraging gentrification over a longer time span. Anti-displacement interventions are needed long before gentrification begins.

In addition to highlighting the need for proactive, early interventions, our results also provide evidence that programs or policies to prevent environmental gentrification will require multi-pronged, equity-focused strategies (Copic et al., 2020). The lack of a strong association between environmental amenities and changes in the number of households in poverty suggests that policies focused on income disparities and housing affordability may not fully address gentrification problems. Moreover, that brownfields cleanup correlates with some ethnicity and race groups suggests that avoiding environmental gentrification will require attention to racial equity. Environmental justice organizers, environmental planners, landscape architects, ecologists, and others working to clean up contamination and promote urban greening can draw upon research that has examined strategies for improving environmental quality without displacement. Rigolon and Christensen (2019) studied parks-related anti-displacement strategies in U.S. cities. Oscilowicz et al. (2021) studied urban greening in Western European, Canadian, and U.S. cities to identify policies, planning mechanisms, and financial instruments that can reduce displacement pressures. Both research groups recommend planning for anti-displacement strategies early, ideally before gentrification takes hold, and using a mix of context-specific policies and programs that integrate, for example, environmental improvements, affordable housing, small business support, and job training. They advocate community engagement and collaboration across sectors. Oscilowicz et al. (2021) further encourage planners to take into account the historical and contemporary context of injustice within local communities and related, on-going power asymmetries that exist within and between communities, government agencies, and non-governmental organizations. Future research should examine further the racialized nature of these dynamics and whether and how anti-displacement interventions associated with environmental improvements can help to disrupt power asymmetries and advance environmental justice.

4.2. Study limitations

Our quantitative findings showed that gentrification followed some environmental amenity changes (brownfields cleanup) but not others (increased green area). However, because our green area variable came from satellite data, we could not differentiate characteristics of the green area, such as usability or accessibility. The correlation analysis for green area might differ were data available to discern changes in not only quantity but also quality of green area. Furthermore, our analyses do not identify causal relationships. Chicago neighborhoods appear to have shifted from Hispanic toward White residents following brownfields cleanup and construction of The 606, but we cannot tell if cleanups and The 606 caused this shift. We also cannot be certain that, due to a lack of correlation, Black population is unaffected by any environmental

amenity changes, or that other neighborhood demographics are unaltered by changes in green area. It is not possible to draw *ceteris paribus* conclusions because other neighborhood characteristics can affect demographics. While we could control for these other characteristics in our quantitative analysis using multiple regression methods, causal analysis was not the goal of our study, which focused on perceptions around environmental gentrification, environmental amenities, and the demographics that people can observe in Chicago communities. This likely explains why prior research using multiple regression analysis finds environmental improvements in Chicago can contribute to displacement of Black residents (Melstrom, Mohammadi, Schusler, & Krings, 2022), a pattern that our correlation analysis and interviews suggest may be hidden and underappreciated relative to gentrification risks in Hispanic neighborhoods. Thus, causal analysis plays a crucial role in understanding environmental gentrification and should remain an area of ongoing research.

Our qualitative results expand upon and add nuance to the quantitative findings; however, our purposive sample does not provide generalizable results about public opinion. Because our sampling approach included respondents throughout Chicago, they do not capture the complexity surrounding environmental quality, disinvestment, gentrification, and displacement in specific neighborhoods but rather illuminate broad themes that arose across neighborhoods. The results also reflect key informants' perceptions at a single point in time, although processes of environmental and neighborhood change are dynamic and individuals' perceptions may shift as conditions evolve.

Despite the limitations within our quantitative and qualitative findings, the mixed methods design allows us to capitalize upon the strengths of each. Our results suggest that the risk of environmental gentrification in Chicago is greatest in association with brownfields cleanup in predominantly Hispanic neighborhoods or in association with high profile, recreation-oriented, greening projects that become a focal point for development. Several key informants also perceived disinvestment as a key driver of displacement from communities of color in Chicago. These results add to a growing body of evidence that indicates the need for environmental professionals and advocates to give more attention to equity considerations when planning and implementing environmental improvements in cities.

5. Conclusion

Communities of color are more likely to be exposed to environmental pollution and have less access to environmental amenities, such as green spaces, than neighborhoods that house more affluent or White residents. Yet, environmental improvements to clean up pollution and/or create parks, gardens, or trails can contribute to gentrification, displacing or excluding vulnerable groups. Using mixed methods, we investigated environmental gentrification and perceptions about its risks in the city of Chicago. We statistically examined the association between green areas, The 606 trail, brownfields cleanup, and indicators of gentrification. We also interviewed key informants about their perceptions around the risk of environmental gentrification and its impacts.

The quantitative analysis found statistically significant correlations between brownfield cleanups and decreases in percent Hispanic population and increases in percent White, but not changes in percent Black residents, the poverty rate, percent of households with children, or percent renters. Similarly, the analysis turned up correlations between the location of a new elevated recreational trail (The 606) with decreases in percent Hispanic and increases in percent White. Correlations between green area and demographics were generally low and insignificant. These associations suggest that environmental gentrification may be occurring in predominantly Hispanic neighborhoods and that the displacement of Hispanic households is not due solely to family status, income, or housing tenure. Key informants whom we interviewed described experiencing the impacts of environmental gentrification within Hispanic neighborhoods and feeling conflicted about working to improve the quality of their local environment while fearing gentrification, displacement, and exclusion of Hispanic residents. The qualitative findings also may help explain why an increase in environmental amenities is not associated with a decrease in the share of Black residents. Interview respondents described that disinvestment in predominantly Black neighborhoods, as well as one racially mixed community, has driven people to move away seeking a higher quality of life elsewhere. While gentrification is a concern in some Black neighborhoods, environmental improvements are not perceived to be a contributor. Rather, in many Black neighborhoods, poor environmental health, business closures, school closures, crumbling infrastructure and crime are thought to drive displacement. These results highlight that interventions to prevent environmental gentrification will need to be context-specific, equity-centered, multi-faceted, and ideally occur early on within disinvested communities before gentrification takes hold.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

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