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Research Paper

Care and safety in neighborhood preferences for vacant lot greenspace in legacy cities

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HIGHLIGHTS

- Microscale landscape elements affect maintenance requirements for vacant lots.
- Microscale landscape elements affect perceptions that underpin well-being.
- Perceived care strongly relates to preference and explains the effect of perceived safety.
- In a legacy city, tree planting is less preferred than low-growing flowering plants with turf.
- Mown turf alone requires less maintenance and is preferred over untended vacant lots.

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ABSTRACT

We conducted a post-construction survey of neighborhood preferences for street scale urban greenspace designed as green stormwater infrastructure (GSI) on vacant residential lots in Detroit, a city where greenspace has potential to address structural inequities that characterize legacy cities and affect well-being. We investigated residents' preferences related to their perceptions of microscale elements: immediately perceptible fine grain landscape characteristics of plants, landform, water, and structural materials. Our results suggest that microscale elements affect residents' perceptions of care and safety, which are strongly related to preferences for landscape treatments on vacant lots near their homes. For each of two replicate pilot sites, we developed 15 alternative landscape treatments (including a control vacant lot). Across treatments, we varied microscale elements that could act as cues to care (CTC) or cues to safety (CTS). In a survey of all households within 250 m of the two sites, we measured residents' perceptions of and preferences for alternative treatments. Among CTC, regular mowing was essential to preference, and low-growing shrubs and forbs with prominent flowers characterize the most preferred treatments. A CTS, bollards separating vacant lots from public access, were preferred for most treatments. Lots planted with many trees were preferred by a smaller percentage of residents, and their perceptions of care were less related to their preference. Overall, preferences are more well-explained by perceived care than by perceived safety. Furthermore, perceived care explains the effect of perceived safety on residents' preferences for vacant lots near their homes.

1. Introduction

1.1. Study overview

In many legacy cities, deindustrialization, racist housing policies, and years of disinvestment have contributed to depopulation, with poverty and property vacancy disproportionately affecting disadvantaged residents in some neighborhoods (McClure et al., 2019). In these neighborhoods, residents' experiences with vacant property may undermine their own well-being, personal safety and property values (Sivak, Pearson, & Hurlburt, 2021). Greening of vacant lots may promote well-being and contribute to addressing structural inequities in greenspace quality and access (South, Hohl, Kondo, MacDonald, & Branas, 2018; Kondo, Fluehr, McKeon, & Branas, 2018; Williams, Logan, Zuo, Liberman, & Guikema, 2020; Woolf, 2017). However, maintenance to ensure that vacant lots are well-cared-for is challenged by budgetary

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limitations of legacy cities (Nassauer & Raskin, 2014). Neighborhood residents, who may themselves experience financial stress, often take on basic maintenance of nearby vacant lots (Sampson et al., 2017).

Addressing the perceived care and safety of vacant lots and the need for their maintenance, we initiated a transdisciplinary greening project in the legacy city of Detroit, MI, USA. The project brought the resources of the local water utility to bear on vacant lot maintenance because we designed vacant lots as greenspace that functions as green stormwater infrastructure (GSI) (Nassauer et al., 2019), helping the water utility meet legal requirements to manage urban stormwater under the US Clean Water Act (Detroit Water and Sewerage Department (DWSD), 2017). In our project, we developed and tested multi-functional GSI that was designed to be maintained by the water utility while also improving neighborhood residents' perceptions of care and safety of vacant lots in their neighborhoods. Conducting this action research, we aimed to generate knowledge generalizable to other legacy cities where residents experience inequities in greenspace opportunities, and where trade-offs between neighborhood residents' well-being and maintenance requirements of greenspace are considered.

Past research on residents' experiences of vacant property has focused on relationships between greening and safety as indicated by crime rates (e.g., Branas et al., 2018; Heinze et al., 2018), and related to mental health (South et al., 2018). Consistent with a large literature suggesting that greenspace affects well-being (e.g., Hartig, Mitchell, de Vries, & Frumkin, 2014; Raymond et al., 2017; Twohig-Bennett & Jones, 2018; van den Bosch & Sang, 2017), Sivak et al. (2021) found vacant lot greening improved health in 73% of studies reviewed. Moreover, most of these studies specifically associate vacant lot greening with health benefits. However, no studies have experimentally varied microscale elements of greening to specify their relationship to perceived care and safety, and none of the studies has explicitly varied microscale elements based on their different maintenance requirements. To support decision making by residents and practitioners, we examine microscale characteristics with different maintenance requirements to learn how they affect residents' perceptions of care and safety in their neighborhoods.

1.2. Microscale greenspace effects

Greenspace effects are not equitably distributed among urban residents, and more study is needed, especially at the scale at which residents experience their neighborhoods (Hunter et al., 2019; Keeler et al., 2019; Williams et al., 2020; Woolf, 2017). These experiences may affect aspects of residents' psychological health (Bratman et al., 2019; Collins et al., 2020), physical health (Deng et al., 2020), and social cohesion (De Vries, Van Dillen, Groenewegen, & Spreeuwenberg, 2013; Skogan, 2015). Further, many greenspace metrics do not directly measure experience, and some classify vacant land as greenspace (Ekkel & de Vries, 2017; Nordbø, Nordh, Raanaas, & Aamodt, 2018; Sivak et al., 2021; van den Bosch & Sang, 2017). Results of greenspace and well-being studies that employed remote sensing (e.g., Wheeler et al., 2015), and more recently, Street View and social media (e.g., Xiao, Wang, & Fang, 2019) have varied. These measures may assume that more accessible greenspace is experienced more often, but they do not measure the quality of the experience.

Such studies may overlook microscale elements, which directly affect the experience of residents (Collins et al., 2020; Keeler et al., 2019; Root, Silbernagel, & Litt, 2017). For example, microscale elements affect human comfort (e.g., Zölch, Maderspacher, Wamsler, & Pauleit, 2016) and some aspects of mental and physical health (Chalmin-Pui et al., 2021; Deng et al., 2020; Huang, Yang, Jane, Li, & Bauer, 2020; Li, Deal, Zhou, Slavenas, & Sullivan, 2018). Raymond et al. (2017) identify the microscale as the scale of neighborhood and street, within a hierarchy of landscape extents that are necessary to assessing effects of nature-based solutions. In this study, we define microscale elements as: immediately perceptible fine grain landscape characteristics of plants, landform, water, and structural materials. These are fine grain characteristics of landcover that vary in structural materials, plant species abundance and diversity, vertical structure, and patch and matrix patterns. Importantly, they constitute residents' everyday experiences of yards, gardens, streets, parks, and neighborhoods.

Microscale elements that reflect local social and cultural norms for neighborhood landscapes that connote care, neighborliness, and safety may be particularly relevant to restoring neighborhood characteristics that have been undermined by vacancy (Gobster, Rigolon, Hadavi, & Stewart, 2020; Krusky et al., 2015; Li & Nassauer, 2020; Nassauer & Raskin, 2014; Stewart et al., 2019; van den Bosch & Sang, 2017). Further, neighborhood experiences of greening that support well-being may be of proportionally greater importance for communities affected by structural inequities including safety risks or limitations on travel to more distant greenspace experiences (Keeler et al., 2019; Mitchell & Popham, 2008; Root et al., 2017; Roux, 2016; South et al., 2018; Williams et al., 2020).

1.3. Cues to care and cues to safety

Cues to Care (CTC) are microscale elements that are "immediately recognizable as designed, and that signal continuing human presence to care for a landscape" (Li & Nassauer, 2020). We define Cues to Safety (CTS) as microscale elements that are immediately recognizable as promoting the safety of people or nearby property.

CTC contribute to a sense of orderliness, and may promote perceptions of a place as both well cared-for and safe (Nassauer & Raskin, 2014). In contrast, cues to physical disorder have been shown to undermine perceptions of safety, and, in some studies, are associated with higher crime rates (Branas et al., 2018; Sampson & Raudenbush, 2004; Skogan, 2015). Both CTC and their opposite, cues to physical disorder, have been widely examined in many contexts (Li & Nassauer, 2020). In this study, we investigated perceptions of the following CTC elements: trees, shrubs and forbs with prominent flowers, regularly mown turf; and we include these cues to physical disorder or neglect: unweeded flowers and shrubs, and infrequently mown turf.

