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(Not) in my backyard: Access to community gardens, neighborhood characteristics, and food deserts

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ABSTRACT

Community gardens have gained popularity worldwide not only as an alternative source of fresh food but also as a platform to promote sustainable urban living. In this study, we compile a unique dataset that consists of 1874 documented community gardens in 24 cities or metropolitan areas in the U.S. to examine the relationship between neighborhood characteristics and access to community gardens. We further investigate the spatial distribution of community gardens in the context of food deserts that are used to describe low-income neighborhoods with a lack of fresh food access. Our results show that several neighborhood characteristics, such as the share of Black populations, poverty rate, and housing unit vacancy rate, can systematically explain whether a neighborhood has community gardens. Notably, we find that community gardens may have limited capacity to address the issue of food deserts, given that the vast majority of current community gardens are in neighborhoods not identified as food deserts. Our findings provide new insights into the need for strategic urban planning and community-led initiatives to facilitate the construction of community gardens for a sustainable urban food environment.

1. Introduction

While supermarkets remain the major source of fresh and healthy food supply, community gardens have emerged as a popular alternative worldwide, especially in urban neighborhoods in Western countries (Bieri et al., 2024). Typically, community gardens are shared green spaces where residents in the same neighborhood collectively grow vegetables and fruits for local consumption. Often established on vacant lots, rooftops, or other underused areas, community gardens not only provide residents with fresh produce but also serve as hubs for social interaction and community building (Armstrong, 2000; Bendt et al., 2013; Kingsley et al., 2020; Schmelzkopf, 1995). Additionally, they provide community-wide platforms to promote sustainable living through nutritional education (Hume et al., 2022; McCormack et al., 2010; Twiss et al., 2003).

Given the popularity of community gardens, an increasing number of studies have examined the spatial distribution of community gardens and further explored the association between access to community gardens and various neighborhood characteristics. Understanding where community gardens are and what population they serve has important policy implications. Generally, community gardens are more likely to be established in neighborhoods with predominantly non-Hispanic black and Latino residents (Butterfield, 2020; Gripper et al., 2022; Taylor et al., 2024). Additionally, prior studies find that higher rates of low-income households positively correlate with the availability of community gardens (Butterfield, 2020; Taylor et al., 2024). Other neighborhood characteristics are also significantly related to the number of community gardens. For example, Garrett and Leeds (2015) show that home vacancy rates and poverty rates have a positive impact on the availability of community gardens. However, most of these prior studies focus on single cities or regions, raising concerns about the generalizability of their findings to broader urban contexts.

Among the many benefits that community gardens can provide to residents in the neighborhood, mitigating food insecurity arguably receives the most attention (Carney et al., 2012; Furness & Gallaher, 2018; Gregory et al., 2016). The concept of "food deserts" has been proposed to specifically describe low-income neighborhoods with a substantial number or share of residents with low access to retail outlets providing

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healthy and affordable food choices (Ver Ploeg et al., 2009). Specifically, a low-access area is defined as an area where at least 500 persons and/or at least 33 % of the urban residents live more than one mile (and rural residents live more than ten miles) from a supermarket, and a low-income area is defined as an area with a poverty rate of 20 % or higher (or the median family income is at most 80 % statewide). Naturally, whether community gardens indeed mitigate the issue of food deserts becomes a question of interest in policies (Wang et al., 2014; Wang & Plancich, 2024).

To address these gaps, we compiled a unique dataset of 1874 documented community gardens across 24 cities and metropolitan areas in the United States, spanning from the West Coast to the East Coast and ranging from small-sized cities to large metropolitan regions. This broader geographic scope enables a more comprehensive analysis of how neighborhood characteristics relate to access to community gardens. Furthermore, by linking this newly constructed dataset with census-tract-level data on food desert status from the United States Department of Agriculture (USDA), we provide new empirical evidence on the relationship between food deserts and community garden availability—an area where quantitative analysis remains scarce.

This study makes two primary contributions. First, it extends the literature by moving beyond single-city case studies to provide generalizable insights into the spatial and demographic patterns of community garden distribution across diverse U.S. regions. Second, it assesses the role of community gardens in mitigating food deserts, offering timely policy implications for urban planners and community organizers aiming to improve fresh food access. Our findings emphasize the importance of channeling community garden investments into underserved neighborhoods, which can be achieved through community land trusts and long-term land tenure guarantees. Additionally, it is crucial to implement policies that prevent green gentrification and pair community garden planning with affordable housing protections. By doing so, community gardens can better serve as an effective tool to combat food deserts.

2. Literature review

2.1. Access to community gardens

A growing body of literature has measured the spatial distribution of community gardens and further analyzed their relationship with neighborhood characteristics, focusing primarily on socio-demographics. When it comes to ethnic origin, Butterfield (2020), Gripper et al. (2022), and Taylor et al. (2024) find that community gardens are more likely to be in neighborhoods with predominantly non-Hispanic black and Latino residents. Household income is another factor related to the availability of community gardens. Generally, community gardens are found to be in neighborhoods with higher rates of low-income households (Butterfield, 2020; Taylor et al., 2024). Additionally, Butterfield (2020) finds that neighborhoods with a higher percentage of residents with a bachelor's degree or advanced education tend to have more community gardens due primarily to residents' greater interest in sustainable food sources. Limerick et al. (2023) examine 15-min walking access to community gardens in New York City. They indicate that more than half of the city's residents have access to a community garden. Moreover, neighborhoods with lower income, lower percentages of White residents and homeowners, and higher rates of educational attainment have better access to community gardens.

Some other neighborhood characteristics have also been explored in prior studies. Focusing on residents' choice of transportation modes for daily commute, Wang and Qiu (2016) find that neighborhoods with higher percentages of residents who use public transportation or walk as their primary travel options have more access to community gardens. Garrett and Leeds (2015) show that home vacancy rates and poverty rates have a positive impact on the number of community gardens, while homeownership rates have a negative effect.

Notably, existing research on the spatial distribution of community gardens has largely been confined to limited geographic scales, often focusing on individual neighborhoods within a city. For instance, Petrovic et al. (2019) examine 35 community gardens in East Harlem, New York City. A broader body of literature has explored community gardens at the city level, with notable examples including Butterfield (2020) and Limerick et al. (2023) in New York City, Gripper et al. (2022) in Philadelphia, and Wang et al. (2014) in Edmonton. Some studies extend the scope slightly by comparing gardens across a small number of cities. For example, Anderson et al. (2019) analyze community gardens in Baltimore, Chicago, and New York City to explore variations in vegetation and surface cover. A handful of studies have adopted a regional approach, such as Taylor et al. (2024), who examine 53 community gardens across Michigan. However, nationwide or multi-metropolitan comparative studies remain rare.

