Assessing the Relationship of Crime and Urban Gardens in Minneapolis, Minnesota through GIS

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Abstract

Since the 1970's, the inner cities of many U.S. metropolitan areas have had issues with increasing vacant land and crime, which led to decreasing property values, and less tax revenue for the city. The resurgence of urban gardens has been one method that city governments and the people living in low-income areas have used to redefine and invigorate their communities. The purpose of this study was to discover if there was a change in the number of crimes committed surrounding urban gardens in Minneapolis. This study explored 13 urban gardens in Minneapolis, MN and 13 randomly selected areas with no urban gardens present within one mile of the urban gardens and within the same neighborhoods. Crimes committed during 2017 were analyzed in two buffer zones, an area of suggested influence within 500 ft of the garden, referred to as the "inner-ring," and from 501-1000 ft, an area outside the suggested range of influence, referred to as the "outer-ring." Urban gardens for this study were selected by average income, proximity to other urban gardens, proximity to large parks and bodies of water, and proximity to shopping centers. The raw results showed an average of 1.6 more crimes in the outer-ring compared to the inner-ring of the garden locations, while the locations with no gardens showed almost no difference. On average, the outer-ring had 0.16 crimes less than the inner-ring for the 2017 year in locations with no gardens. Statistical tests however showed no significant difference between the two distance zones as well as no significant difference between areas with urban gardens present and the random locations with no urban gardens.

Introduction

Since the 1960's, major cities across the United States have seen large decreases in their urban populations. Minneapolis, MN witnessed a maximum population of 521,718 in 1950 before falling to 368,383 in 1990 and then stabilizing at 382,000 for the 2000 and 2010 census (US Census Bureau, 2017). With the loss of residents, vacant lots started appearing in the inner city urban areas in the City of Minneapolis. Vacant lots can be detrimental to neighborhood stability, increasing crime rates and contributing to the overall deterioration of the community (Slabinski, 2013). Many of the properties are a result of tax foreclosures and the properties changing possession from the owners to the government (Dewar, 2015). Owley and Lewis (2010) performed a study in Philadelphia where it was determined the city spent $20 million per year to upkeep these properties and lost $2

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million a year in lost tax revenue. Slabinski (2013) also supports this stating the continued cost of boarding up homes, preventing illegal entry, hiring companies to control animal infestations, and paying disposal fees for trash and debris collection cost cities vast amounts of capital. Urban farms and gardens provide one solution that cities and its citizens are turning to for the reuse of vacant land. Urban agriculture improves the community's health by providing food for neighborhoods that currently lack grocery stores (Jacob, 2015). In addition to allowing access to food, urban gardens help transfer responsibilities of abandoned properties from municipal governments to neighborhood volunteers (Knigge, 2006).

It is important to understand the usefulness and impact of urban gardens because many of these lots represent potential income for cities or private companies. Gardens are often pitted against other revitalization projects like affordable housing (Voicu and Been, 2008). Urban gardens give individuals more access to food, keep people physically active, and give city people the ability to appreciate nature while in the cities (Wakefield, Yeudall, Taron, Reynolds, Skinner, 2007). These points are difficult to quantify, thus needing persuasive arguments to be able to compete with other amenities (Schmelzkopf, 1995).

Gardens located in lower income neighborhoods can assist in community development, leading to a sense of added security (Glover, 2004). Those interviewed by Teig, Amulya, Bardwell, Buchenau, Marshall, and Litt (2009) described what an urban garden can represent: "a place with no drugs, no prostitution, a safe place for families and a catalyst for additional activities to be invested in." Kou, Sullivan, Coley, and Brunson (1998) found residents living closer to green spaces had closer ties with their neighbors, more social activities, more knowledge of neighbors, a stronger sense of belonging, and more awareness and willingness to help one another than residents living near barren lots. These relationships were also passed down to youth as adults worked together to help prevent local youth from participating in criminal behavior (Allen, Alaimo, Elam, and Perry, 2008). An interviewee with Glover (2004) mentioned because of the collective reclaiming of the neighborhood, people made efforts to know who is who and introduced themselves to new people more readily.

Gorham, Waliczek, Snelgrove, and Zajicek (2009) noted that even though their research indicated no changes in crime, six out of 11 urban garden respondents mentioned a positive change in property value, drug activity, and neighborhood activity. These urban garden users perceived they were living in a safer neighborhood (Gorham *et al.*, 2009).