Related to the CTC in our study: Trees have been found to be preferred in many but not all residential contexts (Kronenberg, Łaszkiewicz, & Sziło, 2021). Trees that obscure sight lines may be perceived to undermine safety (Harvey, Aultman-Hall, Hurley, & Troy, 2015; Hong et al., 2018). Further, maintenance and safety concerns have been identified as reasons that residents did not desire trees in several legacy cities including Detroit (Carmichael & McDonough, 2018; Mattocks, Meyer, Hopkins, & Cohen-Callow, 2019; Troy, Grove, & O'Neil-Dunne, 2012), and Chicago (Gobster et al., 2020; Heckert & Kondo, 2018). Similarly, maintenance to keep shrubs trimmed to a height that does not obscure sight lines has been assumed to affect landscape perceptions in studies in several legacy cities (Hur & Nasar, 2014; (Krusky et al., 2015); Troy, Nunery, & Grove, 2016). In wide-ranging contexts including legacy cities, both mown turf and flowers consistently have been found to connote good care, and weeds to connote neglect (Hur & Nasar, 2014; Li & Nassauer, 2020; Nassauer & Raskin, 2014; Skogan, 2015; Troy et al., 2016). Colorful flowers have been found to be preferred in urban landscapes internationally (Avolio, Blanchette, Sonti, & Locke, 2020; Chalmin-Pui et al., 2021; Hoyle, Hitchmough, & Jorgensen, 2017; Ramer et al., 2019).

Related to CTS in our study: Some safety concerns for GSI relate to stormwater management functions. These include concerns about insect-borne diseases associated with standing water and drowning hazards exacerbated by steeply sloped GSI stormwater practices (National Research Council, 2008; Sivak et al., 2021). Other safety concerns arise from vacancy. These are: concerns for areas obstructed from view, which are associated with illegal activities and fears for personal safety; concerns about vehicles entering vacant lots for dumping of debris and garbage, and concerns about informal gatherings on vacant lots near private homes (Nassauer & Raskin, 2014; Sivak et al., 2021). In this study, to protect the community, we designed all treatments to meet concerns related to stormwater management and unobstructed views. We investigated perceptions of one CTS, a barrier adjacent to the sidewalk to prevent unsanctioned vehicle entry and discourage informal gatherings.

1.4. Research questions

We wanted to learn about residents' vacant lot preferences and perceptions for CTC and CTS elements that had varying maintenance requirements, including vacant lots that received little or no maintenance. We investigated whether residents' perceptions of care and safety were affected by variation in CTC and CTS microscale landscape elements, and whether their perceptions related to their preferences for implementing alternative treatments in a vacant lot near their own home.

In this paper, we address the following research questions:

1. Do specific CTC and CTS affect preference?
   - Are treatments that include more microscale CTC (flowery forbs or shrubs, trees, turf) preferred over other treatments with fewer CTC?
   - Are treatments that include microscale CTS (bollards) preferred over other treatments?
   - Does the presence of CTS differentially affect preference for treatments with different CTC?
2. Do perceived care and perceived safety affect preference for treatments with different CTC and CTS?
   - Does greater perceived care affect preference for treatments?
   - Does greater perceived safety affect preference for treatments?
   - Does perceived care differentially affect preference for treatments incorporating more microscale CTC, or incorporating a CTS?
   - Does perceived safety differentially affect preference for treatments incorporating more microscale CTC, or incorporating a CTS?
3. Do relationships between perceived care and safety of different CTC and CTS treatments help to explain treatment effects on preference?
   - Does perceived care explain the effect of perceived safety on preference?
   - Does perceived care or perceived safety explain preference for treatments with bollards, a CTS?
   - Does perceived care explain why specific CTC treatments are more preferred than others?

2. Methods

2.1. Collaborative design process

We employed a design-in-science approach in which researchers, practitioners, and community members worked together in an iterative process to develop and refine alternative experimental treatments for GSI on vacant residential lots in Detroit, MI, USA (Nassauer & Opdam, 2008). In our transdisciplinary research team, researchers from design, planning, engineering, law, social science, and natural science disciplines collaborated with decision-makers of the Detroit Water and Sewerage Department (DWSD), the water utility for the City of Detroit; the Detroit Land Bank Authority (DLBA), which owns thousands of vacant residential properties in the city; City of Detroit departments with responsibility for planning, development, and housing; and leaders of community and neighborhood residents' organizations. In addition, members of the City of Detroit Department of Neighborhoods (DN) and Department of Public Safety (DPS) advised this project (Nassauer et al., 2019). The team included local community members throughout the research process.

2.2. Study areas

We selected two study areas to construct replicate GSI treatments within the catchment of the Upper Rouge Tributary of the Detroit River, which had been prioritized for GSI implementation (Fig. 1). Each study area had majority black populations and a majority of households with incomes below $25,000/year (classified by the US Department of Health and Human Services as below poverty level for a 4-person household).

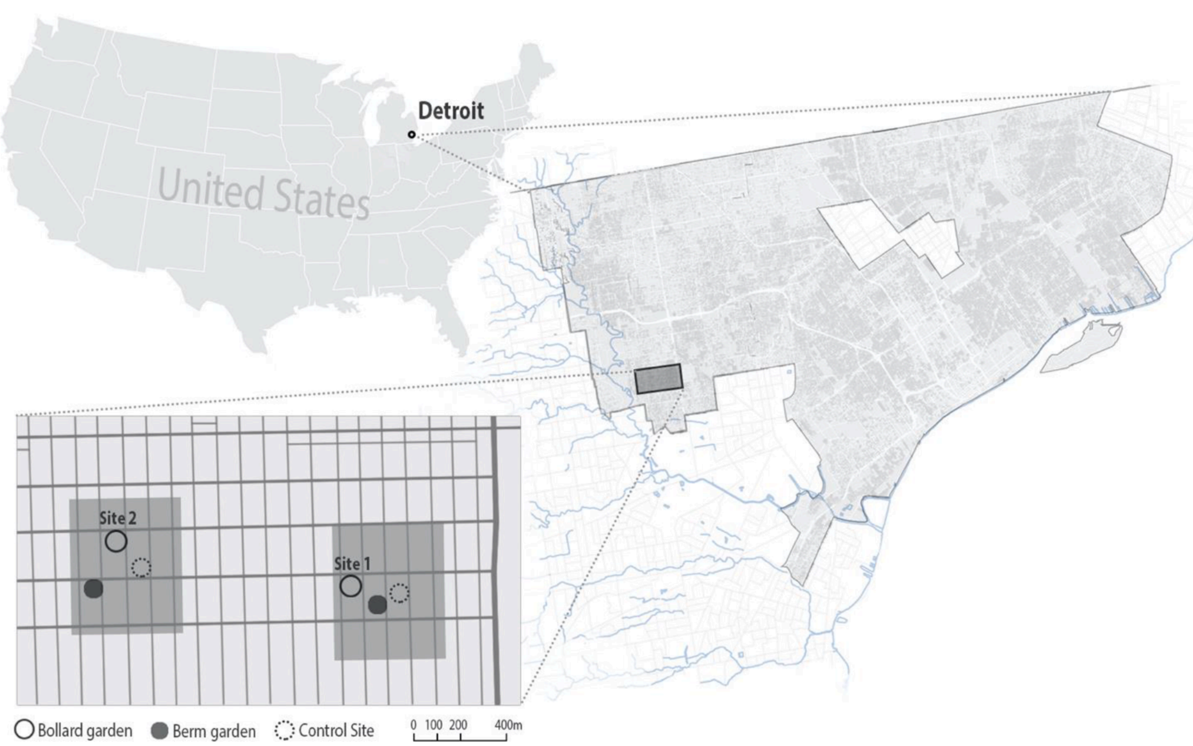


Fig. 1. Study areas for construction of pilot sites and post-construction survey of nearby residents.

Using American Community Survey data (Census Bureau, 2011), we controlled for median household income across study areas. Each was characterized by occupied homes mixed with vacant properties. Leonard (2018) investigated property vacancy within both study areas, and found that 78 properties (11%) became abandoned or vacant between 2013 and 2017, increasing overall vacancy from 31% to 39%. Between 2000 and 2010, population fell by 16.5% in the broader neighborhood (25 census block groups) (Census Bureau, 2000, 2010).

We set study area boundaries >2415 m apart to reduce the likelihood of spillover effects of treatments across study areas. As part of site selection, the possibility of constructing GSI on each site was vetted with nearby neighbors by the DLBA and the DN. Within each study area, our team constructed two different GSI designs on two pilot sites operated by the DWSD. Each pilot site consisted of two adjacent vacant residential lots owned by the DLBA. A control vacant lot was also selected within each study area. To increase the likelihood that surveyed residents would be familiar with pilot sites, study areas were delineated approximately 250 m from a centroid point between pilot and control sites.

2.3. Experimental treatments

We designed alternative treatments in two stages. First, we designed alternative treatments for construction as replicates in the two study areas, and our team constructed replicates of the two different treatments on four pilot sites in each of the two study areas in 2015. Each alternative included the same CTC (flowery forbs, flowery shrubs, and mown turf), but a different CTS (either bollards or a flowery berm as a barrier between the sidewalk and the vacant lot to prevent unsanctioned vehicle entry and discourage informal gatherings).