2.2. Effects of community gardens

Community gardens can improve fresh food intake and potentially address food desert issues. For instance, Corrigan (2011) finds evidence that community gardens in Baltimore, Maryland, contribute to individual, household, and community food security. In rural Oregon, community garden projects yield a four-fold and three-fold increase in vegetable intake for adults and children, respectively (Carney et al., 2012). In the case of Edmonton, Canada, Wang et al. (2014) show that community gardens improve fresh food accessibility to some extent, especially in mature, inner-suburban neighborhoods. Algert et al. (2016) reports that members of community gardens in San Josè, California, gain a doubling of vegetable intake within their families, reaching the daily intake level recommended by the U.S. Dietary Guidelines. Particularly, community gardens in New Jersey provide affordable fresh produce for people with disabilities who frequently experience food inequity and related health risks (Spencer et al., 2023).

Beyond fresh food access, community gardens also serve as green infrastructure that provides a wide range of social and environmental services and well-being benefits. For instance, focusing on the effect of reducing urban heat islands, Zhang et al. (2022) find that in the Phoenix metropolitan area, the community gardens required for extreme heat mitigation can double the number for food desert mitigation, given the semi-arid desert environments in the study region. Ambrose et al. (2023) show that residents in the Minneapolis-St. Paul area reported a higher happiness index from engaging in community gardens than other outdoor activities such as biking and walking. Petrovic et al. (2019) find that most gardeners in East Harlem, New York City, show a strong sense of belonging to their gardens and indicate that community gardens enhance their neighborhood pride and decrease their likelihood of moving. Nevertheless, growing concerns about gentrification have been raised regarding the location of community gardens during the redevelopment processes (Aptekar & Myers, 2020; Hawes et al., 2022).

3. Data and methods

3.1. Community garden data

Our study covers 24 cities or metropolitan areas across the U.S., including Atlanta, Cambridge, Charlottesville, Charlotte, Houston, Jersey City, Los Angeles, Louisville, New York City, Pasadena, Philadelphia, Portland, Rochester, Salem, Salisbury, San Antonio, San Francisco, Santa Clara, Savannah, Syracuse, Tallahassee, Tucson, Tulsa, and Washington, D.C. We obtained a total of 1874 community gardens with geographic coordinates from the publicly available GIS Open Data portal provided by these 24 cities or metropolitan areas.[1] Table A1 in the appendix lists the number of community gardens in each study area with web links for data download.

To address the variability across GIS Open Data sources, we implemented a standardized data extraction process. First, despite the differences in available attributes across study areas (e.g., some datasets included community garden names and street addresses, while others did not), all GIS portals consistently reported the precise geographic coordinates (latitude and longitude) of community gardens. Therefore, we used these coordinates as the key variable for our spatial analysis. Second, we accounted for differences in file formats and data structures. While most study areas provided data in standard shapefile (.shp) format, a few cities, such as San Francisco and Los Angeles, offered their GIS data in KML format, which contained multiple layers corresponding to different city districts. In these cases, we first merged all relevant layers within each KML file to consolidate city-wide community garden data. We then extracted the geographic coordinates from the merged dataset following the same process used for shapefiles. This approach ensured consistency in our final dataset and mitigated the effects of structural and attribute-based discrepancies across the original GIS data sources.

We further processed the community garden data as follows. First, based on the geographic coordinates of each community garden, we spatially matched each community garden to its corresponding census block group. For each block group that has community gardens, we further counted the number of community gardens, as it is common for block groups to have multiple community gardens. Second, for block groups with community gardens, we identified the census tract to which each block group belongs and then identified all other block groups within the same census tract that do not have any community gardens. The identification of block groups without any community gardens using this approach is important for direct comparison in neighborhood characteristics between block groups with and without community gardens. As a result, we obtained a set of 3907 block groups (corresponding to a total of 1315 census tracts) in this study, among which 1543 block groups have community gardens while the remaining 2364 block groups do not.

Fig. 1 shows the locations of 24 cities or metropolitan areas in our study, with the number of community gardens in each city or metropolitan area. As can be seen, the availability of community gardens widely differs across the nation. Generally, large cities and metropolitan areas tend to have more community gardens. For example, Atlanta and New York City contain the highest numbers of community gardens, with 650 and 427, respectively. In contrast, Tulsa and Salisbury host fewer than ten community gardens, with only seven and four, respectively.

Fig. 2 demonstrates the spatial distribution of community gardens in six cities or metropolitan areas with the most community gardens, including Atlanta, New York City, Los Angeles, Houston, Rochester, and Washington, D.C. Evidently, the availability of community gardens within a city or metropolitan area can vary substantially. Panels (a) and (f) show that community gardens in Atlanta and Washington, D.C. are extensively distributed and cover most parts of the region. In contrast, community gardens in Los Angeles and Rochester are more concentrated locally in the south-central and central parts of the city, respectively, with almost no community gardens present in other areas (see panels c and e). Panel (b) shows that community gardens in New York City are mainly concentrated in three areas: the southwest Bronx, northern Manhattan, and northern Brooklyn, exhibiting a relatively high density. Panel (d) shows that Houston's community gardens follow a radial distribution originating from the city center, but the overall spatial layout is quite scattered, with relatively low density.

3.2. Census block group data

Census block group data were from the 2022 American Community Survey (5-year ranges), which was accessed from IPUMS's National Historical GIS database.[2] Following the extant literature, we extracted a list of census block group variables that can be roughly categorized into two groups. The first group is about neighborhood socio-demographics, including the total population, gender, age (e.g., children and seniors), race (e.g., White, Black, Asian, and other races), and educational attainment (e.g., high school, college degree, graduate degree). The second group concerns neighborhood economic and structural factors, covering poverty rate, housing unit vacancy rate, and owner-occupancy rate.

3.3. Food Access Research Atlas

Food Access Research Atlas offers census-tract-level data on food access in the U.S. and is provided by the USDA's Economic Research Service.[3] This dataset indicates whether a census tract is identified as a low-income and low-access area, commonly referred to as a food desert (Ver Ploeg et al., 2009). We spatially matched the 2019 dataset of food deserts, which is the most recent version available to the public, with the aforementioned 1315 census tracts that include information on the number of community gardens.

Fig. 3 illustrates the spatial distribution of community gardens and census tracts identified as food deserts in six cities or metropolitan areas with the most community gardens. Except for New York City, food desert census tracts exist in all other five study areas. Washington, D.C., Rochester, and Los Angeles have fewer food desert census tracts, covering approximately ten tracts each, mostly concentrated in specific parts of the cities. In Atlanta and Houston, food deserts are more extensive, particularly in Houston, where they spread throughout the city.