Background

The practice of urban agriculture is typically defined as the practice of growing, processing, and distributing foods and animal husbandry within a city (Bailkey and Nazr, 1999). Society is currently in an era where going "green" is on the agenda of many major cities. This though is not a new phenomenon, but rather a modern practice that rural and urban dwellers have embraced throughout American history (Slabinski, 2013). According to Schmelzkopf (1995), gardening has its origins in American cities in the late nineteenth century, when gardens began to be developed by low-income groups to grow food for local consumption on land in which little market

value was attached.

Abandoned lots played a role in these early gardens as far back as the 1890s when cities like Detroit, Chicago, and Philadelphia gave small parcels of vacant city land to the unemployed (Lawson, 2005). Called "Potato Patches," these lots provided residents with a low-cost way to supply fresh vegetables to their families until they could again obtain gainful employment (Slabinski, 2013).

Brown and Jameton (2000) suggest community gardens have made substantial contributions to the American food supply; World War II "Victory Gardens" have been credited with providing an estimated 40% of the U.S. vegetable supply in 1944. Post WWII, retail grocery stores started to replace the needs of home and community gardens (Mukherji and Morales, 2010). During the 1970's, public awareness of the ecological movement, brought on by rising inflation in food prices, helped bring about a renewal in environmental stewardship (Brown and Jameton, 2000). Community agriculture projects have expanded their operations to respond to poverty, environmental degradation, and the lack of green spaces in deprived urban places (Milbourne, 2012). Full service grocery stores and food markets are often absent from low income neighborhoods and only convenience stores and fast food chains that offer high-fat high-processed foods are available (Treuhaft and Karpyn, 2010). These areas often become what the United States Drug Administration (USDA) define as "Food Deserts."

The USDA (2017) defines "Food Deserts" based on three indicators:

- Accessibility to sources of healthy food, as measured by distance to a store or by the number of stores in an area.
- Individual-level resources that may affect accessibility, such as family income or vehicle availability.
- Neighborhood-level indicators of resources, such as the average income of the neighborhood and the availability of public transportation.

Urban gardens are important because they provide food security, improve health, renew peoples' sense of pride in their areas, and create new forms of social interaction and public participation (Milbourne, 2012).

Crime and Land Use

Vacant lots have potential to be a place for criminal activities. Abandoned structures are susceptible to fires, scrapping, and illegal activities (Dewar, 2015). The fear of crime in urban areas is often linked to densely vegetated areas leading to a lower perceived security (Shaffer and Anderson, 1985). This is due to the reduced view and areas where potential criminals may hide (Nasar and Fisher, 1993).

To get a better understanding of these perceptions, Kuo and Sullivan (2001) conducted a survey of selected Chicago neighborhoods and the impact vegetation had on crime rates. Their results stated total crime dropped between 42% and 52% from buildings with low vegetation to buildings with medium and high vegetation. In Los Angeles, the Los Angeles County Department of Parks and Recreation's Park After Dark (PAD) programs have seen serious and violent crime decrease 32% between 2009 and 2013 during the summer months where three of the program's parks are located compared to similar parks not in the program. Parks not in the program have seen an 18% rise in crimes (Jacob, 2015). PAD is a night program where kids can

swim, play, and exercise three times a week in conjunction with the LA Deputy Department. In measuring crime in relation to greenness of an area, Snelgrove, Michael, Waliczek, and Zajicek (2004) found 83% of all crimes accrued in areas that had greenness values below 34%.

Another study by Gorham *et al.* (2009) used a different model, which tested crimes within 1/8 mile of a garden compared to random locations in similar neighborhoods, and found no statistical evidence of lower crime occurrences.

Difficulties

A major obstacle facing urban farming and its potential to help curb the proliferation of vacant land within cities is the absence of a legal framework by which communities can obtain property rights to vacant parcels and, even if rights can be obtained, what uses are permitted by the city's municipal code (Slabinski, 2013). Owley and Lewis (2010) suggest viable sites for urban gardens will sit empty because absentee landlords or public owners are reluctant to sell or lease their land for agricultural uses. Bailkey and Kaufman (2000) also discuss how the land tenure can cause issues when urban farmers wish to secure land for growing produce in the city. Most parcels are not owned by the farmers that farm these lots and are usually owned by private landowners or public agencies that view these land usages as temporary (Bailkey and Kaufman, 2000). Challenges like clear title or leasehold make it difficult for urban farmers to obtain services like water or garbage (Owley and Lewis, 2010).