All alternatives allowed open pedestrian sight lines across and into the site. This was achieved by choosing plants that would not obstruct sight lines into and across the site. In treatments with canopy trees, obstructed sight lines were minimized by placing trees in regularly spaced rows. All alternatives managed stormwater in the same way with the same bioretention capacity. They addressed safety concerns by avoiding standing water or steep slopes. (Nassauer et al., 2019).

In the second stage, we revised the designs based on discussion within our transdisciplinary team and feedback from community members. As we gained experience with the constructed sites, team members expressed concerns about maintenance costs of CTC elements in the designs. Community members expressed safety concerns about the berm barrier, which obstructed sight lines from passing cars into the site. Moreover, they expressed a preference for bollards as a barrier. We addressed these concerns in second stage designs, which we report on here. These seven alternative treatments varied in CTC and maintenance requirements, and were presented with or without bollards as a CTS. These were compared with the control vacant lot.

For the survey in this study, we used the replicate bollard pilot sites in each of the two study areas (Fig. 2) as base images for highly realistic visualizations of alternative treatments (Fig. 3). To answer our research questions, our factorial design varied CTC with different maintenance requirements among treatments, and with or without a CTS (bollards) for each CTC treatment (Fig. 3).

2.4. Survey method

We conducted a census survey of all occupied households within our study areas two years after construction. Using a combination of parcel and occupancy data (Detroit, 2014) and Google maps we identified all parcels located within our study areas that were likely occupied. Then we mailed invitations to all those households and adjusted our estimate of occupied households based on postal returns. Our final area frame (N = 399) included households that had appeared to be vacant, but where our trained interviewers, who were current or past Detroit residents, used their local knowledge to identify signs of occupancy. They attempted to survey each household at least three times over eight months. Reasons for non-response included no person home, no person over the age of 18 home, and verbal refusal (e.g., not interested, do not have time). Interviewers conducted a 30–40 min interview with an adult (18 or older) in each participating household. Each participant received a US $25. gift card. The survey and protocol were reviewed and approved by the University of Michigan Institutional Review Board. Response rate for this survey was 43.0% (N = 171/399). Power analyses (Coffey, 2010) conducted prior to administration of the survey indicated a sample of at least 160 would be sufficient for detecting significant effects when exploring associations between treatment alternatives, perceptions, and preferences.

2.5. Measures

The survey included residents' demographic and health characteristics, time in and perceptions of their neighborhood, familiarity with pilot sites, and perceptions of alternative treatments as shown on a glossy color print (28 × 43 cm). Of the 15 alternatives for their study area (Fig. 3), each respondent was shown ten prints: seven randomly-assigned treatments, two existing treatments in their study area, and the control site. To minimize the potential for respondent fatigue or treatment ordering to affect responses, prints were randomly ordered within four different sets, and respondents were randomly assigned to one of four sets. Each print was shown as long as needed for the respondent to reflect and provide a response; there was no time limit.

- *Perceived care* was measured as a 3-item mean composite scale. Respondents indicated each treatment's apparent attractiveness, neatness, and care on 5-point Likert scales (e.g., unattractive, somewhat unattractive, neither unattractive nor attractive, somewhat attractive, attractive). Due to skewed distributions toward the higher (positive) end of the scales, items were recoded to 3-points prior to

Fig. 2. Existing bollard pilot sites as they appeared in 2019, four years after construction.

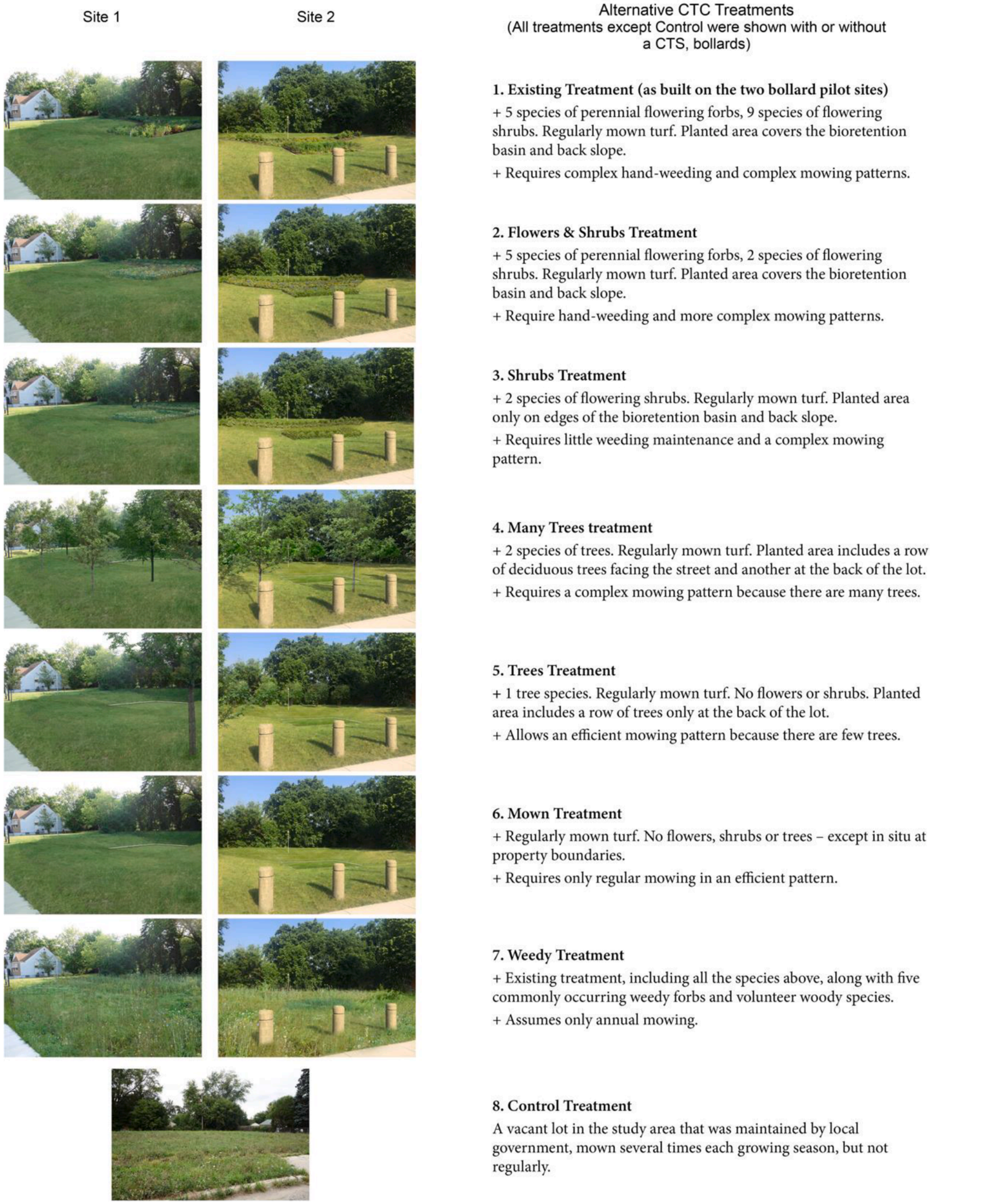


Fig. 3. Alternative treatments as represented in survey visualizations, in which each treatment was shown with and without bollards. Respondents viewed treatments as they would appear on the pilot site in the study area where they lived. Treatments are numbered in order, with higher numbers requiring less maintenance and having fewer CTC. Plant species selections are given in Appendix 1.

scale creation (e.g., 1 = unattractive/somewhat unattractive/neither; 2 = somewhat attractive; 3 = attractive). Collapsing Likert scale response categories is recommended over modeling sparsely distributed data in order to obtain more accurate parameter estimates and standard errors (DiStefano, Shi, & Morgan, 2021). Cronbach's alpha for the scale with the final analytic sample excluding Weedy and Control treatments (N = 1253) was 0.84.

- *Perceived safety* was measured with a single item on a similar 5-point Likert scale in which residents were asked 'Would you say this lot looks safe, somewhat safe, neither dangerous nor safe, somewhat dangerous, or dangerous?' Like perceived care, perceived safety was recoded to a 3-point scale (1 = dangerous/somewhat dangerous/ neither; 2 = somewhat safe; 3 = safe).

- *Preference* was measured as a two-part question in which respondents indicated which of the 10 treatments they would most (1st) and second most (2nd) prefer to have installed on a vacant lot near their home. For some descriptive and all multivariate analyses, 1st or 2nd most preferred responses were combined into a single variable (0 = not preferred; 1 = either 1st or 2nd preference).