3.4. Empirical strategy

We adopt two different statistical models to examine the relationship between access to community gardens and neighborhood characteristics. First, we use a logit model to investigate whether certain neighborhood characteristics affect the availability of community gardens in a block group:

$$y_i = \boldsymbol{X_i}\boldsymbol{\beta} + \varepsilon_i \quad (1)$$

where y_i is a binary variable denoting whether block group i has any community gardens, $\boldsymbol{X_i}$ is a list of characteristics for block group i with $\boldsymbol{\beta}$ denoting the corresponding coefficient estimates, and ε_i is an error term. Specifically, the characteristics at the block group level include the total population (*Total population*), the percentage of the male population (*% male*), the percentage of the population aged under 18 (*% children*), the percentage of the population aged 65 and older (*% senior*), the percentage of White residents (*% White*), the percentage of Black or African American residents (*% Black*), the percentage of Asian residents (*% Asian*), the percentage of residents belonging to racial groups other than the three previously mentioned (*% other races*), the percentage of residents holding a high school degree or below (*% high school*), the percentage of residents holding a college degree (*% college*), the percentage of residents holding a graduate degree (*% graduate*), the poverty rate (*%*

[1] We acknowledge that there may be cities and metropolitan areas in the U.S. with community gardens that are not included in our study. This is mainly because data for these community gardens are not yet publicly available or miss geographic coordinates, which renders the use of them in this study.

[2] See data source and description: https://www.nhgis.org/.

[3] See data source and description: https://www.ers.usda.gov/data-products/food-access-research-atlas/download-the-data/

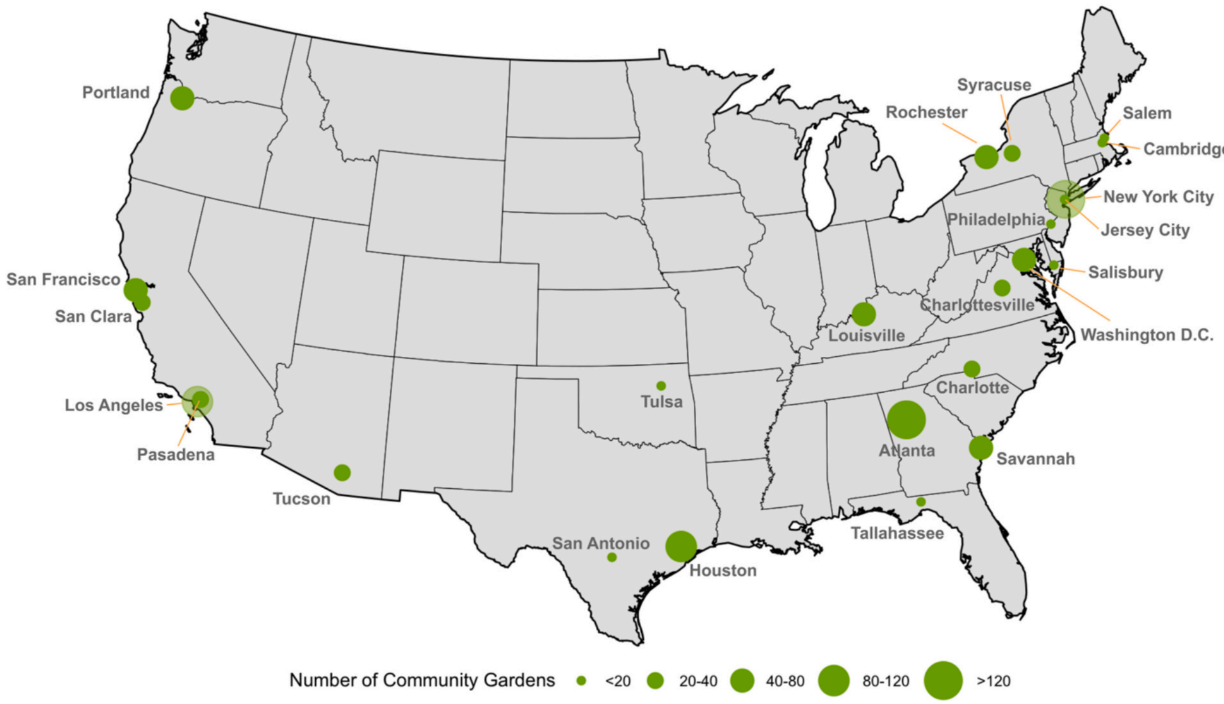

Fig. 1. Map of Cities and Metropolitan Areas with Community Gardens.
Notes: This figure shows the map of 24 cities or metropolitan areas with community gardens in our study.

poverty), which is measured by the percentage of the population with income below the poverty level in the past 12 months, the vacancy rate of housing units (*% vacancy*), and the percentage of owner-occupied housing units (*% owner*).

Second, to further explore whether certain neighborhood characteristics affect the number of community gardens in a block group, we use a Poisson regression as follows:

$$L_i|\lambda_i \sim \text{Poisson}\{\lambda_i\}\ln\{\lambda_i\} = \boldsymbol{X_i\beta} + \varepsilon_i \tag{2}$$

where L_i is the number of community gardens in block group i and λ_i is the expected number of community gardens in block group *i*. The logarithm of the expected count is assumed to be a linear function of neighborhood characteristics as described in Eq. (1).

3.5. Summary statistics

Table 1 summarizes the access to community gardens and census block group variables used in this study. Our final sample includes 3907 census block groups in 24 cities or metropolitan areas in the U.S., covering a total of 1874 community gardens. Approximately 39.5 % of block groups have community gardens. On average, there are 0.48 community gardens per block group, with a maximum of 9 community gardens. The average population of a block group is 1356, with the male population accounting for an average of 48.7 %. The average percentages of children and seniors are 20 % and 14 %, respectively. For different racial groups, White residents have the highest average percentage of 42 %, followed by Black residents (29.6 %), Asian residents (8 %), and other races (19.6 %). In terms of educational attainment, an average of 35 % and 47 % of residents have a high school diploma or lower and a college degree, respectively, while the average proportion of residents with a graduate degree is about 18 %. Regarding neighborhood structural factors, the average poverty rate is 16.6 %, and the average housing unit vacancy rate and owner-occupancy rate are 8.8 % and 46.3 %, respectively.

4. Results

4.1. Differences in neighborhood characteristics

Table 2 presents the differences in neighborhood characteristics between census block groups with community gardens (1543 block groups) and those without community gardens (2364 block groups). We can see that block groups with community gardens have an average total population of 1433, which is significantly higher than that of 1306 in block groups without community gardens. However, there is no significant difference in gender distribution between the two groups, with the male population comprising approximately 49 % in both cases.