Owley and Lewis (2010) also suggest that landowners may seek to limit the leases to only a few years at a time to enable conversions of the lot to other uses should community circumstances change. Of the delinquent properties that do sell, new owners mainly use them as speculative investments (Dewar, 2015). As examples, Dewar (2015) states properties auctioned off in New York City from 1990-1995 mainly became parking lots or remained vacant, and in Detroit and Flint Michigan, nearly half of vacant land bought by owners of the adjacent property showed no signs of use or redevelopment. Dewar's (2015) conclusion was that large amounts of properties auctioned or sold in the cities with high levels of disinvestments failed to return into a tax yielding property and continue to be a large problem cities face in trying to turn properties around into profitable land.

This study takes place in Minneapolis, MN, which along with St. Paul, have amended zoning codes to allow for expanded urban agriculture. The City of Minneapolis (n.d.) established the Minneapolis Community Garden, Market Garden, and Urban Farm Policy on November 20th, 2015 to help adapt policy and assist in urban agriculture. Key points include:

- Extend execution of leases of up to 5 years for gardens on parcels determined to be undevelopable.
- Criteria providing a parcel's eligibility for lease or sale as a garden space to commercial growers and community gardeners.
- Expand city-owned lots available by 43 for additional gardens.
- Define garden lease standards for fees, insurance, and security deposits.

To investigate if the investments in urban gardens are making a difference, this study will compare crime data within an inner-ring and outer-ring buffer zone to

determine if any difference in crime frequency has been observed.

Methodology

Gardens

Garden locations for the City of Minneapolis were collected through the Gardening Matters (2017) webpage, which holds a database of urban gardens throughout Minnesota. Urban gardens located in Minneapolis were then selected and entered into ArcMap along with a Minneapolis neighborhoods layer. 2016 average income was then collected from the Minnesota Compass webpage, which compiles records from the U.S. Census. This data was used due to its compatibility with the neighborhood aspect of urban garden analysis. The 2016 income data also gave the most up to date information to use alongside the 2017 crime and garden data. The Jenks method of classification was then used to separate incomes into three groups. This method was used to create the best definitions between low, medium, and high by maximizing class variance.

Since about 70% of the gardens were in low-income range neighborhoods, those with an average income less than $52,579, only these gardens and neighborhoods were considered for the study (Figure 1).

Further analysis was conducted based upon a combination of two prior studies on urban gardens. Gorham *et al*. (2009) researched crime within a 1/8-mile radius of the urban gardens and compared these numbers to random 1/8-mile buffer locations within a 1-mile buffer of the urban gardens. A study on property values near urban gardens by Espey and Owusu-Edusei (2001) showed that small parks, similar in size to urban gardens, have a statistically positive effect within 600 feet and no statistically significant effect beyond.

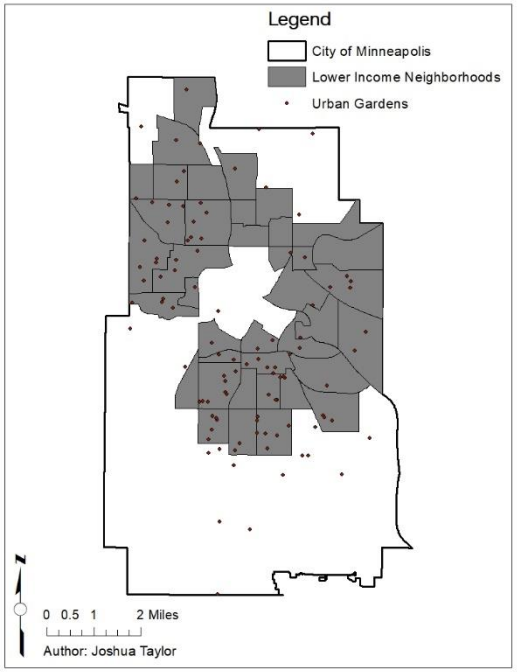

Figure 1. Grey selection represents neighborhoods that fell into the low-income category of < $52,579. Dots represent all urban gardens referenced from the Gardening Matters webpage.