2.6. Data analysis

To calculate descriptive statistics, we first re-structured the data so that each respondent had ten lines of data, one for each of the 10 treatments they saw during the survey (N = 1710). Variables for each line included CTC and CTS of the treatment, respondent's perceptions of care and safety, and their 1st or 2nd preference for installation nearby. We then removed 144 records that were missing data for both 1st and 2nd preference variables. For the analyses in which we focused on differences among treatments rather than the effects of disorder, we later removed data about Weedy and Control treatments for our analytic sample (N = 1253).

Descriptive analysis: preference by treatments (CTC and CTS): We determined the number of times each treatment was selected as respondents' 1st or 2nd preference (p), and the number of times each treatment was shown across respondents (t). From this, we calculated a weighted percentage preference (w) for each treatment.

$$u_i = \frac{p_i}{t_i}$$

$$w_i = \frac{u_i}{\sum_{i=1}^{n} u_i}$$

We also examined descriptive statistics for perceived care and safety by treatment.

Multivariate analysis of main effects: We conducted multi-level logistic regression analyses in Mplus (Version 8.4; Muthén & Muthén, 1998–2017) to examine the main effects of CTC, CTS, perceived care and safety on preference for specific treatments. This analysis accounts for the non-independent structure of the data (i.e., responses about 10 treatments nested within respondents) by including a respondent-level random intercept. While we used some ordinal data in our analyses (e.g., perceived care and safety), employing parametric statistics with ordinal data is generally considered appropriate and has been found to produce robust results (Norman, 2010). Given the strong correlation (r = 0.59) between perceived care and safety, we conducted separate models to examine the main effects of each. The main effect models predicting preference included five independent variables: 1) perceived care or safety; 2) CTS (0 = no bollards; 1 = bollards present); 3–5) dichotomous variables for treatments characterized by these CTC (Flowers & Shrubs/Shrubs, Many Trees, Trees/Mown). We used the Existing treatment as the reference group for these models to help us understand relative preference for and perceptions of treatments that used fewer CTC and required less maintenance than Existing. Main effects were considered statistically significant at p-value < 0.05.

Interactive effects: To examine interaction effects we employed a single model that included all hypothesized interaction effects. A separate interaction model was conducted for perceived care and safety similar to our testing of main effects. In the two models, we included the following interactions: CTC × CTS, CTC × perceived care/safety, and CTS × perceived care/safety. For these models, we effect coded the three CTC and single CTS dichotomous variables (i.e., recoded from 0 and 1 to −1 and 1) and group (respondent) mean-centered perceived care and safety. Interaction effects were considered statistically significant at p-value < 0.05. Significant interactions were explored using an online tool for multilevel models (Preacher, Curran, & Bauer, 2006) and then graphed using the line chart function in Excel.

Indirect effects: To examine indirect effects we used Bayesian bootstrap modeling. This approach allows for testing of all hypothesized

Table 1
Respondents to our census survey of all households within ~250 m of existing pilot sites (response rate = 43.0%), with their household characteristics, compared with study area population.

	Survey Respondents (N = 171)		***Study Area Population*** [a]
Respondent Characteristics	***%***	***Mean (SD)***	
Age (18–99)		45.2 (15.8)	29.4[b]
Gender (% female)	69.0		53.3
Race (% Black)	87.1		84.3
Income below $25,000/year	43.3		51.9[c]
Less than High School Education	12.2		18.8
Unemployment rate	8.2		11.6
Years in neighborhood		13.8 (12.6)	N/A
Household Characteristics			
Household size		3.4 (1.7)	3.0
Housing tenure (% owners)	47.1		53.0

Notes: [a] Study area population data are pooled five-year estimates (2013–2017) from the American Community Survey obtained from socialexplorer.com (Census Bureau, 2017). Data were aggregated across 14 census block groups that comprise the study area; [b] median age of all residents in study area census blocks; [c] percentage of households with income less than $24,999.

Table 2
Preference for treatments with different CTC and CTS. *Treatments by CTC* (top of table) presents data for all treatments. *CTC Treatments, excluding Weedy & Control* (below) presents the final analytic sample, which aggregates treatments with similar CTC (e.g., Flowers & Shrubs and Shrubs).

Treatments by CTC	**% (N) of each Treatment in Analytic Sample**[a]	**% (N) 1st Preference**[b]	**% (N) 2nd Preference**[b]	**% (N) Combined (1st or 2nd) Weighted Preference**[b]
Existing	30.1 (472)	28.1 (86)	30.7 (91)	29.4 (177)
Flowers & Shrubs	10.0 (157)	20.6 (21)	22.3 (22)	21.4 (43)
Shrubs	10.0 (156)	20.7 (21)	15.3 (15)	18.1 (36)
Many Trees	10.0 (156)	20.7 (21)	13.3 (13)	17.1 (34)
Trees	10.0 (156)	4.9 (5)	12.3 (12)	8.5 (17)
Mown	10.0 (156)	3.0 (3)	6.1 (6)	4.5 (9)
Weedy	10.0 (157)	1.0 (1)	0.0 (0)	0.5 (1)
Control (shown without bollards only)	10.0 (156)	1.0 (1)	0.0 (0)	0.5 (1)
Total	100.0 (1566)	100.0 (159)	100.0 (159)	100.0 (318)
CTC Treatments, excluding Weedy & Control, aggregated for final analytic sample				
Existing	37.7 (472)	38.2 (86)	42.7 (91)	40.4 (177)
Flowers & Shrubs/ Shrubs	25.0 (313)	28.2 (42)	26.2 (37)	27.2 (79)
Many Trees	12.5 (156)	28.2 (21)	18.4 (13)	23.5 (34)
Trees/Mown	24.9 (312)	5.4 (8)	12.8 (18)	9.0 (26)
Total	100.0 (1253)	100.0 (157)	100.0 (159)	100.0 (316)
CTS Treatments, excluding Weedy & Control, aggregated for final analytic sample				
Bollards	50.0 (626)	61.8 (97)	65.4 (104)	63.6 (201)
No Bollards	50.0 (627)	38.2 (60)	34.6 (55)	36.4 (115)
Total	100.0 (1253)	100.0 (157)	100.0 (159)	100.0 (316)

Notes: [a] In the analytic sample, the total number of times that specific treatments were shown to the N = 171 respondents is preliminarily reduced from 1710 to 1566 because some respondents had missing values on 1st or 2nd preference variables. Then Weedy and Control responses are removed because these alternatives were virtually never preferred (N = 1253). [b] The percentages presented in these columns are weighted percentages for each treatment, as described in the methods section.

main and indirect effects in a single model. This also provides robust estimates of tested indirect effects' 95% credibility interval, a more reliable test of its significance (Yuan & MacKinnon, 2009). Indirect effects with a p-value < 0.05 and a 95% credibility interval that does not cross zero were considered statistically significant.

3. Results

3.1. Demographic characteristics of respondents

Demographic characteristics of the 171 survey respondents were similar to characteristics of the study area population. Given that we surveyed only heads of households, by definition our respondents were older than the population as a whole (Table 1):

3.2. Descriptive results

Descriptive results, below, explain our rationale for data aggregation and inclusion in our analytic sample. They also provide general indications of responses to our research questions, which are addressed in more specific statistical detail in the model results section that follows.

3.2.1. Do specific CTC and CTS affect preference?

For the vacant lot nearest their home, respondents overwhelmingly preferred treatments that include more microscale CTC (flowers, shrubs, trees, turf) over treatments with fewer CTC. The Existing treatment, which included the most CTC was most often preferred (Fig. 3, Table 2). Flowers & Shrubs, Shrubs, and Many Trees also were preferred frequently. Treatments with fewer trees (Trees) and only mown turf (Mown) were preferred much less frequently.

Regarding CTS, treatments with bollards were more often preferred than those without. This, however, was not the case for all treatments (Table 3). For example, the Many Trees treatment was preferred without bollards by nearly as many respondents as preferred it with bollards.

Importantly, Weedy and Control treatments were virtually never preferred (0.5%), and their perceived care was significantly lower than Trees/Mown treatments ($p < .001$), the CTC treatment otherwise least preferred (Table 3). Consequently, since we aimed to understand the effects of varied CTC or CTS on residents' preferences, we omitted Weedy and Control treatments from subsequent analysis, resulting in a final analytic sample of $N = 1253$. For multivariate analysis, we aggregated treatments with similar CTC, since we found that all treatments with flowery forbs or shrubs were most often preferred over those with fewer CTC (Fig. 3, Table 2).

3.2.2. Do perceived care and safety affect preference for treatments with different CTC and CTS?

Effects of perceived care and safety on preference. On average, preferred treatments were rated significantly higher in perceived care ($M = 2.8$) and safety ($M = 2.7$) than treatments that were not preferred (care $M = 2.2$; safety $M = 2.3$) (Table 3).