In terms of age distribution, the percentage of children is 20.4 % in block groups with community gardens and 19.6 % in those without, with the difference being statistically significant. Meanwhile, the percentage of seniors is approximately 14 % in both groups, showing no significant difference. Regarding racial composition, significant differences exist in the percentage of Black, Asian, and other racial residents between the two groups, except for White residents. Specifically, block groups with community gardens have a significantly higher proportion of Black residents (31.9 %) compared to those without community gardens (28.1 %). Conversely, the proportions of Asian residents and other racial groups are significantly lower in block groups with community gardens. When it comes to educational attainment, no significant differences are observed between the two groups in the proportions of residents with a high school diploma or below (approximately 35 %), a college degree (47 %), or a graduate degree (18 %).

Additionally, block groups with community gardens exhibit significantly higher poverty rates and housing unit vacancy rates, at 17.5 % and 9.3 %, respectively, which exceed those of block groups without community gardens at 16.2 % and 8.5 %, respectively. However, the percentage of owner-occupancy rate does not show a statistically significant difference between the two groups.

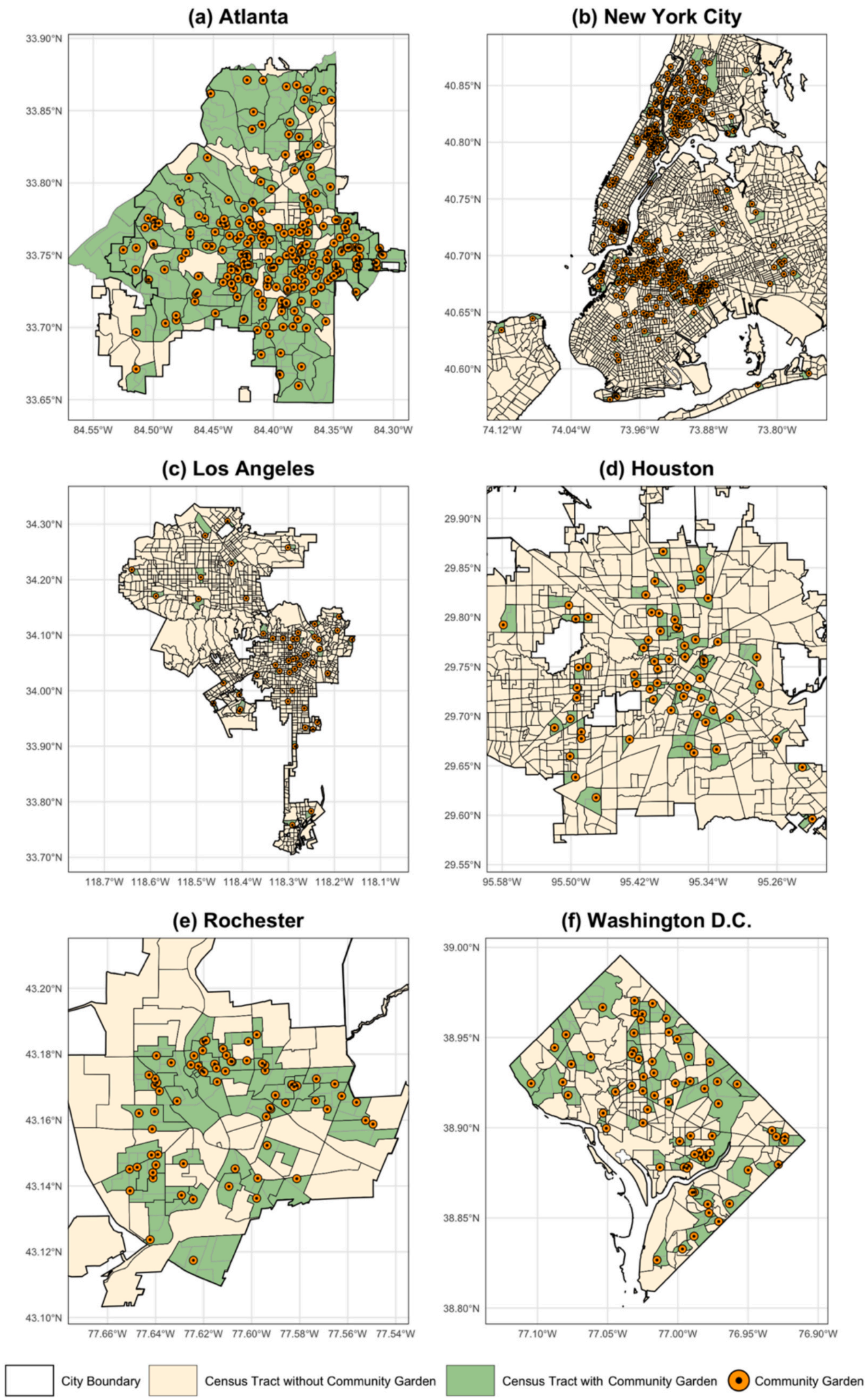

Fig. 2. Spatial distribution of community gardens in six selected study areas.

