A GREENER NEW YORK IS A SAFER NEW YORK
We have long understood that our spaces have tremendous impacts on the communities that surround them. Removing signs of disorder and demonstrating care sends a message to residents that their community is valued. It supports local groups to continue driving strength from within. We commissioned Glass Frog Solutions, a research and evaluation company, to help us more accurately understand the outcomes of our work. The results were startling:

There were 213 fewer felonies each year in neighborhoods with high NYRP activity than neighborhoods with no NYRP activity.*

Glass Frog’s study compared neighborhoods where we have a strong presence (greater than 0.1% of total square footage managed by NYRP in our parks or gardens) to demographically similar neighborhoods. Our ‘treatment’ neighborhoods were East Harlem North, East Harlem South, Highbridge, Hunts Point, Marble Hill-Inwood, Washington Heights South, and Washington Heights North. The comparison neighborhoods were Central Harlem-South, Kingsbridge Heights, and Soundview-Bruckner.

This has huge implications. A growing body of evidence drawn from cities like Philadelphia, Baltimore, and Youngstown, Ohio demonstrate that improvements to green spaces have a significant impact on safety, mental health, perceptions of worthlessness, and longer-term health outcomes. However, our research is one of the first focused on New York City, particularly the most underserved communities.

With New York City’s hyper real estate market and associated risk of displacement, our administration is rightly pushing for a denser and better optimized urban landscape. There is currently an estimated 1,800 acres of city owned land – approximately two Central Parks – classified as having no current use. **If revitalized into parks and gardens, the land could serve as a low-cost and highly effective tool for improving quality of life and making a safer, healthier, and happier city.**

I invite you to review the report and welcome any feedback you may have.

Deborah Marton

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*213 fewer crimes each year per 40,000 residents. This is based on research findings of 3.8 fewer non-major felonies per 1,000 residents and 1.5 fewer major felonies per 1,000 residents. Figures also compare pre-2003 rates and post-2003 rates.
ACKNOWLEDGEMENTS

This report was prepared by Rebecca Casciano, with significant research assistance from Saul Thorkelson, Erica Chutuape, and Pratikshya Bohra-Mishra. Jennifer Puma provided project management assistance, and Valerie Meter provided editorial and administrative assistance. The authors thank the New York Restoration Project staff for their time, cooperation, and guidance throughout the project. This report was written for an internal audience at NYRP and therefore may assume a degree of familiarity with the program and its history. The report is intended to be an overview of the methods and results. Please direct additional questions to Rebecca Casciano at rebecca@glassfrog.us.

Abridged version of report prepared by Glass Frog Solutions (focused on crime) 2018
New York Restoration Project (NYRP) is a nonprofit organization dedicated to restoring outdoor space as a means of improving quality of life in New York City (NYC), particularly in low-income communities. Created in 1995, NYRP was an outgrowth of a local grassroots effort to beautify public space, but has expanded such that it now has a presence in all five boroughs, in spaces ranging from small plots to large parks covering over 50 acres. In 1997, NYRP acquired over 50 community gardens that they subsequently restored and made available to the public. Today, it manages these gardens, maintaining them and using them to provide programming to local communities.

NYRP hypothesizes that acquiring and restoring these gardens improves the quality of life in low-income neighborhoods by creating and maintaining open space, beautifying deteriorating lots, and encouraging outdoor activity. The goal of the project is to estimate the impact of NYRP’s renovation of vacant and distressed lots on crime. Specifically, we answer two questions:

1. Have neighborhoods in which NYRP has made the most significant investment experienced more positive outcomes relative to similar neighborhoods in which NYRP has not made an investment? (RQ1)
2. To what extent is the prevalence of restored NYRP spaces in a neighborhood correlated with improvements in key outcomes? (RQ2)

To answer our questions, we conducted two sets of analyses, which we discuss in the following section.

METHODOLOGY

We draw on a comparative interrupted time series (CITS) design to measure NYRP’s impact on crime. The outcomes in our analysis are detailed below. All outcome variables are measured at the neighborhood level and, in all analyses, we operationalize the “neighborhood” by using New York City’s neighborhood tabulation areas (NTAs). NTAs are aggregated Census tracts, so they are larger than a Census tract, but smaller than Public Use Microdata Areas (PUMAs). They align closely but not perfectly with well-known neighborhood boundaries in the city. We accessed NTA geographic data from NYC Open Data made available from the NYC Department of City Planning.

Table 1 shows borough-specific NTA population averages for specific years between 2000 and 2015. Maps of NTAs in Bronx, Brooklyn, and Manhattan, the three boroughs most often used in our analyses, are shown in Figures 1a–c.