Effects of perceived care and safety on preference for treatments: Overall, treatments with more CTC were more frequently preferred and were perceived as more well cared-for and safer (Table 3). Further, those who preferred a treatment typically perceived it as more well cared-for and safer than those who did not prefer it. Overall, treatments with a CTS, bollards, were rated as safer and more well cared-for than treatments without bollards (Table 3).

Table 3
Perceived care and perceived safety related to preference for treatments with different CTC and CTS. The top part of the table (*Treatments by CTS*) presents data for all treatments in the analytic sample, which excludes Weedy and Control treatments since they were not preferred. The lower part of the table includes Weedy and Control treatments as supporting information.

	% (N) of each Treatment in Analytic Sample[a]	% (N) 1st or 2nd Preference[b]	Perceived Care (Mean, SD)		Perceived Safety (Mean, SD)	
			1st or 2nd Preference	Not Preferred	1st or 2nd Preference	Not Preferred
Treatments by CTS						
Bollards	50.0 (626)	63.6 (201)	2.8 (0.4)	2.4 (0.7)	2.8 (0.5)	2.4 (0.8)
No Bollards	50.0 (627)	36.4 (115)	2.8 (0.5)	2.1 (0.8)	2.6 (0.7)	2.1 (0.9)
Total	100.0 (1253)	100.0 (316)	2.8 (0.4)	2.2 (0.8)	2.7 (0.6)	2.3 (0.9)
Treatments by CTC and CTS						
Existing						
Bollards	49.8 (235)	64.0 (113)	2.9 (0.3)	2.8 (0.4)	2.9 (0.4)	2.7 (0.6)
No Bollards	50.2 (237)	36.0 (64)	2.8 (0.4)	2.7 (0.4)	2.7 (0.6)	2.6 (0.6)
Total	100.0 (472)	100.0 (177)	2.9 (0.3)	2.8 (0.4)	2.8 (0.5)	2.7 (0.6)
Flowers & Shrubs/Shrubs						
Bollards	49.8 (156)	64.7 (51)	2.8 (0.3)	2.8 (0.4)	2.9 (0.4)	2.7 (0.6)
No Bollards	50.2 (157)	35.3 (28)	2.9 (0.3)	2.7 (0.5)	2.7 (0.5)	2.6 (0.6)
Total	100.0 (313)	100.0 (79)	2.8 (0.3)	2.7 (0.5)	2.8 (0.5)	2.7 (0.6)
Many Trees						
Bollards	49.4 (77)	53.6 (18)	2.8 (0.4)	2.8 (0.4)	2.7 (0.6)	2.6 (0.6)
No Bollards	50.6 (79)	46.4 (16)	2.4 (0.7)	2.4 (0.5)	2.3 (0.9)	2.3 (0.7)
Total	100.0 (156)	100.0 (34)	2.6 (0.6)	2.6 (0.5)	2.5 (0.7)	2.4 (0.7)
Trees/Mown						
Bollards	50.6 (158)	72.6 (19)	2.5 (0.7)	2.5 (0.5)	2.4 (0.8)	2.6 (0.7)
No Bollards	49.4 (154)	27.4 (7)	2.8 (0.4)	2.4 (0.6)	2.7 (0.8)	2.4 (0.8)
Total	100.0 (312)	100.0 (26)	2.6 (0.6)	2.4 (0.5)	2.5 (0.8)	2.5 (0.7)
Weedy						
Bollards	49.7 (78)	100.0 (1)	3.0 (0.0)	1.1 (0.3)	3.0 (0.0)	1.3 (0.6)
No Bollards	50.3 (79)	0.0 (0)	0.0 (0.0)	1.0 (0.2)	0.0 (0.0)	1.0 (0.2)
Total	100.0 (157)	100.0 (1)				
Control (shown without bollards only)						
No Bollards	100.0 (156)	100.0 (1)	1.0 (0.0)	1.1 (0.4)	1.0 (0.0)	1.4 (0.6)
Total	100.0 (156)	100.0 (1)				

Notes: [a] In the analytic sample, the total number of times that specific treatments were shown to the $N = 171$ respondents is reduced from 1710 to 1566 due to some respondents having missing values on the preference 1st or 2nd variables Then Weedy and Control responses are removed because these alternatives were virtually never preferred ($N = 1253$) and were both rated significantly ($p < .001$) lower on perceived care and safety compared to Trees/Mown, the CTC treatment least often preferred. [b] The percentages presented in these columns are weighted percentages for each treatment as described in Methods.

Differential effects of perceived care and safety on preference for treatments with different CTC and CTS: Perceived care and safety differentially affect preference for treatments with different combinations of CTC and CTS (Table 3). Two leading examples are: 1) the Many Trees treatment, unlike all other treatments, was perceived similarly regardless of whether respondents preferred it, and 2) the Trees/Mown treatment was perceived as safer and more well-cared-for by those who preferred it without bollards. Notably, both of these examples describe treatments preferred by a relatively small number of respondents.

3.3. Model results

3.3.1. Do specific CTC and CTS affect preference?

Our main effects models (Tables 4 and 5) suggest that CTC and CTS affect preference. Specifically, treatments with more CTC are significantly more likely to be preferred, and treatments with bollards, a CTS, are significantly more likely to be preferred.

Considering CTC, the Existing treatment (the reference group for our main effects models) had significantly greater odds of being preferred compared to all others (Table 4). Further, the size of the effect increased in relation to the number of CTC in a treatment. Specifically, the Trees/Mown treatment had much lower odds of being preferred compared to Existing than did the Many Trees and Flowers & Shrubs/Shrubs treatments.

3.3.2. Do perceived care and safety affect preference for treatments with different CTC and CTS?

Perceived care and perceived safety affect preference for treatments with different CTC and CTS (Tables 4 and 5). Treatments with greater perceived care (Table 4) and those with greater perceived safety (Table 5) had significantly greater odds of being preferred.

While perceived care differentially affects preference for treatments with different CTC (Table 4), perceived safety has no statistically significant effect on preference for treatments with different CTC (Table 5).

Table 4
Main and interactive effects of perceived care (care) and the presence of a CTS (bollards) and CTC on preference. Both the unstandardized regression coefficient (b) accompanied by the standard error (SE) and the standardized regression coefficient or odds ratio (OR) accompanied by the 95% confidence interval (95% CI) are given for each independent variable. The N-adjusted BIC is an indicator of overall model fit. Fig. 4 shows how the one statistically significant interaction effect (Care × Many Trees) compares with other CTC.

N = 1251	*Main Effects Model*		*Interaction Effects Model*	
Independent Variables	b (SE)	OR (95% CI)	b (SE)	OR (95% CI)
Care	0.51 (.18)**	1.67 (1.18, 2.35)	0.57 (.53)	1.77 (0.63, 5.00)
CTS (Bollards)	0.76 (.14)***	2.14 (1.62, 2.82)	0.24 (.18)	1.27 (0.89, 1.81)
CTC				
Existing (Reference Group)	–	–	–	–
Flower & Shrubs/Shrubs	−0.56 (.17)**	0.57 (0.41, 0.79)	−0.28 (.10)**	0.75 (0.62, 0.91)
Many Trees	−0.70 (.22)**	0.50 (0.32, 0.77)	−0.28 (.12)*	0.76 (0.60, 0.95)
Trees/Mown	−1.78 (.23)***	0.17 (0.11, 0.27)	−0.82 (.13)***	0.44 (0.34, 0.58)
Interactions				
CTS × CTC (Flowers & Shrubs/Shrubs)			−0.05 (.09)	0.95 (0.80, 1.12)
CTS × CTC (Many Trees)			−0.18 (.12)	0.84 (0.66, 1.06)
CTS × CTC (Trees/Mown)			0.00 (.13)	1.00 (0.78, 1.30)
Care × CTC (Flowers & Shrubs/Shrubs)			0.18 (.33)	1.20 (0.62, 2.30)
Care × CTC (Many Trees)			−0.73 (.33)*	0.48 (0.26, 0.92)
Care × CTC (Trees/Mown)			−0.13 (.37)	0.88 (0.43, 1.83)
Care × CTS (Bollards)			−0.15 (.25)	0.86 (0.52, 1.42)
N-adjusted BIC	1303.23		1312.17	

Notes: * p < .05; ** p < .01; *** p < .001.

Table 5
Main and interactive effects of perceived safety (safety) and the presence of a CTS (bollards) and CTC on preference. These models exclude perceived care, given its strong correlation with safety (r = 0.59). Both the unstandardized regression coefficient (b) accompanied by the standard error (SE) and the standardized regression coefficient or odds ratio (OR) accompanied by the 95% confidence interval (95% CI) are given for each independent variable. The N-adjusted BIC is an indicator of overall model fit. None of the interaction effects were statistically significant.