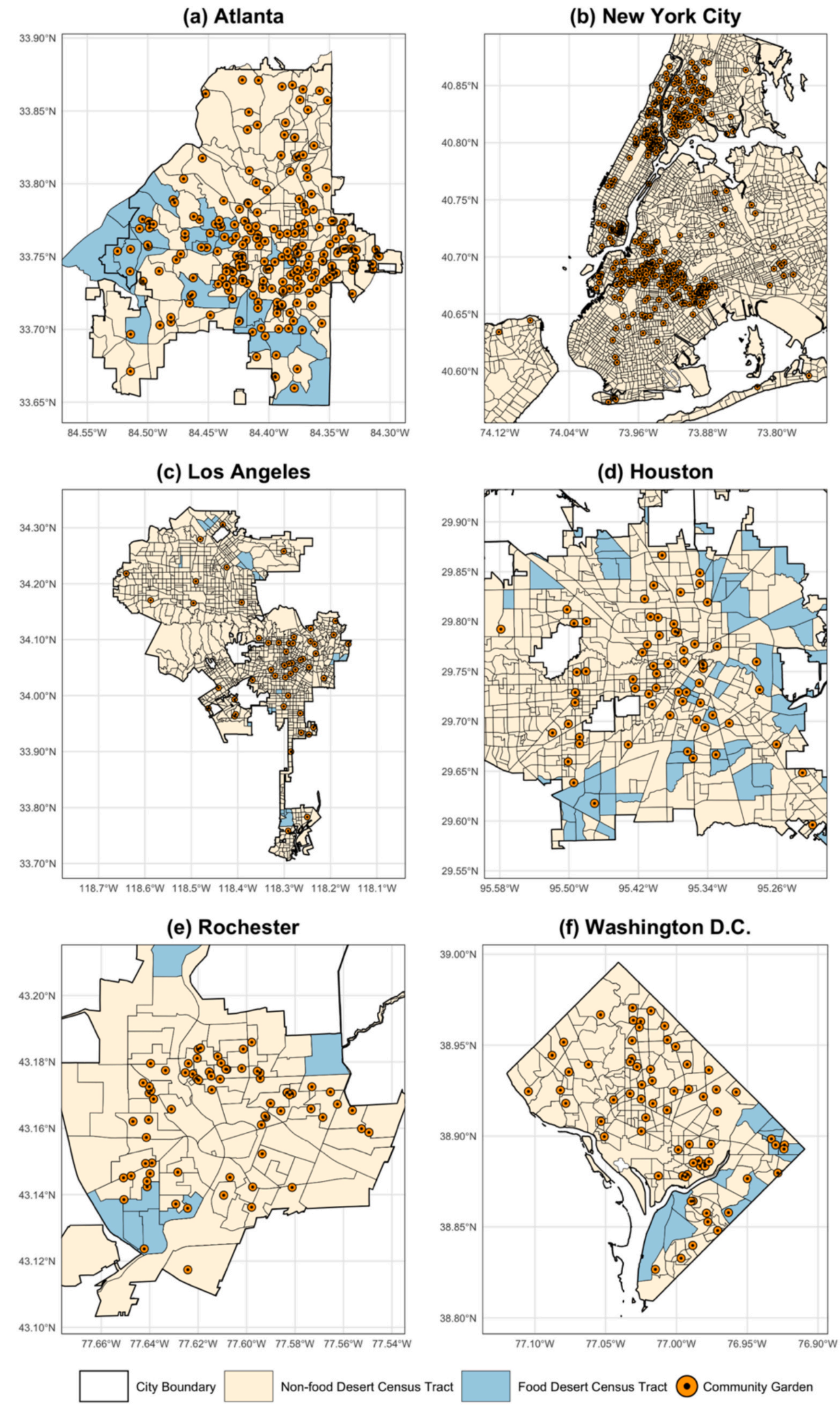

Fig. 3. Spatial distribution of food desert census tracts in six study areas.

Table 1
Summary statistics.

Variable	Mean	S.D.	Min.	Max.
Panel A: Community garden				
Access (yes = 1)	0.395	0.489	0	1
Number of community gardens	0.480	0.702	0	9
Panel B: Census block group characteristics				
Total population (in 1000)	1.356	0.652	0.001	6.199
% male	0.487	0.088	0	1
% children	0.199	0.108	0	0.658
% senior	0.141	0.100	0	0.915
% White	0.428	0.287	0	1
% Black	0.296	0.301	0	1
% Asian	0.080	0.130	0	0.900
% Other races	0.196	0.193	0	1
% High school	0.351	0.229	0	1
% College	0.469	0.151	0	1
% Graduate	0.180	0.160	0	1
% Poverty	0.167	0.161	0	1
% Vacancy	0.088	0.094	0	1
% Owner	0.463	0.310	0	1

Notes: This table summarizes the access to community gardens and characteristics for 3907 census block groups in 24 cities or metropolitan areas in our study, covering a total of 1874 community gardens.

Table 2
Differences in neighborhood characteristics between census block groups with and without community gardens.

Variable	With community gardens [1]	Without community gardens [2]	Difference [1–2]
Total population (in 1000)	1.433	1.306	0.127***
% Male	0.488	0.486	0.002*
% Children	0.204	0.196	0.008**
% Senior	0.138	0.143	−0.005
Race			
% White	0.419	0.433	−0.014
% Black	0.319	0.281	0.038***
% Asian	0.075	0.083	−0.008**
% Other races	0.187	0.202	−0.015**
Educational attainment			
% High school	0.354	0.348	0.006
% College	0.467	0.470	−0.003
% Graduate	0.179	0.181	−0.002
% Poverty	0.175	0.162	0.013**
% Vacancy	0.093	0.085	0.008**
% Owner	0.468	0.460	0.008
Observations	1543	2364	–

Notes: This table compares the summary statistics between census block groups with and without community gardens. A two-sample *t*-test with equal variances is used to show whether the mean difference for each variable is statistically significant.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

4.2. Relationship between neighborhood characteristics and access to community gardens

Tables 3 and 4 present the regression results on the relationship between neighborhood characteristics and access to community gardens. Access to community gardens, the dependent variable, is measured in two ways: a binary variable indicating whether a block group has any community gardens and a count variable indicating the number of community gardens. To assess the robustness of our findings, we estimate three model specifications, where the explanatory variables include: (a) socio-demographic variables only, (b) economic and structural factors only, and (c) all variables together. Across model specifications, the results remain generally consistent.

Table 3
Relationship between neighborhood characteristics and whether there are community gardens.

Variable	Dependent variable: access (yes = 1)		
	Model I	Model II	Model III
Total population (in 1000)	0.325***		0.368***
	(0.053)		(0.055)
% Male	0.380		0.393
	(0.388)		(0.405)
% Children	0.175		−0.062
	(0.345)		(0.373)
% Senior	−0.264		−0.332
	(0.363)		(0.385)
Race (% White as the baseline)			
% Black	0.308**		0.296**
	(0.145)		(0.150)
% Asian	−0.514*		−0.461
	(0.282)		(0.285)
% Other races	−0.499**		−0.332
	(0.230)		(0.241)
Educational attainment (% graduate as the baseline)			
% High school	−0.148		−0.265
	(0.253)		(0.268)
% College	−0.436		−0.366
	(0.319)		(0.327)
% Poverty		0.707***	0.679**
		(0.235)	(0.272)
% Vacancy		0.843**	1.219***
		(0.355)	(0.380)
% Owner		0.299**	0.279**
		(0.121)	(0.140)
Constant	−0.751**	−0.758***	−1.134***
	(0.317)	(0.095)	(0.335)
Log likelihood	−2587.8	−2604.5	−2570.9
Observations	3904	3894	3892

Notes: This table reports the regression results from estimating the models specified in Eq. (1). Robust standard errors are in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

Analyzing socio-demographic characteristics, we find that block groups with larger populations are more likely to have community gardens. However, there is no statistically significant association between community garden access and the proportions of male residents, children, or seniors. Regarding racial composition, block groups with higher percentages of Black residents are more likely to have community gardens, a pattern consistent with previous research. For example, Alaimo et al. (2008) document strong community garden engagement among African American residents in Flint, Michigan, where a citywide survey found that 61.5 % of participants identified as African American. Regarding educational attainment, we do not find any statistically significant relationship between access to community gardens and the percentages of residents with high school diplomas or college degrees when compared to graduate degrees.