The selection process for the urban gardens involved making sure none of the inner-ring zones interfered with another garden's outer-ring. This is because research suggests urban gardens would only influence crime within the inner-ring and not in the outer-ring. Thus, it was important that the two types of zones not overlap in order to prevent contaminated results. Outer-ring buffers were allowed to overlap.

Gardens located near large multi-acre parks were also removed due to influences from the parks. Also removed were gardens whose influence area occupied large open industrial areas, consisted mostly of highways or interstates, or was located near large bodies of water or shopping malls. Thirteen gardens remained in the study

area after applying these criteria (Figure 2).

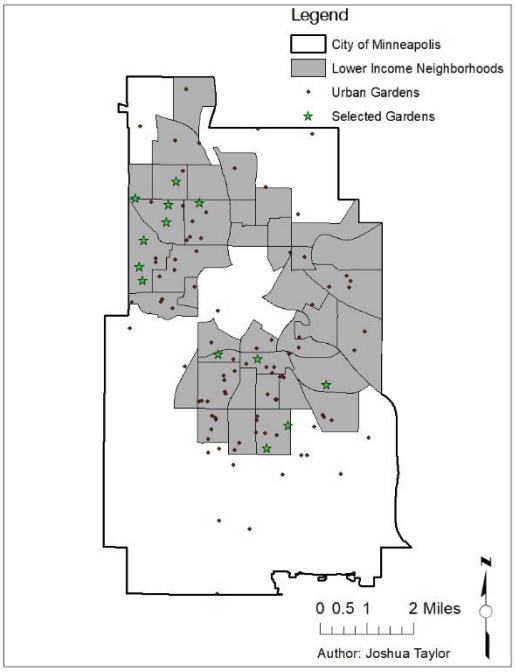

Figure 2. Thirteen gardens to be studied for effect on crime that met the criteria, including being located in a neighborhood with median income under $52,579, no overlapping of "area of influence" (inner-ring buffer), and not having their zones of study (outer-ring) near any large parks.

The 13 gardens represent nine Minneapolis neighborhoods: Bancroft, Powderhorn Park, Seward, Stevens Square, Venture Village, Willard Hay, Jordan, Cleveland, and Folwell. Twelve of the gardens are used primarily for food and one for non-edibles. All gardens are in northwest Minneapolis and the north-central neighborhoods located just south of downtown.

Crime

This study used crime data from the City of Minneapolis Interactive Crime Map (n.d.) for the year 2017 to count crimes within a 0-500 ft (inner-ring) and 501-1000 ft (outer-ring) buffer. This data was used instead of GIS data from Open Minneapolis, because it located crimes at the address of the crime as opposed to the intersection or mid-point of the block. This allowed for more accurate data collection due to the use of actual location versus approximate location.

Random Point Generation

In addition, a one-mile buffer was established around all low-level income urban gardens because this range was likely to be in the same neighborhood or a similar demographic area as the urban garden (Gorham *et al*., 2009). The neighborhood layer was overlain to keep the study contained in the lower income neighborhoods and 13 random points were selected from this combined buffer after applying the same criteria as the selected gardens.

Selections were made by placing a grid over low-income neighborhoods and using a Python script number generator to choose an X, Y location on the grid. The grid was created by taking Township 28 and 29 of Range 24 and dividing them into sections. From there city blocks and lots were used as the grid for X, Y locations. For all steps, the Python script was used to choose the X, Y location. The same inner-ring and outer-ring buffers were created for these points (Figure 3).

To accurately compare the inner-ring buffer to the outer-ring buffer, crimes per acre was used due to the area difference between the two sections. The crimes and area of the inner-ring buffer were not included in the outer-ring buffer in order to avoid counting crimes and area twice.

Crimes for the selected urban gardens and random points were then counted and calculated to a number representing crimes/acre.