1 New York City Department of City Planning. 2016. New York City Neighborhood Tabulation Areas (Edition 16D), Bytes of the Big Apple. Published October 27, 2016.
2 Maps for all boroughs can be found at the New York City Department of City Planning’s website: https://www1.nyc.gov/assets/planning/download/pdf/data-maps/nyc-population/census2010/ntas.pdf?v=022016.
Table 1. NTA population estimates by year and borough. Source: NYC Department of City Planning 2016 NYC Neighborhood Tabulation Areas.

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Brooklyn</td>
<td>48,340</td>
<td>48,726</td>
<td>49,112</td>
<td>49,498</td>
</tr>
<tr>
<td>Bronx</td>
<td>35,070</td>
<td>35,760</td>
<td>36,450</td>
<td>37,140</td>
</tr>
<tr>
<td>Manhattan</td>
<td>53,007</td>
<td>53,846</td>
<td>54,685</td>
<td>55,525</td>
</tr>
<tr>
<td>Queens</td>
<td>38,438</td>
<td>38,449</td>
<td>38,461</td>
<td>38,472</td>
</tr>
<tr>
<td>Staten Island</td>
<td>23,354</td>
<td>24,012</td>
<td>24,670</td>
<td>25,328</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>41,068</td>
<td>41,496</td>
<td>41,924</td>
<td>42,352</td>
</tr>
</tbody>
</table>

Figure 1a. Bronx NTAs. Source: Population Division, New York City Department of City Planning.
Figure 1b. Brooklyn NTAs. Source: Population Division, New York City Department of City Planning.
Figure 1c. Manhattan NTAs. Source: Population Division, New York City Department of City Planning.
Outcomes

The New York City Police Department (NYPD) uses a data management tool called Compstat (short for compare statistics) to track up-to-date crime-related statistics. It was introduced in 1994 and has since been adopted by other law enforcement agencies in other major cities across the country (e.g., Baltimore, Los Angeles, and Washington, D.C.). In addition to tracking crime statistics, Compstat functions as an accountability model that aims to provide transparency to the public and hold local police responsible for crime in their areas (Eterno & Silverman, 2010) with the ultimate goal of reducing crime. This analysis uses precinct-level crime data, made publicly available through Compstat, from 2000 to 2016. Using these datasets, we computed the following variables, specific to each year and individual NTA:

- **Major felony crime rate**: number of major felony crimes per 1,000 people in NTA. Felony crimes include: murder and non-negligible manslaughter; rape; robbery; felony assault; burglary; grand larceny; and grand larceny of motor vehicles.
- **Non-major felony crime rate**: number of non-major felonies per 1,000 people in NTA. Non-major felonies include: felony possession of stolen property; forgery/fraud/identity theft; arson; felony sex crimes; felony dangerous drugs; felony dangerous weapons; and felony criminal mischief and related offenses.
- **Misdemeanor rate**: number of misdemeanors per 1,000 people in NTA. Misdemeanors include: misdemeanor possession of stolen property; misdemeanor sex crimes; misdemeanor dangerous drugs; misdemeanor dangerous weapons; petit larceny; assault 3 and related offenses; intoxicated and impaired driving; vehicle and traffic laws; misdemeanor criminal mischief and related offenses; criminal trespass; unauthorized use of a vehicle; offenses against the person; offenses against public administration; administrative code; frauds; aggravated harassment; and other misdemeanors.

Figure 2 shows average NTA-level crime and misdemeanor rates between 2000 and 2015 in Brooklyn, Bronx, and Manhattan (the boroughs primarily used in this analysis). As the chart indicates, all three rates dropped between 2000 and 2015. These data are reported at the precinct level; we used geographic software to convert the geographic identifiers to NTAs.

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3 Prior to 2000 crime data were collected and reported using different methods and sources. Before 2000, the NYPD published “Arrests and Complaints” (hereafter “AC”) for the seven major felonies, seven non-major felonies, and misdemeanors at the precinct level. After 2000, the NYPD switched to Compstat for publishing crime statistics. However, the reports of crime data pre-2000 do not always correspond with crime data post-2000 (as reported by Compstat). Specifically, the precinct totals do not match across the two different data sources. For example, the total number of seven major felony offenses in AC reports is different than the total number in Compstat reports for the same year. These inconsistencies have been examined by researchers who have analyzed crime data over the past few decades (see for example, Geller, A. (2011). Measuring New York City: A Cautionary Tale. Understanding the Crime Decline in New York City, John Jay College of Criminal Justice, New York, NY.). Moreover, the introduction of Compstat changed the way crime data were reported. Used as an accountability and managerial tool, police face organizational pressure to demonstrate reduced crime in their areas, which may be represented by increasing the number of arrests and/or downgrading crimes to lesser offenses. Such pressures to demonstrate a reduction in crime through statistical reports have resulted in some inaccuracies in the reporting of crime data (see, for example, Eterno, J.A. & Silverman, E.B. (2010). The NYPD’s Compstat: compare statistics or compose statistics? International Journal of Police Science and Management, 12(3), 426-449.). This further underscores that Compstat data cannot be reliably compared to AC data pre-2000. As such, we do not include crime data prior to 2000 due to these inconsistencies.
Analytic Strategy