The poverty rate, a key indicator of low income, is significantly and positively correlated with greater access to community gardens. Similarly, block groups with higher vacancy rates are more likely to contain community gardens. This pattern aligns with findings from Corrigan (2011) in Baltimore. Her interviews reveal that residents actively repurposed vacant lots into community gardens, highlighting how such spaces often emerge as grassroots responses to local disinvestment. Interestingly, block groups with higher owner-occupancy rates also exhibit a greater presence of community gardens. Smith et al. (2013), in interviews with urban gardeners, find that homeowners were more likely than renters to initiate and maintain garden projects—potentially due to increased neighborhood stability and greater access to land.

Table 4
Relationship between neighborhood characteristics and the number of community gardens.

Variable	Dependent variable: Number of community gardens		
	Model I	Model II	Model III
Total population (in 1000)	0.209*** (0.032)		0.241*** (0.033)
% Male	0.304 (0.252)		0.327 (0.260)
% Children	−0.235 (0.235)		−0.373 (0.244)
% Senior	−0.324 (0.247)		−0.327 (0.261)
Race (% White as the baseline)			
% Black	0.323*** (0.092)		0.296*** (0.095)
% Asian	−0.452** (0.189)		−0.419** (0.190)
% Other races	−0.411*** (0.151)		−0.315** (0.155)
Educational attainment (% graduate as the baseline)			
% High school	−0.152 (0.169)		−0.228 (0.176)
% College	−0.388* (0.220)		−0.301 (0.220)
% Poverty		0.467*** (0.147)	0.482*** (0.172)
% Vacancy		0.755*** (0.224)	0.901*** (0.240)
% Owner		0.146* (0.082)	0.150* (0.089)
Constant	−0.836*** (0.210)	−0.951*** (0.064)	−1.124*** (0.214)
Log likelihood	−3489.6	−3507.9	−3468.6
Observations	3904	3894	3892

Notes: This table reports the regression results from estimating the models specified in Eq. (2). Robust standard errors are in parentheses.
* $p < 0.1$.
** $p < 0.05$.
*** $p < 0.01$.

4.3. Food deserts and the number of community gardens

Fig. 4 illustrates the share of food desert and non-food desert census tracts with community gardens. We can observe that the majority of community gardens are located in census tracts not identified as food deserts, despite the primary goal of community gardens in providing fresh produce and mitigating food insecurity. In detail, in census tracts with only one community garden, the percentage of food deserts is only 5.57 %. In census tracts with two community gardens, the percentage increases to 8.93 %. When the number of community gardens reaches three or more, the percentage of food desert census tracts rises to 10.66 %. This result suggests that, despite the social and environmental benefits community gardens can provide to the community, addressing the issue of food deserts is likely limited, given the current distribution of community gardens.

We further explore whether there are any systematic differences in the number of community gardens between census tracts identified as food deserts and those that are not food deserts. The results are presented in Fig. 5. Panel (a) compares the average number of community gardens between the food desert and non-food desert census tracts. Across all study areas, the average number of community gardens in census tracts identified as food deserts is 1.586, which is higher than that in census tracts not identified as food deserts (1.414). Similar patterns can be observed in six study areas (i.e., Atlanta, Savannah, Washington D.C., Tallahassee, Louisville, and San Antonio) where census tracts identified as food deserts have more community gardens. In contrast, nine study areas (i.e., Charlottesville, Rochester, Salisbury, Syracuse, Portland, Charlotte, Santa Clara, Tucson, and Houston) demonstrate opposite trends, where more community gardens are available in non-food desert census tracts. In Tulsa, the average number of community gardens is the same for food desert and non-food desert census tracts. Interestingly, community gardens are only in census tracts not identified as food deserts in the remaining eight study areas (i.e., Salem, New York City, Pasadena, Cambridge, San Francisco, Los Angeles, Jersey City, and Philadelphia).

To statistically investigate the relationship between the number of community gardens and food desert status at the census tract level, we calculated Pearson's correlation coefficients, and the results are reported in panel (b) of Fig. 5. Generally, these results are consistent with findings from panel (a). We find that the number of community gardens is positively and weakly correlated with whether a census tract is a food desert at the 10 % significance level, with a correlation coefficient of 0.045. For the six study areas that have more community gardens in food desert census tracts, a positive correlation is expected, although the correlation is statistically significant only in Washington, D.C., and Atlanta. For the nine study areas that have fewer community gardens in food desert census tracts, a negative correlation is expected, and the correlation turns out to be not statistically significant for all of them. For the eight study areas that do not have any community gardens in food desert census tracts and Tulsa (which has the same average number of community gardens for food desert and non-food desert census tracts), correlation coefficients cannot be obtained and are thus not shown in the figure.

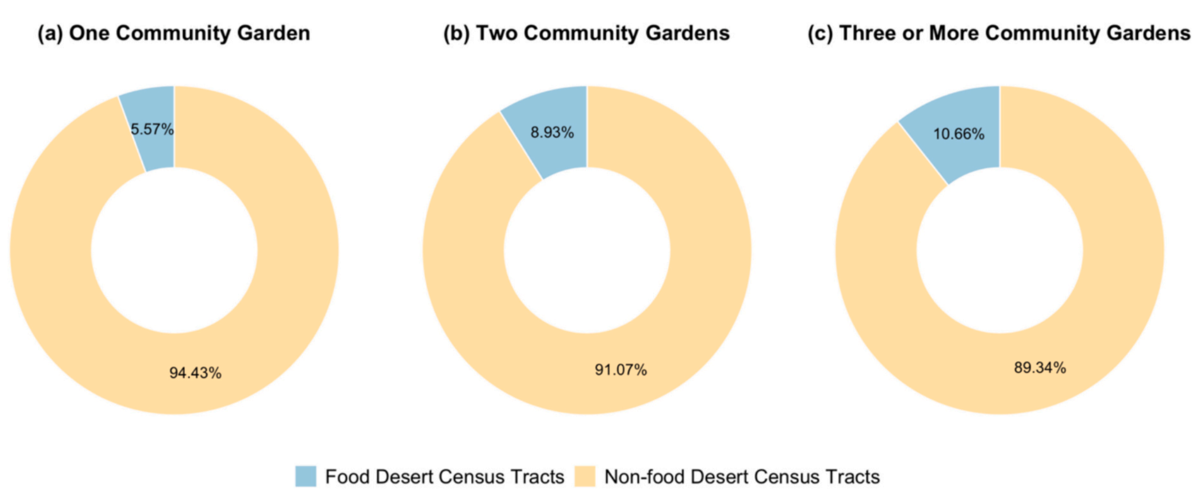

Fig. 4. Share of food desert and non-food desert census tracts with community gardens.

