



# Park Renewal

**Exploring Parks Renewal History & Impacts  
in Brooklyn, New York City**

CASA0003: Group Mini Project: Digital Visualisation

Group Project Theme 2022-2023: Urban Revival/Regeneration

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### Statement:

This document is the report for the group project – Park Renewal. The project is completed for the CASA0003 Group Mini Project: Digital Visualisation. And the topic theme 2022-2023 is Urban Revival/Regeneration.

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### Project Output:

Project Output	Output Description
Project Output Files	Zip File on Moodle
Project Website	<a href="https://ucfnlui.github.io/Group-Eyrie---Digital-Visualisation/main.html">https://ucfnlui.github.io/Group-Eyrie---Digital-Visualisation/main.html</a>

### Contribution:

Our team members contributed to the project generally based on the following table (Table1).

**Table1: Team members contribution**

Task Name	Major Contributors	Additional Contributors	Relevant Chapters in Report
Concept Development	All team members	/	1
Data preparation and integration	All team members	/	2
Analysis - History - Map1	Yijing Zhang, Yushen Sun	/	3.4.1
Analysis - History - Map2	Jinzhao Bai, Yijie Lu, Yijing Zhang	/	3.4.1
Analysis - Infrastructure - Map	Jinzhao Bai, Yijing Zhang	/	3.4.2
Analysis - Infrastructure - Chart	Jinzhao Bai	/	3.4.2
Analysis - Economy - Charts	Jinzhao Bai	/	3.4.3
Impact – Green - Map	Jinzhao Bai, Yijing Zhang	/	3.5.1
Impact - Air Pollution - Map	Yushen Sun	/	3.5.2
Impact - Population Density - Map	Yushen Sun	Yijing Zhang	3.5.3
Impact – Home Value Index - Map	Yushen Sun	Jinzhao Bai, Yijing Zhang	3.5.4
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Presentation Slides	Yijing Zhang	All team members	/
Report Writing	Yijing Zhang	/	1, 2, 3.1, 3.4.1, 4, 5, others
	Yijie Lu	/	3.2
	Jinzhao Bai	/	3.4.2, 3.4.3, 3.5.1
	Yushen Sun	/	3.5.2, 3.5.3, 3.5.4

***Yijing Zhang***

- She was responsible for the collection and pre-processing of spatial data, including statistics of street trees within hexagons, calculation of population density, and geojson data processing.
- She was responsible for the overall content structure of the project as well as the overall design of the colours, backgrounds, and logo.
- She collected and organised the park history data and text.
- She was mainly involved the visualisation of the park renewal history maps and the infrastructure maps.
- She prepared the presentation slides.
- She wrote 1, 2, 3.1, 3.4.1, 4, 5, others and eventual integration of this report.

***Yijie Lu***

- She was responsible for web coding, overseeing the overall integration of the website.
- She was responsible for implementing the prototype of web design, enhancing the website's visual appeal and interactivity.
- She was responsible for the data collection.
- She wrote 3.2 in this report.

***Jinzhao Bai***

- He was responsible for making the interactive map of tree visualization and urban infrastructure visualization.
- He was responsible for making the line charts and pie charts of economy analysis.
- He was responsible for making the line charts of three areas in Brooklyn with the greatest change in home value index
- He was responsible for making the interactive map of Brooklyn Parks Construction and Renewal Details.
- He wrote 3.4.2, 3.4.3, 3.5.1 in this report.

***Yushen Sun***

- He took charge of creating interactive maps showcasing the construction time of parks and their effects on population, housing, and air quality. This involved handling the entire process, from data collection and processing to map implementation and visualization refinement.
- He wrote 3.5.2, 3.5.3, 3.5.4 and their general method in this report.

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# 1 Introduction

## 1.1 Motivation

When discussing the topic of Urban Revival/Regeneration, projects such as the restoration of historic buildings, the transformation of old factories and the functional re-planning of areas are often of wide interest to governments and communities. They often contribute to solving real problems, bringing economic benefits and optimising the use of urban space (Roberts et al. 2017, Urban 2021). However, their renewal and revitalisation processes are often short-lived, which means that while such human buildings and landscapes are planned, the time period between restoration and commissioning is short. Even if similar renovations can be transferred and applied to other areas, the positioning and development of the area are hardly likely to change transformatively again after the renewal.

In understanding the development and regeneration of the park, therefore, we realised its value in the research that distinguishes it from other urban regeneration projects. Such regeneration projects not only go back to an earlier history of urban regeneration but also play an important role in the human and natural development of the city at the same time. In a time when most cities are more concerned with sustainable development, topics such as urban landscape and environmental friendliness are receiving more attention from planners. Research on the development and regeneration of emerging parks is therefore of great value and influence.

Initially, we focused our research on Brooklyn Bridge Park, a new park built in 2010, as a great example of current urban regeneration. Not only does it have a more detailed infrastructure on its website (2023), but its planning and design is a better representation of the steps taken to regenerate the city to meet the needs of its citizens today, which is valuable for analysis and reference.