Identifying a “pre” and “post” period

We use the CITS design to measure NYRP’s impact on neighborhood-level outcomes. A CITS design requires us to determine a “pre” and a “post” period for the analysis. In this case, the “pre” period corresponds to the time period directly preceding NYRP’s neighborhood investment and the “post” period corresponds to the time period following NYRP’s investment. Since clean up on all properties began sometime in 2001, we selected 2003 as the cutoff year. This allows for adequate time for the clean up to be completed and be made available for public use. Thus, in all analyses, the “pre” period includes all pre-2003 years for which data are available and the “post” period includes 2003 and all post-2003 years for which data are available.

Identifying the “treatment” and “comparison” groups

As described earlier, this report seeks to answer two research questions (see page 1). The sample of NYRP neighborhoods (i.e., “treatment” neighborhoods) and comparison neighborhoods differs for each analysis.

Sample for RQ1. This analysis compares neighborhoods that have received the greatest NYRP investment to neighborhoods that were demographically similar in the pre-treatment period but did not receive any NYRP investment. For this analysis, we selected the neighborhoods with the greatest NYRP coverage (as measured in square feet). Neighborhoods with greater than .1% of total square footage covered in NYRP parks or gardens are considered the “treatment” neighborhoods. These neighborhoods include East Harlem North, East Harlem South, Highbridge, Hunts Point, Marble Hill-Inwood, Washington Heights South, and Washington Heights North. The comparison neighborhoods were selected by using a propensity score matching procedure to match other NYC neighborhoods to neighborhoods with the greatest NYRP coverage.
on specific variables including poverty rate, unemployment rate, percentage black/Hispanic, and percentage 65 years or older as measured in year 2000. The comparison neighborhoods are Central Harlem-South, Kingsbridge Heights, and Soundview-Bruckner. (Central Harlem-South is given extra weight in order to create two balanced samples.) Table 3 shows characteristics of NYRP and comparison neighborhoods based on 2000 Census data. As the table indicates, the two groups were similar, on average, prior to the NYRP investment.

Table 3. Year 2000 neighborhood-level characteristics for NYRP (i.e., treatment) NTAs and comparison NTAs. Source: 2000 U.S. Census data.

<table>
<thead>
<tr>
<th></th>
<th>NYRP</th>
<th>Comparison</th>
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</thead>
<tbody>
<tr>
<td>% unemployed</td>
<td>16.9</td>
<td>16.5</td>
</tr>
<tr>
<td>% below poverty line</td>
<td>35.0</td>
<td>34.8</td>
</tr>
<tr>
<td>% black or Hispanic</td>
<td>88.5</td>
<td>88.8</td>
</tr>
<tr>
<td>% aged 65 or older</td>
<td>70.8</td>
<td>70.8</td>
</tr>
</tbody>
</table>

Sample for RQ2. This analysis compares neighborhoods with moderate or high exposure to NYRP parks and gardens to those with no exposure. The analysis includes all neighborhoods in NYC with a federal poverty rate of 30 percent or higher. We limit to high poverty neighborhoods because this is the type of neighborhood that NYRP would invest in and therefore want to make generalizations about. For all neighborhoods in NYC, we created a variable that indicates the total square footage of NYRP parks and gardens within 1.5 miles of the neighborhood. This variable is meant to be a proxy for how much exposure residents get to the NYRP parks and gardens. We assume that more proximate green space (i.e., green space within or close to the neighborhood) is more impactful and therefore give those gardens/parks heavier weighting than those that are farther away.