N = 1251	*Main Effects Model*		*Interaction Effects Model*	
Independent Variables	b (SE)	OR (95% CI)	b (SE)	OR (95% CI)
Safety	0.27 (.12)*	1.31 (1.03, 1.66)	0.51 (.38)	1.66 (0.79, 3.47)
CTS (Bollards)	0.78 (.14)***	2.17 (1.65, 2.86)	0.27 (.18)	1.31 (0.92, 1.86)
CTC				
Existing (Reference Group)	–	–		
Flower & Shrubs/Shrubs	−0.58 (.16)***	0.56 (0.40, 0.77)	−0.33 (.09)***	0.72 (0.61, 0.86)
Many Trees	−0.73 (.22)**	0.48 (0.31, 0.74)	−0.35 (.11)**	0.71 (0.57, 0.88)
Trees/Mown	−1.89 (.23)***	0.15 (0.10, 0.24)	−0.97 (.13)***	0.38 (0.30, 0.49)
Interactions				
CTS × CTC (Flowers & Shrubs/Shrubs)			−0.04 (.09)	0.96 (0.81, 1.13)
CTS × CTC (Many Trees)			−0.16 (.12)	0.85 (0.68, 1.07)
CTS × CTC (Trees/Mown)			0.06 (.13)	1.06 (0.82, 1.37)
Safety × CTC (Flowers & Shrubs/Shrubs)			0.31 (.23)	1.37 (0.87, 2.15)
Safety × CTC (Many Trees)			−0.13 (.23)	0.88 (0.56, 1.39)
Safety × CTC (Trees/Mown)			−0.13 (.26)	0.88 (0.53, 1.48)
Safety × CTS (Bollards)			0.22 (.18)	1.25 (0.88, 1.76)
N-adjusted BIC	1307.36		1322.16	

Notes: * p < .05; ** p < .01; *** p < .001.

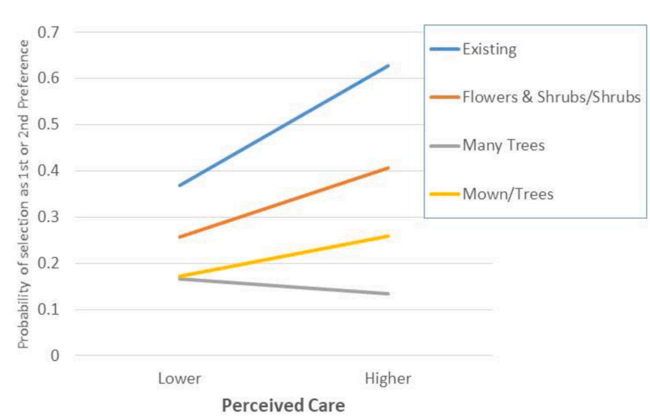


Fig. 4. Interaction effect of CTC treatments on the association between perceived care and preference. As presented in Table 4, among the four CTC treatments, only in comparing Existing and Many Trees is the association between care and preference is statistically different. Other treatments suggest a gradation of effects that are not statistically different from Existing.

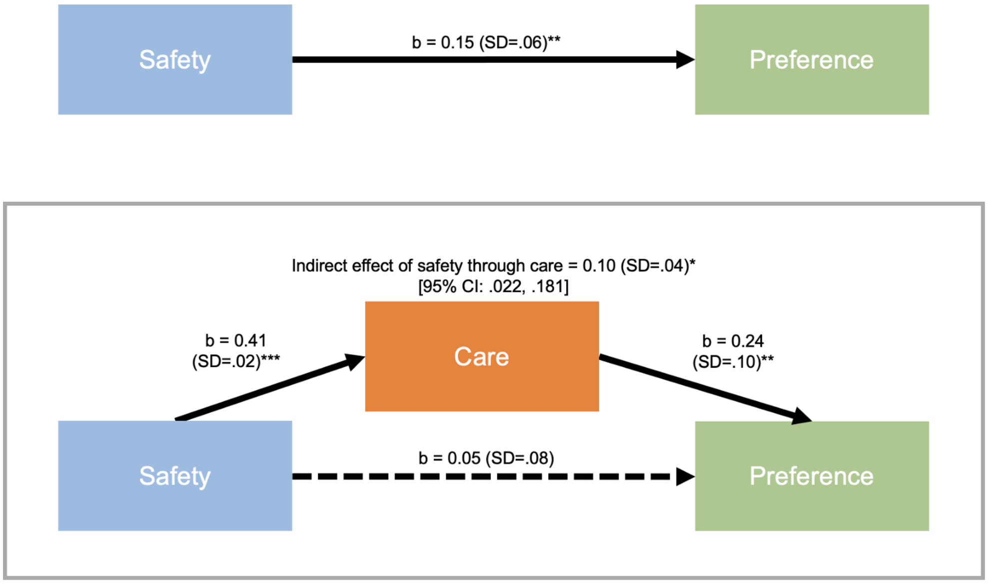


Fig. 5. Indirect effect of perceived safety on preference through perceived care. The top of this figure presents the effect of perceived safety on preference controlling for CTC and CTS, without modeling an indirect effect. The path is labeled with the unstandardized regression coefficient (b), posterior standard deviation (SD), and level of statistical significance. The bottom of this figure presents results from a single model testing the hypothesized indirect effect, controlling for CTS and CTC. Each path is labeled with unstandardized regression coefficient (b), posterior standard deviation (SD), and level of statistical significance. Solid lines indicate statistically significant associations as indicated by p < .05 and a 95% credibility interval (CI) that does not cross zero. Dotted lines indicate non-significant associations. The box labelled care gives the unstandardized coefficient of the indirect effect of safety on preference operating through perceived care along with its posterior standard deviation, level of statistical significance, and 95% CI. This indirect effect has a p-value < 0.05 and the CI interval does not cross zero, indicating the indirect effect is statistically significant. Notes: * p < .05; ** p < .01; *** p < .001.