However, it soon became apparent that a single case of regeneration might not be a more comprehensive representation of urban-scale regeneration. Therefore, we decided to broaden our focus and explore the development of more parks. Combining parks development with urban regeneration, we decided on a theme of Park Renewal and thus explored the history and impact of park regeneration in Brooklyn.

## 1.2 Background

### ***Urban Renewal vs “Park Renewal”***

Urban renewal refers to schemes and activities that upgrade neighbourhoods and suburbs in a state of distress or decay. It is considered an effective tool for addressing land shortages, optimising the spatial layout and functional positioning of cities (Cui et al. 2021), managing environmental degradation, increasing land values, and promoting desirable physical and socio-economic transformation (Keddie and Tonkiss 2010). Terms covering similar concepts mainly include urban regeneration, urban revitalisation, Urban Revival, urban redevelopment, et al. For instance, urban renewal is often referred to as urban regeneration in the UK while urban redevelopment is often used in the US (Cui et al. 2021). In many regions, urban renewal has been applied as a significant urban development policy.

In America, the term Urban Renewal first appeared in the United States in 1954 in the Housing Act (Weber 2002). Since then, it has been used to describe the rehabilitation of older urban areas in different regions and at different times. For example, in the 1960s, the term 'Urban Renewal' was used to refer to the redevelopment of physical forms (Lovering 2007); in the 1970s, the term 'Urban Regeneration' was coined to focus on economic revitalization; in the 1990s, the term 'Urban Renaissance' focused on community building (McDonald et al. 2009). It can be seen that the meaning of urban regeneration has been continuously broadened, from the initial comprehensive physical push to redevelopment to the pursuit of a multifaceted physical, economic and cultural revival of the regenerated area. In this project, the history of park restoration dates back

to the 1930s, with a large number of restorations taking place in the 1990s, hence the earlier and broader meaning of Urban Renewal and 'Park Renewal' is chosen here.

Park development and renewal can often repurpose underutilised or derelict areas of a city and transform them into attractive public spaces. Investing in park renewal can provide a solution for cities to address issues such as ageing infrastructure, outdated facilities and changing recreational preferences within the park system. Park renewal projects often seek to create multi-functional spaces to accommodate a variety of activities such as sports, cultural events, picnics and nature appreciation. The research on the renewal of parks has been undertaken through interview studies of large parks (Veitch et al. 2014), development projects in a particular park (Spiers 2009, Boumali et al. 2022), historical collation of a particular park (Kuklick 1991). Etc. However, the research on longitudinal (historical) renewal studies of parks within a city or region is limited.

### ***Park Renewal in Brooklyn***

According to the *OneNYC 2050* report (2019), the aim of achieving carbon neutrality results in investments in infrastructure that mitigate the physical risks posed by climate change including natural infrastructure such as wetlands and upland forests. As one of New York City's most vibrant and diverse boroughs, Brooklyn has witnessed a remarkable transformation of its park spaces.

Urban renewal in Brooklyn, New York, involves the construction and renewal of a wide range of parks that contribute to the overall revitalisation of the borough. These parks act as important green spaces and community centres, promoting social interaction, recreational activities and environmental sustainability. Today's diverse and varied park landscape in Brooklyn is a result of its constant renewal and exploration. These parks have been built and renewed at different times due to their unique location, historical elements, functional characteristics, risks and economic factors. A series of projects



have been built to help revitalise underutilised areas, provide essential green space and enhance community well-being.

To sum up, a collation and analysis of the history of the renewal of Brooklyn Park is necessary. We aim to present the features and potential impacts of the regeneration of the regional park vividly on the website through diagrams, spatial visualisation and textual explanation. We hope that this would provide reference to the study of the characteristics, functions and impacts of urban parks renewal history, the construction and renewal of urban infrastructure, and the role of park development in urban renewal.

### 1.3 Research Questions

In order to achieve a more logical and rational presentation of the above-mentioned renewal, the site visualisation focuses on three main research questions:

- 1 What is the process of construction and renewal of Brooklyn Parks and what are its characteristics?
- 2 What is the current development of the completed Brooklyn Park and its surroundings?
- 3 What are the potential natural and human factors that have been impacted by the construction and renewal of the park?

## 2 Data Source

The districts' data in Brooklyn is originally from NYC Open Data, named NYC Parks Districts Map (2023). In the subsequent selection of areas for the parkland and street trees data, the Brooklyn boundary of this park district was applied. The boundary is more appropriate for this study than the administrative boundary as the subject of the study is the park.



The parkland data is from NYC Open Data, named Functional Parkland Map (2023). It gives a more comprehensive picture of the distribution and scales of parks in Brooklyn. This dataset was used extensively in various sections of the study.

The history analysis information is mainly from NYC Parks and some of the parks' own websites. In the "explore more" section of the renewal details map on the web, there is information on the main source sites.

The urban green data in Brooklyn is mainly described by the street trees data from NYC Open data (2023) in 1995, 2005, and 2015. It is worth noting that these are the distribution of trees in areas outside the urban parks.

As for air pollution data (PM2.5 and NO2), population data (population density) and housing data (Zillow Home Price Index, ZHVI) in Brooklyn, their source and application will be noted in their analysis (3.5.2, 3.5.3, and 3.5.4). In addition, air pollution data and population data are applied following the "Community Districts", while housing data is used following "Zip Code Boundaries".