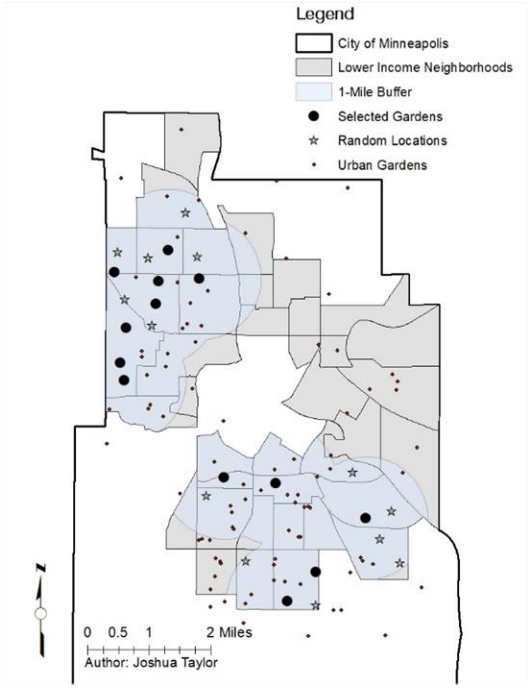

Figure 3. The locations of the randomly selected locations relative to the current urban garden locations.

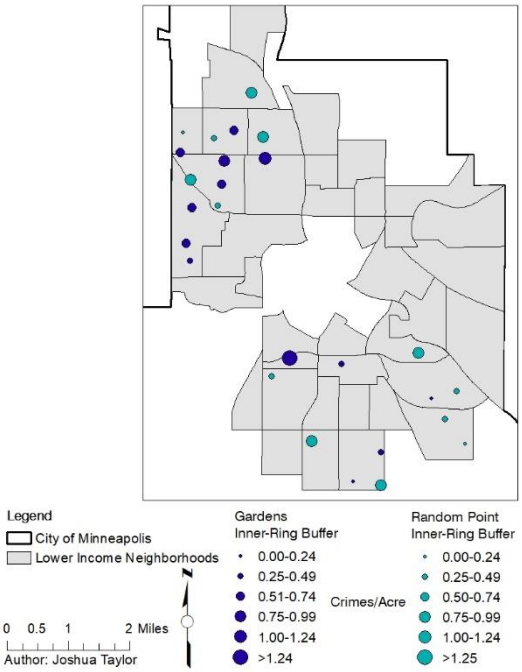

Figure 4. The crimes/acre in the inner-ring buffer of the selected urban gardens and random points.

Results

Raw Data Analysis

The inner-ring buffer zone for the selected urban gardens yielded an average crimes per acre value of 0.63 while the outer-ring buffer zone yielded a crimes per acre value of 0.72. Randomly selected locations yielded inner-ring buffer results of 0.51 crimes/acre while the outer-ring zones yielded 0.50 crimes/acre (Figure 4).

Of the selected urban gardens, eight of them showed fewer crimes/acre in the inner-ring than the outer-ring, one showed no difference in crime, and four showed more crimes/acre in the inner-ring (Figure 5). All the gardens selected just south of downtown had a raw increase in crime when moving from the inner-ring buffer to the outer-ring buffer. In north Minneapolis, five out of the eight gardens located showed a decrease in crime moving from the inner-ring to outer-ring buffer.

Statistical Analysis

An independent left-tailed T-test with the significance value set to 0.01 was used to measure if there were any significant differences between three distinct attributes: the inner-ring buffer around the gardens compared to the outer-ring buffer and the inner-ring garden buffer compared to the random location inner-ring buffer.

For each equation, the null hypothesis (H_o) was tested to see if crimes in the inner-ring buffer for gardens were equal to the outer-ring buffer and the inner-ring buffer of the randomly selected locations. The alternative hypotheses ($H_{a)}$ tested to identify if the inner-ring garden location had less crimes than the other two areas.

The comparison of the urban garden locations' inner-ring buffers to the outer-ring buffers resulted in a t-value of -0.6283, which is greater than the critical value of -2.493 meaning the null hypothesis is not rejected. The p-value of

0.2679 is ≥ 0.01, which also results in not rejecting the null hypotheses. Both results support that there is not enough evidence to claim that the crimes within inner-ring buffer of the urban gardens are less than the outer-ring buffer (Table 1).