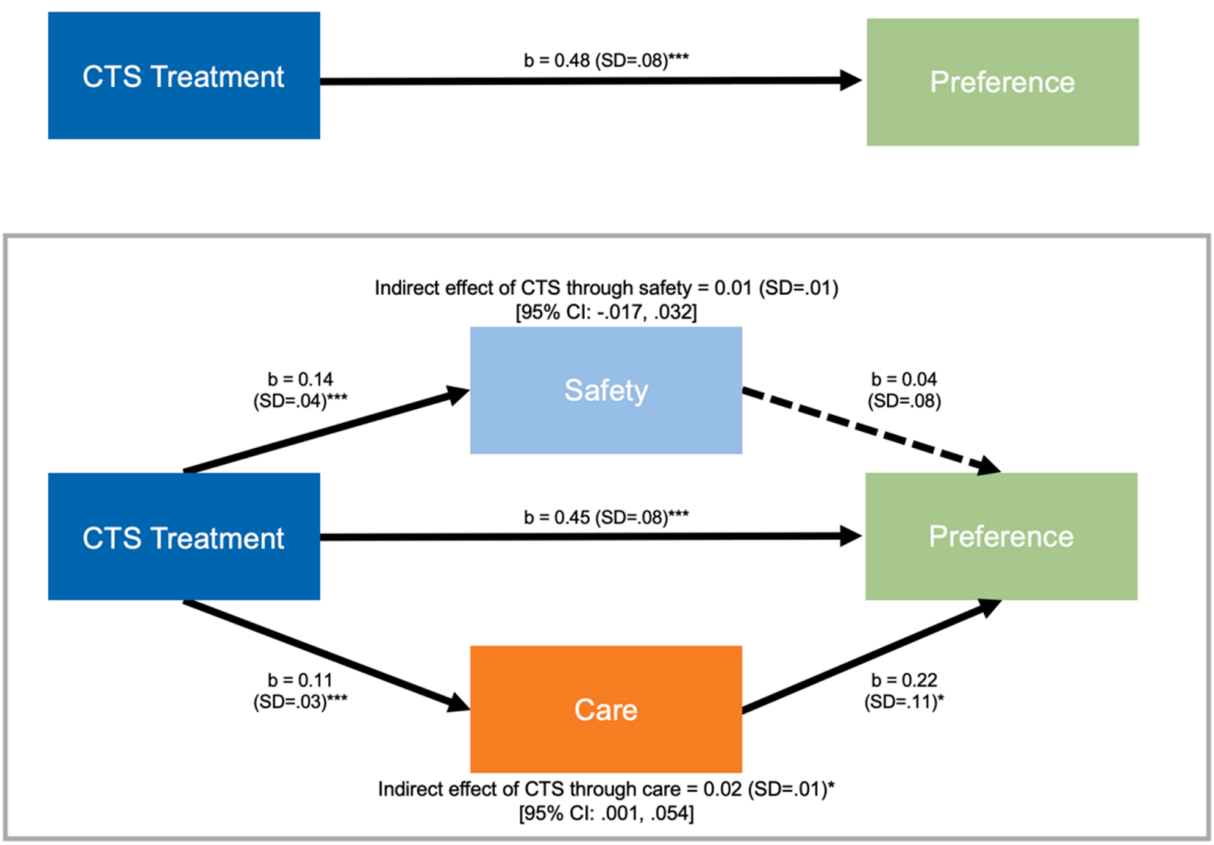


Fig. 6. Indirect effect of bollards, a CTS, on preference through perceived care and safety. The top of the figure presents the effect of CTS on preference controlling for CTC without modeling indirect effects. The path is labeled with the unstandardized regression coefficient (b), posterior standard deviation (SD), and level of statistical significance. The bottom of this figure presents results from a single model testing the hypothesized indirect effect. It controls for other variables included in this study (CTC). Paths are labeled with unstandardized regression coefficients (b), posterior standard deviation (SD), and level of statistical significance. Solid lines indicate statistically significant associations as indicated by p < .05 and a 95% credibility interval (CI) that does not cross zero and dotted lines indicate non-significant associations. The box labeled safety and the box labeled care give unstandardized coefficient of the indirect effect of CTS on preference operating through each along with its posterior standard deviation, level of statistical significance, and 95% CI. This interval for perceived safety has a p-value > 0.05 and the CI crosses zero indicating it is not significant, whereas for perceived care it has a p-value < 0.05 and the CI does not cross zero indicating it is significant. Notes: * p < .05; *** p < .001.

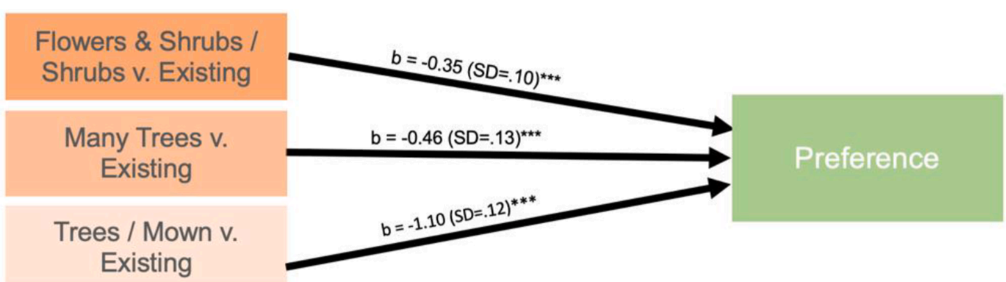
This is indicated by the presence of one statistically significant interaction in the perceived care model, but none in the perceived safety model. Further examination of the significant interaction shows that higher ratings of perceived care were associated with greater odds of being preferred – except for Many Trees, for which perceived care had little to no effect on preference (Fig. 4).

3.3.3. Do relationships between perceived care and safety of different CTC and CTS treatments help to explain treatment effects on preference?

We found that the relationship between perceived care and safety does help to explain preference, and further, that perceived care explains the effect of perceived safety on preference. Given our result that perceived safety did not differentially affect preference for treatments but perceived care did, we tested the indirect effect of safety on preference through perceived care in a single model (Fig. 5). In this model we found that greater perceived care was associated with greater odds of being preferred, and we found perceived safety was significantly associated with perceived care but not with preference. However, we found that the indirect effect of safety on preference through care was statistically significant.

We also found that perceived care partially explains preference for bollards, a CTS, but perceived safety does not. We tested the indirect effect of this CTS on preference through both perceived care and safety (Fig. 6), and found that treatments with bollards were rated significantly higher in both perceived care and safety, and had greater odds of being preferred. However, perceived care was associated with significantly greater odds of a CTS being preferred, but perceived safety was not. Furthermore, the indirect effect of CTS on preference through care was statistically significant, while the indirect effect through safety was not.

Finally, we found that perceived care explains why specific CTC treatments are more preferred than others (Fig. 7). Perceived care was associated with greater odds of a treatment being preferred. Existing, which had the most CTC and was the reference treatment, was significantly preferred over all other treatments. However, while perceived care explained why Trees and Trees/Mown were less often preferred than Existing, care did not explain why Existing was preferred more often than Flowers & Shrubs/Shrubs; all (Existing and Flowers & Shrubs/Shrubs) were perceived as very well cared-for. Consistent with these results, respondents to an open-ended item (84%, n = 143), gave these reasons why they preferred a particular treatment to be near their home: aesthetics, the presence of plants and flowers, or a well-maintained appearance. Many (~80) said more specifically that they liked the pretty, attractive appearance, neatness, and colors of flowers.



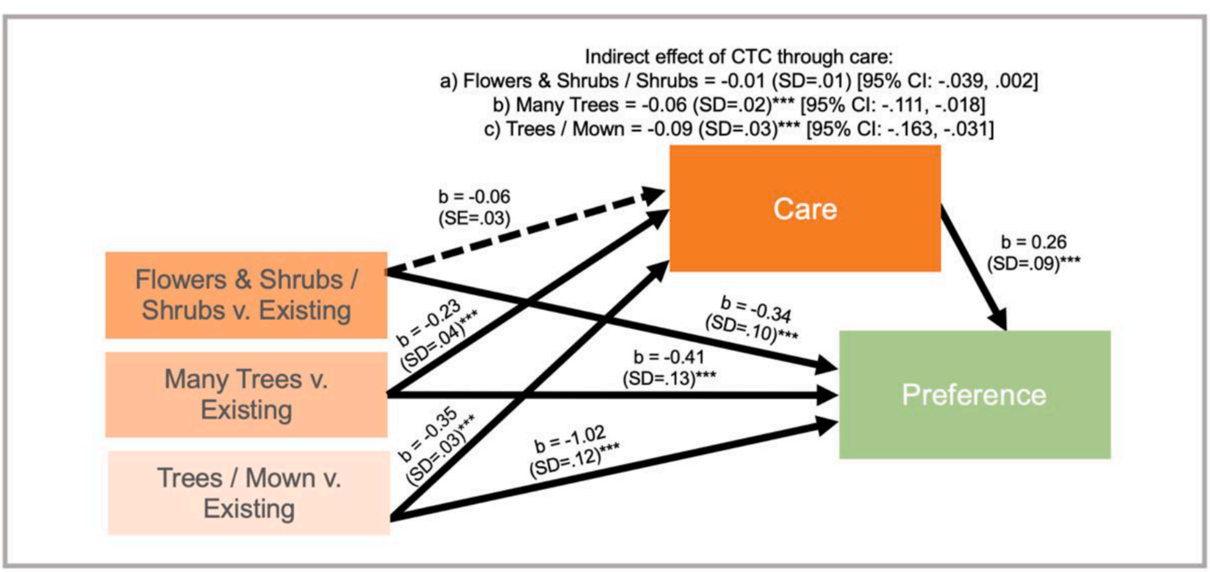


Fig. 7. Indirect effect of CTC on preference through perceived care. The top of the figure shows the effect of CTC on preference controlling for CTS without modeling indirect effects. Each path gives the unstandardized regression coefficient (b), posterior standard deviation (SD), and level of statistical significance for each CTC treatment compared to the Existing. The bottom of the figure shows results from a single model testing the hypothesized indirect effect, controlling for CTS. Above each path is the unstandardized regression coefficient (b), posterior standard deviation (SD), and level of statistical significance. Solid lines indicate statistically significant associations as indicated by $p < .05$ and a 95% credibility interval (CI) that does not cross zero and dotted lines indicate non-significant associations. The box labeled care gives the unstandardized coefficient of the indirect effects of each treatment on preference operating through perceived care along with each's posterior standard deviation, level of statistical significance, and 95% CI. For Flowers & Shrubs/Shrubs the p-value is > 0.05 and the CI crosses zero indicating it is not significant, whereas for Many Trees and Trees/Mown it has a p-value < 0.05 and the CI does not cross zero and is significant. *** $p < .001$.

4. Discussion

This study investigated residents' perceptions of and preferences for alternative microscale treatments of nearby vacant lots. To contribute to addressing structural inequities in legacy cities by greenspace design and planning, our results: 1) provide evidence about specific microscale elements that affect urban residents' experiences of neighborhood greenspace, which may affect their well-being, and 2) provide evidence for practical insights about trade-offs between selection of microscale elements and greenspace maintenance requirements.