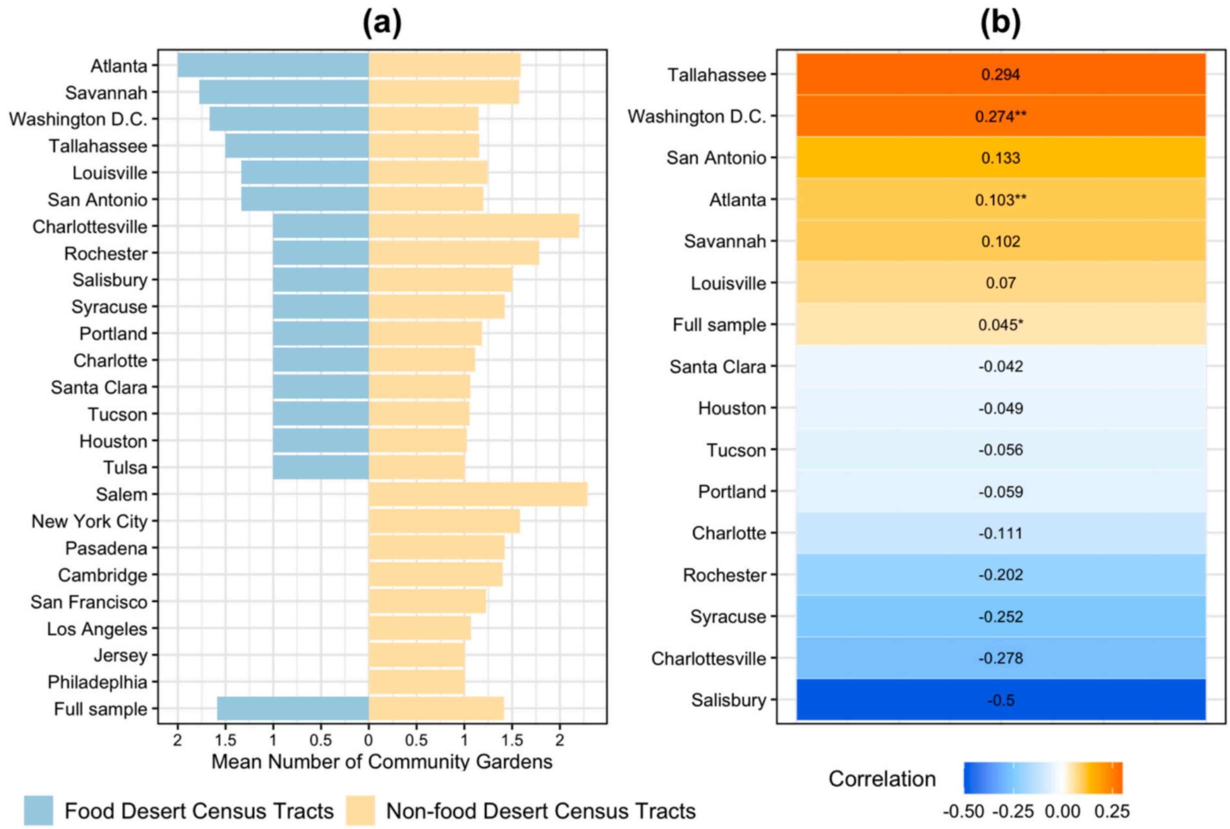

Fig. 5. Correlation between the Number of Community Gardens and Food Desert Status.
Notes: Eight study areas (i.e., Salem, New York City, Pasadena, Cambridge, San Francisco, Los Angeles, Jersey City, and Philadelphia) do not have community gardens in census tracts identified as food deserts. Tulsa has the same average number of community gardens for food desert and non-food desert census tracts. As a result, correlation coefficients cannot be obtained for these nine study areas and are thus not shown in panel (b).

5. Discussion

Consistent with prior studies (Butterfield, 2020; Gripper et al., 2022; Taylor et al., 2024), we find that census block groups with a higher percentage of Black populations are more likely to have community gardens. Additionally, similar to the findings of Garrett and Leeds (2015), our results show that poverty rates and housing unit vacancy rates are positively associated with the number of community gardens at the block group level. Finally, we provide new evidence that the vast majority of community gardens are in census tracts not identified as food deserts. In this section, we discuss several important policy implications drawn from our findings.

5.1. Race and poverty in shaping community gardens

The finding that community gardens are more likely to be in neighborhoods with higher poverty rates and larger Black populations may reflect long-standing patterns of structural disinvestment (Limerick et al., 2023). Access to fresh and nutritious food is not evenly distributed across urban landscapes. A substantial body of research has shown that Black and low-income communities are more likely to have limited access to supermarkets and healthy food options, while being surrounded by fast-food outlets and understocked stores (see Larson et al., 2009; Miller et al., 2015). These disparities have been identified as a form of structural racism within the urban food system (Bailey et al., 2017).

In response to these inequities, many Black and low-income communities have adopted community gardening as a grassroots strategy to mitigate food insecurity (Ottmann et al., 2012). This spatial pattern is not incidental but reflects deeper sociopolitical dynamics. Many gardens emerge as community-led initiatives, directly addressing the scarcity of affordable, fresh food. Additionally, they function as adaptive mechanisms in contexts of systemic disinvestment and inadequate public services in marginalized neighborhoods (Saldivar-Tanaka & Krasny, 2004; White, 2017). As Butterfield (2020) argues, disadvantaged neighborhoods may host more community gardens, not because they are better resourced, but because they have greater need and fewer alternatives. More fundamentally, they represent acts of resistance against food apartheid and structural racial inequities perpetuated by urban food systems (Gripper et al., 2022). Thus, in these settings, community gardens serve not only as sites of food production but also as spaces of political agency and spatial reclamation.

5.2. Urban space and the role of planning

Given that community gardens are more likely to be in neighborhoods with higher vacancy rates of housing units, policies can incentivize the use of vacant or underutilized spaces for community gardens (Braswell, 2018; Schukoske, 2000), especially in areas identified as food deserts. However, community gardens are often seen as temporary uses of vacant land, which limits their long-term sustainability (Drake & Lawson, 2014). While short-term policy incentives may increase initial access, they often fail to secure long-term land tenure, leaving community gardens vulnerable to removal or redevelopment. Fox-Kämper et al. (2018) show that land tenure is the most crucial governance-related factor for the successful development of community gardens.