We then use this measure to create a variable indicating each neighborhood’s overall exposure to NYRP parks and gardens (i.e., the total square footage within 1.5 miles). This variable has three categories or groups:

<table>
<thead>
<tr>
<th>Group</th>
<th>Coverage</th>
<th>Total square feet (weighted)</th>
<th>% NTAs in group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>No coverage</td>
<td>0</td>
<td>11.6</td>
</tr>
<tr>
<td>2</td>
<td>Low to moderate</td>
<td>26,468</td>
<td>58.1</td>
</tr>
<tr>
<td>3</td>
<td>Moderate to high</td>
<td>994,896</td>
<td>30.2</td>
</tr>
</tbody>
</table>

4 Each park/garden is given a weight that is equal to: 1.5 - “distance from the NTA.” This weight insures that parks and gardens that are within an NTA (distance = 0 miles) receive the maximum weight (1.5) and parks and gardens that are farther away receive less weight. For example, an NYRP garden that is 0.5 miles away from NTA X will receive a weight of 1.0 (i.e., 1.5 – 0.5), whereas an NYRP garden that is 1.4 miles away from NTA X will receive a weight of 0.1 (i.e., 1.5 – 1.4). This weight is multiplied by the total square footage of the park or garden. As an example, if the garden is 10,000 square feet and is located within the NTA (i.e., is zero miles away), it will be adjusted to be 15,000 square feet ((1.5 - 0) * 10,000). If the same garden is 1.4 miles away, it will be adjusted to be 1,000 square feet. This weighting methodology helps ensure that parks and gardens that are geographically closer to the NTA receive greater weighting in the analysis.
Methodology for measuring NYRP’s impact

The CITS design then requires us to do the following:

1. Estimate a neighborhood’s “baseline” (i.e., pre-2003) trend. For all NTAs included in the analysis, we estimated a baseline trend on the outcome variable. For example, if the outcome is the number of new business establishments in an NTA, then the baseline trend is the number of new businesses in the NTA from 1998 to 2002 and, more specifically, the annual change in the number of new businesses during this time (i.e., the slope of the line). We estimate a baseline trend for both the treatment and the comparison group.

2. Estimate a neighborhood’s post-treatment (i.e., 2003 and later) trend. In contrast to the baseline trend, the post-treatment trend measures what occurred in the NTA after the NYRP completed its investment. Using number of new businesses as an example, the post-treatment trend is the number of new businesses in the NTA from 2003 to 2015 and, more specifically, the annual change in the number of new businesses during this time (i.e., the slope). Once again, we estimate a post-treatment trend for both the treatment and the comparison group.

3. Estimate whether there is a difference between the baseline trend and the post-treatment trend and whether this difference is greater or smaller for NYRP neighborhoods, relative to the comparison group(s). This estimation provides the “NYRP effect,” which is equal to the difference between the pre-2003 and post-2003 effects for NYRP sites and the comparison sites.

This process is executed using a statistical model that also includes neighborhood-level control variables that may be associated with both NYRP’s likelihood to invest in the neighborhood, as well as the outcome variables, including: percentage female residents, percentage black or Hispanic residents, percentage unemployed residents, percentage below the federal poverty line, percentage aged 18 to 24, percentage 65 or older, population density, and borough fixed effects. Lastly, we also account for random effects at the NTA level, since the NTAs are clustered over time.

For all analyses related to RQ1, we present one NYRP effect size, which is the difference in the baseline and post-treatment trend lines between the highest investment NYRP neighborhoods and the comparison neighborhoods. For RQ2, we provide two NYRP effects. The first (“low to moderate NYRP coverage”) gives the difference in the trend lines between the low-to-moderate NYRP neighborhoods and neighborhoods with no NYRP investment. The second (“high NYRP coverage”) gives the difference in the trend lines between the high NYRP neighborhoods and neighborhoods with no NYRP investment.
FINDINGS

Crime data was available for 2000 to 2016; thus, the baseline trend includes data from 2000 to 2002 and the post-treatment period is 2003 to 2016. If NYRP is having an impact, we would expect the crime rates in the neighborhoods in which NYRP invests more heavily to be lower than they are in similar neighborhoods with no NYRP investment. This would mean we would expect the NYRP effect size to be negative. Negative numbers indicate that crime rates for NYRP neighborhoods were lower after 2003 versus before 2003, compared to comparison neighborhoods with no access to NYRP parks or gardens.

The results are presented in Table 5. The results for RQ1 are as follows:

- The major felony rate was lower in high exposure NYRP neighborhoods in post-2003, relative to pre-2003 (compared to comparison neighborhoods with no exposure to NYRP parks/gardens), though the difference was not statistically significant.
- The non-major felony rate was significantly lower post-2003 versus pre-2003 for neighborhoods with high exposure to NYRP parks/gardens, relative to the comparison neighborhoods. The effect size was -3.759 (p = .001). Since this is a crime rate, we can interpret the effect as: on average, post-2003, there were annually 3.8 fewer non-major felonies per 1,000 people in NYRP neighborhoods than in non-NYRP neighborhoods. In a neighborhood of 40,000 people, this would translate into 152 fewer non-major felonies per year.
- Relative to the comparison neighborhoods, the misdemeanor rate was lower in high exposure NYRP neighborhoods post-2003 than in pre-2003, though the difference was not statistically significant.