These results support CTC theories, which posit that, for people to accept and sustain landscape change, they must perceive that the landscape is well cared-for; this requires that landscape elements be immediately recognizable, within local cultural or social norms, as indicating caring human intention or human presence (Li & Nassauer, 2020). These results also extend implications of legacy city studies that have found reduced crime or greater perceived safety to be associated with CTC (e.g., Troy et al., 2016) or "visible signs that a lot was cared for" (e.g., Branas et al., 2018). Further, our results align with public health frameworks that explain how population-level approaches may perpetuate health disparities (Frohlich & Potvin, 2008), whereas greenspace designs in disinvested communities, if informed by residents' experiences, may improve well-being.

In our study, neighborhood greenspace that included more microscale elements intended as CTC or CTS was significantly more frequently preferred and perceived as more well-cared for and safer than greenspace with fewer cues. However, residents who preferred less popular treatments sometimes perceived them differently than did others. While exploring differences in respondent characteristics is beyond the scope of this study, understanding such differences could shed light on the distinctly different perceptions of those who preferred less popular treatments.

Our finding that some community members preferred treatments that most perceived as less well-cared for and safe has important practical implications for community engaged design processes. Some voices may be more heard than others, and advocates for a given type of greening may not represent others who are silent, even if more reticent speakers are the majority, as suggested by Kronenberg et al. (2021).

In our study, the majority (>70%) preferred treatments that had vivid flowers (Existing, Flowers & Shrubs, and Shrubs) for a vacant lot near their home. These were perceived as most well-cared for and most safe. This supports results of Chalmin-Pui et al. (2021) who found that flower planting in otherwise bare front gardens in a deprived neighborhood in North England improved aspects of residents' health.

Fewer respondents preferred Many Trees, Trees, or Mown treatments, which were generally perceived as less well-cared-for and safe – even by those who preferred them. Their preferences may be driven by other factors. Notably, we found that perceived care did not significantly drive preference among those who preferred Many Trees. This suggests that tree planting on vacant lots in legacy cities may be welcomed only in certain circumstances (Kronenberg, et al. 2020). There are several potential reasons for some residents preferring tree planting on vacant lots. Residents who prefer Many Trees on a vacant lot near their home may be less concerned about perceived care of the nearby neighborhood, perhaps because they feel more assured of care in their immediate surroundings or because they have greater confidence that government will maintain trees on nearby property. Alternatively, those who prefer Many Trees may perceive and value trees in ways that are less important to other residents; their personal preferences for the appearance of care may override neighborhood norms. Perhaps they have greater aesthetic appreciation for wooded landscapes, or they may believe that heavily planted lots establish a more natural or more ecologically healthy setting. These speculations also suggest why, after accounting for perceived care, bollards did not influence preference for Many Trees; bollards to discourage dumping or unwanted visitors might seem less essential or more intrusive in a setting perceived as more assuredly cared-for or more natural. Our results regarding landscape treatments that include tree planting provide insight for interpreting past studies on perceptions of urban trees and effects of "cleaning and greening" programs in legacy cities. They suggest that urban cleaning and greening programs may be more widely well-received if they are adapted to incorporate more or different microscale elements to act as CTC or CTS in response to community perceptions.

Importantly, in our study, perceived care was necessary for perceived safety to significantly affect residents' preferences for nearby vacant lots. A key example: while the one microscale element that we tested as a CTS, bollards at the street face of the vacant lots, was preferred overall, it functioned as a CTC rather than primarily as a CTS. We speculate that, as a visible and substantial infrastructure investment, bollards may be preferred partly because they represent local government's commitment to care for a neighborhood and maintain its greenspace, akin to bridging social capital (Villalonga-Olives, Adams, & Kawachi, 2016). These results could be different in a city where disinvestment in residential neighborhoods is not widespread, or where there is less concern about safety, dumping, and vandalism. Different contexts might suggest different CTS. However, perception of an intended CTS as a CTC in our study underscores that, rather than particular CTC or CTS being universally applicable, their function – to connote care or safety to local residents – is fundamental. Practically, this means that greenspace interventions that are designed to promote perceptions of safety may not be successful if they do not also promote perceptions of care, which depends to a large degree upon maintenance.

The cost of greenspace maintenance is a particular limitation in cities characterized by property vacancy. We found that treatments that required more maintenance (those with flowers and shrubs) were preferred by significantly more residents, and perceived as significantly more safe and well cared-for. This suggests the potential for greater community health benefits from neighborhood greening that includes maintenance for these plants. At the same time, our results suggest that, where maintenance capacity is limited, greening that ensures regularly mown turf may be sufficient to significantly improve perceptions of care and safety, in comparison with typical treatments of vacant property in legacy cities. This comparison supports conclusions by South et al. (2018) that even very low cost greening efforts can improve well-being. They found that simply cleaning trash and occasionally mowing vacant lots in Philadelphia did not affect self-reported mental health of nearby residents, but a greening intervention that added a fence and regularly mown turf, which have been identified elsewhere as CTC for neighborhoods with pervasive vacancy (Nassauer & Raskin, 2014), was associated with improved mental health. Similarly, our study suggests that perceived care and safety can be associated with regular maintenance of even the most low-cost treatments of vacant lots.

5. Conclusions

Perceived care is the *sine qua non* for landscape treatments of vacant lots because care connotes safety, and perceptions of both care and safety are essential to residents' preferences for vacant lots near their homes. To the extent that residents' perceptions of neighborhood care and realization of their preferences for their own neighborhood landscapes does affect their well-being, as is suggested by the literature more broadly, employing greenspace designs that ensure perceived care may help to address structural inequities that affect the well-being of residents in disadvantaged neighborhoods. Microscale elements that connote neighborhood care to community members may support individual and community well-being. Realizing these benefits requires that selection and articulation of microscale landscape elements be attentive to community cultural traditions and societal norms. Further, to represent these traditions and norms, community-engaged greening programs must include perspectives from community members who may not be highly visible or vocal.

Our study investigating effects of microscale elements can inform decisions about design and maintenance of neighborhood greenspace in legacy cities. We found that residents had strong preferences for treatments that include well-ordered patches of low-growing flowery plants. While these treatments had higher maintenance requirements, residents perceived them as very well cared-for and safe. However, even lower maintenance treatments that did not include flowery plants and were much less often preferred, were distinctly favored over control vacant lots and weedy greenspace. This suggests that even the most minimal continuing care, regular mowing of vacant lots, would support neighborhood well-being. In addition, other CTC that *are* low maintenance but were not part of our experiment (e.g., signs or low-maintenance fences) might increase preference for lower maintenance options. On the other hand, we conclude that tree-planting on vacant lots may only sometimes be welcomed in legacy cities.

This knowledge alone is not sufficient to provoke urban landscape change. Governance for greenspace maintenance is critical to trade-offs among these microscale landscape choices. Greening initiatives can contribute to recognizing and amending the underlying history of structural racism in housing and land use policy that affects cities and neighborhoods. The question of maintenance is only apparently a pragmatic obstacle to implementing neighborhood landscape change to support residents' well-being. Policy changes away from neo-liberalism toward recognition of shared well-being benefits, governance changes related to permitting and property liability that support multi-functional public investments, and innovations in training, technology, and management of landscapes are needed to overcome deeper societal obstacles. Local government planning to address vacant property should consider the historical and public health context in which well-intentioned interventions can sometimes worsen social, economic, racial, and health disparities. This underscores the paramount importance of responding to resident perceptions of and preferences for microscale elements when designing landscape interventions.

To further support well-being, scale of greenspace investigations should be more closely related to both the scale of everyday neighborhood experiences and to the scale of potential landscape interventions. Greater understanding of how everyday experience of greenspace may affect well-being is needed (Bratman et al., 2019; Collins et al., 2020; Deng et al., 2020; Kondo et al., 2018; Root et al., 2017). Where extensive land acquisition or open space system planning is being undertaken, multi-functional microscale greenspace benefits may be less relevant initially. However, where opportunities exist to adapt an existing urban fabric for greater well-being or to develop specific design and maintenance interventions in urban greenspace systems, microscale greenspace elements should be integral to anticipating effects on residents' well-being. Research that quantitatively accounts for well-being benefits of microscale elements can support arguments for public investments in multi-functional landscapes. Causal relationships between specific characteristics of microscale greenspace experience and well-being are only beginning to be established. Greater understanding of these causal pathways can help communities determine how to effectively enhance well-being by infrastructure investment, land development, planning, design, or maintenance.

CRediT authorship contribution statement

Joan Nassauer: Funding acquisition, Supervision, Conceptualization, Methodology, Writing. **Noah Webster:** Methodology, Investigation, Formal analysis, Validation, Writing. **Natalie Sampson:** Conceptualization, Methodology, Investigation, Review & Editing. **Jiayang Li:** Data curation, Visualization, Review & Editing.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.landurbplan.2021.104156.

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