In urban neighborhoods, vacant land can be scarce or entangled in complicated ownership issues. Even when such land is available, it may be owned by private entities or subject to restrictive municipal policies that hinder community garden initiatives. Without legal guarantees or longer-term agreements, these spaces remain at risk, undermining the stability needed for communities to maintain and invest in community gardens over time. Offering tax breaks or other incentives to landowners who allow their property to be used for community gardens can encourage more land to become available. Park and Ciorici (2013) show that neighborhood characteristics such as poverty level and owner-occupancy level can determine the conversion of vacant land to community gardens. Additionally, Li and Long (2024) show that the presence of existing gardens influences residents' preferences for new gardens. These findings will help communities identify and target the most suitable vacant space for future community gardens.

Another policy initiative is to promote multi-use spaces by integrating community gardens into the development of public parks. According to Middle et al. (2014), incorporating community gardens into previously underutilized public park landscapes offers an innovative approach to sustainable planning. These gardens provide a venue for accessible physical activities, such as vegetable and plant gardening, making the park environment more attractive to residents. However, some lessons are noteworthy. For instance, the roles and responsibilities of different agencies involved in the planning and design of these sites need to be clearly defined (Hou & Grohmann, 2018). The private nature of community gardens can lead to spatial and programming conflicts between gardening and other park uses, inducing challenges. More importantly, without addressing long-term tenure, the benefits of integrating community gardens into public spaces may be short-lived. To promote stability, cities could establish formal land trust mechanisms, prioritize long-term leases for community groups, or designate specific parcels of public land for permanent community gardening use.

5.3. Gentrification and the concern for social equity

Although community gardens are often promoted as a strategy to address food insecurity, our findings indicate that they are not predominantly located in food desert areas. This spatial mismatch suggests that food access considerations may not be the primary factor driving the placement of community gardens. As Smith et al. (2013) note, the decision-making process for community garden placement has often been influenced by factors unrelated to food security goals or the geographic distribution of food-insecure populations. Particularly, recent shifts in community food project (CFP) resource planning have emphasized placing gardens in areas of projected growth and development, such as emerging residential zones or areas targeted for revitalization, rather than in neighborhoods with existing food access challenges. These decisions are typically made by institutional or municipal agents whose priorities may align more with economic development goals than with equitable food access. Consequently, the organizational structure and planning processes behind CFPs may inadvertently widen the gap between food-insecure populations and the community food resources intended to support them.

One likely reason for prioritizing future growth areas is the recognized impact that community gardens can have on neighborhood attractiveness and property values. By improving green space and fostering a sense of belonging among residents, community gardens have been shown to increase property values by boosting desirability and social cohesion. Voicu and Been (2008) show that in New York City, the positive effects of urban gardens are particularly evident in neighborhoods with lower average household incomes, where the value can increase by about nine percentage points within five years of the establishment of gardens. This empirical evidence can help local governments make more informed decisions about financially supporting community gardens in certain neighborhoods and even encouraging private investment in them.

This development-oriented siting strategy, while potentially boosting property values, may also accelerate processes of "green gentrification" (Anguelovski et al., 2022; Rigolon & Collins, 2023). When communities face gentrification, it can transform access to and use of community gardens in the city, as well as the politics around them (Aptekar & Myers, 2020). Braswell (2018) indicates that a sociospatial dialectic exists, where the implementation of a community garden, along with changes in urban space usage, can lead to unintended social outcomes. Therefore, the potential of community gardens as instruments for spatial justice depends on institutional support against larger-scale processes like gentrification, which can lead to spatially unjust outcomes. To mitigate these risks, it is crucial that community garden planning be paired with affordable housing protections and inclusive planning processes, especially in food desert neighborhoods. This can be achieved through community land trusts, long-term land tenure guarantees for gardens, and meaningful engagement with local residents in siting and governance decisions. These strategies can help ensure that the benefits of urban agriculture remain accessible to the communities they are intended to serve.

6. Conclusions

This study provides a comprehensive analysis of how various neighborhood characteristics can explain the availability of community gardens across 24 cities or metropolitan areas in the U.S. Our results show that several neighborhood characteristics (e.g., share of Black populations, poverty rate, housing unit vacancy rate) are systematically related to whether a neighborhood has community gardens. Notably, we investigate the spatial distribution of community gardens in the context of food deserts. We find that community gardens may have limited capacity to address the issue of food deserts, given that the vast majority of current community gardens (about 90 %) are in neighborhoods not identified as food deserts.

Despite the new evidence we provide in this study, there are several caveats worth noting, which deserve future investigation. First, while we aim to include as many study areas across the nation as possible, data on the characteristics of community gardens (e.g., size, type of vegetation, operation time) are lacking. These attributes can significantly influence the provision of ecosystem services and the environmental benefits that community gardens offer. For example, previous research shows that natural vegetation and impervious surface cover within community gardens can differ widely across cities, which has useful insights into the extent to which ecosystem services can be provided and the planning trajectories of the cities (Anderson et al., 2019). Second, the information on when each community garden was established is largely missing as well. Documenting the evolution of community gardens is especially useful to more accurately evaluate the impacts of community gardens, such as property values (Voicu & Been, 2008), fruit and vegetable consumption (Carney et al., 2012; Litt et al., 2011), and other socioeconomic consequences (Ambrose et al., 2023; Petrovic et al., 2019). Third, potential biases in our empirical analysis may exist due to excluding cities lacking comprehensive community garden data, tempering the broader generalizability of the findings.

Future research should prioritize the collection of more detailed data on community garden compositions and pursue longitudinal studies that capture the dynamic development of community gardens over time. Moreover, researchers may combine qualitative data, such as interviews with local residents and stakeholders, with quantitative analysis from studies like ours to provide valuable context for the empirical results. Our findings can inform actionable urban planning frameworks, particularly efforts to integrate community gardens into broader urban resilience strategies, such as climate adaptation, public health, and food security planning. However, to maximize the benefits of urban greening initiatives, it is vital to implement robust policies that prevent green gentrification. Without equity-centered planning, the socio-economic and environmental advantages of community gardens may inadvertently contribute to displacement pressures on low-income communities. Ensuring equitable access to these shared spaces is essential for fostering inclusive and sustainable urban environments.

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CRediT authorship contribution statement

Hao Chen: Validation, Software, Investigation, Methodology, Formal analysis, Writing – review & editing, Visualization, Writing – original draft, Resources. **Haoluan Wang:** Writing – review & editing, Conceptualization, Project administration, Writing – original draft, Investigation, Supervision. **Filippo Bora:** Data curation. **Yingqi Hu:** Data curation.

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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