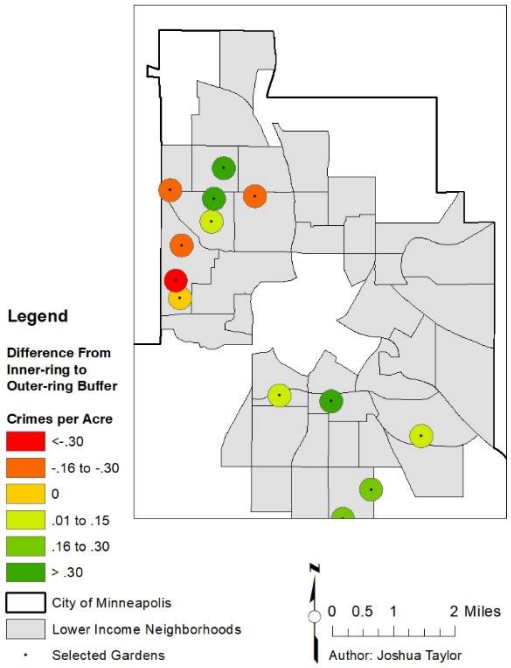

Figure 5. Change in crimes/acre between the inner-ring buffer and the outer-ring buffer. The darker the green the higher the change in crimes/acre when moving from the inner-ring zone to the outer-ring zone. Eight of 13 gardens showed an increase in crime past the 500 ft zone.

Table 1. Independent T-test comparing crimes in the inner-ring of the urban gardens to the outer-ring of the urban gardens. The t-value is greater than the critical value of -2.507 meaning there was not enough evidence to claim the inner-ring buffer had fewer crimes than the outer-ring buffer.

Location	N	Mean	SD	t
Inner-ring Buffer	13	0.6285	0.3724	-0.628
Outer-ring Buffer	13	0.7220	0.3949	

A paired t-test was also conducted treating the inner-ring and outer-ring of each garden as a pair. The null hypotheses that the difference between the inner-ring and outer-ring is equal to zero was tested against the alternate hypotheses of a difference not equal to zero. The result was that the null hypothesis could not be rejected; no significant difference was found between the inner-ring and outer-ring.

The urban garden inner-ring buffers compared to the random point inner-ring buffers also resulted in a t-value, 0.946, being greater than the critical value of -2.507 (Table 2). The p-value of 0.8229 is also ≥ 0.01 resulting in the null hypotheses not being rejected.

Table 2. Independent T-test comparing crimes in the inner-ring buffer of urban garden locations to the inner-ring buffer of randomly selected locations. The t-value is greater than the critical value of -2.507 meaning there was not enough evidence to claim that the crimes in the inner-ring buffer around gardens were less than the random locations.

Location	N	Mean	SD	t
Gardens	13	.1638	.33011	1.537
Random Location	13	-.0146	.25738	

A test to determine if the change in crime between the inner-ring and outer-ring buffer zones was different between the garden locations and random locations also resulted in not enough evidence to claim differences. For this test, the null hypothesis tested if the differences in crimes/acre were the same against the alternative hypotheses that they were different. The t-value of 1.537 was ≤ than the critical value of 2.797 and the p-value of 0.1375 was ≥ than 0.01. This resulted in the null hypothesis not being rejected and no statistical evidence that the change in crimes/acre in the gardens and random locations were different (Table 3).

Discussion

The raw data shows crimes per acre appear to be lower in the randomly selected areas

Table 3. Differences between buffer zones of gardens and buffer zones of random locations. The t-value is less than the critical value of 2.797 meaning there was not enough evidence to claim that the differences in crime between the inner-ring buffer and the outer-ring buffer around urban gardens was different than the differences between the buffer zones around the random locations.

Location	N	Mean	SD	t
Urban Gardens	13	0.6285	0.3724	0.9459
Random Location	13	0.5069	0.2756	

with no gardens compared to the garden areas. Possible explanations for this could be that the places without gardens were generally safer to begin with and may have less vacant lots, so the opportunities for gardens are less. As stated, over 70% of Minneapolis gardens are in neighborhoods that are in the low-income range of Minneapolis neighborhoods, so the people in these areas may have more reasons to begin a garden.

Although the statistical analysis showed no significant difference, the raw data showed that crime increased by 0.09 crimes per acre going from the inner-ring buffer to the outer-ring buffer for urban garden locations. Locations without gardens had a change of -0.003 crimes per acre. The difference of 0.09 crimes per acre is 1.6 less crimes committed for that year for the inner-ring buffer compared to the outer-ring buffer. The non-garden areas selected for the study showed a decrease of 0.16 total crimes for the year when comparing the inner-ring to the outer-ring.

Further research into future changes in crime could provide a better overall assessment. Buffer zones around current gardens could be on a downward trend while random buffers are staying the same or going up. Research in all inner-ring buffer locations compared to the rest of the city could also provide a better overall understanding of the impacts of gardens.

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