The results for RQ2 are as follows:

- Neighborhoods exposed to NYRP parks/gardens showed greater drops in major felonies after 2003, compared to neighborhoods with no exposure to NYRP parks/gardens. The difference between neighborhoods with low to moderate coverage and neighborhoods with no coverage was statistically significant (p = .032). On average, post-2003, there were annually 1.5 fewer major felonies per 1,000 people in neighborhoods with low to moderate NYRP investment than in non-NYRP neighborhoods. In a neighborhood of 40,000 people, this would translate into 61.6 fewer major felonies per year. The NYRP effect was also negative when we compared high coverage neighborhoods to no coverage areas, though this difference was not statistically significant.
- Neighborhoods with exposure to NYRP parks/gardens show larger drops in non-major felonies after 2003, compared to neighborhoods with no exposure to NYRP parks/gardens. The difference between neighborhoods with high coverage and neighborhoods with no coverage is nearly statistically significant (p = .093).
- The misdemeanor rate in neighborhoods with NYRP parks/gardens was higher after 2003, compared to neighborhoods with no exposure to NYRP parks/gardens, though the difference was not statistically significant. (It is unclear why the effect size is positive. It is inconsistent with the other findings.)
Table 5. Summary of findings on NYRP’s impact on neighborhood-level crime rates.

<table>
<thead>
<tr>
<th></th>
<th>RQ1 Analysis *</th>
<th>RQ2 Analysis *</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NYRP “effect”</td>
<td>Low to moderate NYRP coverage</td>
</tr>
<tr>
<td>7 major felonies</td>
<td>-0.818</td>
<td><strong>-1.541</strong></td>
</tr>
<tr>
<td>7 non-major felonies</td>
<td><strong>-3.759</strong></td>
<td>-1.151</td>
</tr>
<tr>
<td>Misdemeanors</td>
<td>-5.046</td>
<td>5.987</td>
</tr>
</tbody>
</table>

*Statistically significant effects (p<.05 level) are bold-faced when the effect is in the expected direction. Effect sizes approaching significance (p<.10 level) are italicized. Models also include controls for % female in NTA, % black or Hispanic in NTA, % unemployed in NTA, % poor in NTA, % aged 18-24 in NTA, % aged 65 or above in NTA, NTA population density, and borough fixed effects. We also account for random effects at the NTA level since the NTAs are clustered over time.
CONCLUSION

To summarize, the goal of this project was to estimate the impact of NYRP’s renovation of vacant and distressed lots on crime. We used a comparative interrupted time series to answer two specific questions:

1. Have neighborhoods in which NYRP has made the most significant investment experienced more positive outcomes relative to similar neighborhoods in which NYRP has not made an investment? (RQ1)
2. To what extent is the prevalence of restored NYRP spaces in a neighborhood correlated with improvements in key outcomes? (RQ2)

The results can be summarized as follows:

- Our analyses support the hypothesis that neighborhoods in which NYRP has invested more heavily have experienced lower crime rates than similar neighborhoods with no NYRP investment. To contextualize the effect sizes:
  - In one analysis, the non-major felony rate was significantly lower post-2003 versus pre-2003 for neighborhoods with high exposure to NYRP parks/gardens, relative to the comparison neighborhoods. The effect size was -3.759 (p = .001). Since this is a crime rate, we can interpret the effect as: on average, post-2003, there were annually 3.8 fewer non-major felonies per 1,000 people in NYRP neighborhoods than in non-NYRP neighborhoods. In a neighborhood of 40,000 people, this would translate into 152 fewer non-major felonies per year.
  - In another analysis, neighborhoods exposed to NYRP parks/gardens showed greater drops in major felonies after 2003, compared to neighborhoods with no exposure to NYRP parks/gardens. The difference between neighborhoods with low to moderate coverage and neighborhoods with no coverage was statistically significant (p = .032). On average, post-2003, there were annually 1.5 fewer major felonies per 1,000 people in neighborhoods with low to moderate NYRP investment than in non-NYRP neighborhoods. In a neighborhood of 40,000 people, this would translate into 61.6 fewer major felonies per year. The NYRP effect was also negative when we compared high coverage neighborhoods to no coverage areas, though this difference was not statistically significant.