In general, the visualisation of the maps in the website is based on OpenStreetMap, following the WGS84 coordinate. Because the Urban Green map involves the spatial calculation of polygons, it is a Mercator projection coordinate. All other maps are geographical coordinates.

## 3 Visualisation Process and Technique

### 3.1 General Design

As for project's colour strategy, the theme colour of green was decided on early on in the project to suit the main theme of the park. On the one hand, in the overall design and visualisation, in addition to different shades of green, we have also used similar shades of yellow and blue to give the project a more harmonious and visually pleasing

effect. On the other hand, some of the illustrations that need to be differentiated, such as roads and metro lines, have been differentiated by using more distinctive colours.

As for the background design, the background image for our homepage is from the website of Marine Park (Marine Park Alliance 2021), Brooklyn's largest park. The paper pattern background mimics a park' brochure or map, allowing the reader to read the information on the site in a more intimate way. The font "Georgia" is applied for the same reason.

As for the project logo design (figure 1), we based it on the edge of a map of Brooklyn as a tree or leaf pattern. Its internal pattern resembles both the grain of the leaf veins and reflects the study area. We designed an unfilled leaf as well as a filled leaf, which represents not only the initial construction but also the continuous renewal that has led to the current appearance of the city park.



**Figure 1: Project Logo**

### **3.2 Website Technique Design**

The idea was to create a website to showcase park renewal in Brooklyn. The content was presented on a single, scrollable page with the aim of enhancing the connectivity between different sections and providing users with a cohesive understanding of the entire park renewal project.

To differentiate the various themes and aid navigation, a fixed navigation bar was introduced at the top of the webpage. This navigation bar remained visible at all times,

offering quick-access buttons for different topics and helping users navigate to their desired sections efficiently.

Furthermore, the website's interactivity was taken into consideration. Maps and charts were made clickable, allowing users to view thumbnail images and then click for more detailed information. The content was thoughtfully arranged to ensure clarity and coherence, enabling users to easily comprehend the information presented.

Lastly, visual effects were incorporated to enhance the website's appeal. Dynamic animations, such as zooming in and out of maps, filter functionality, tooltips appearing when hovering over images, and captivating image transitions, were implemented to increase visual engagement. These visual effects not only caught users' attention but also enhanced the overall visual experience of the website.

In conclusion, our website design approach aimed to showcase the Park Renewal projects in Brooklyn through a single, scrollable page, a fixed navigating bar for easy navigation, interactive elements like clickable maps and charts, well-organized content for clarity, and visually appealing effects. This design aimed to provide users with an immersive, clear, and visually captivating platform to explore and appreciate the park renewal.

### **3.3 Home**

The Home page is the start of the website, as well as contains a background statement to the project and introductory sentences.

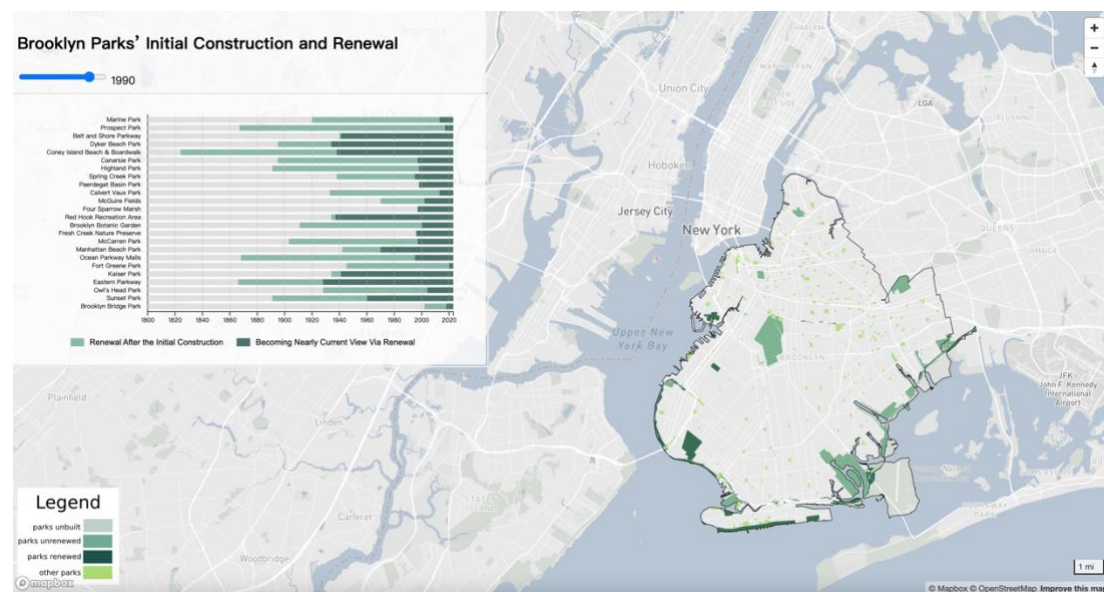
### **3.4 Analysis**

#### **3.4.1 History**

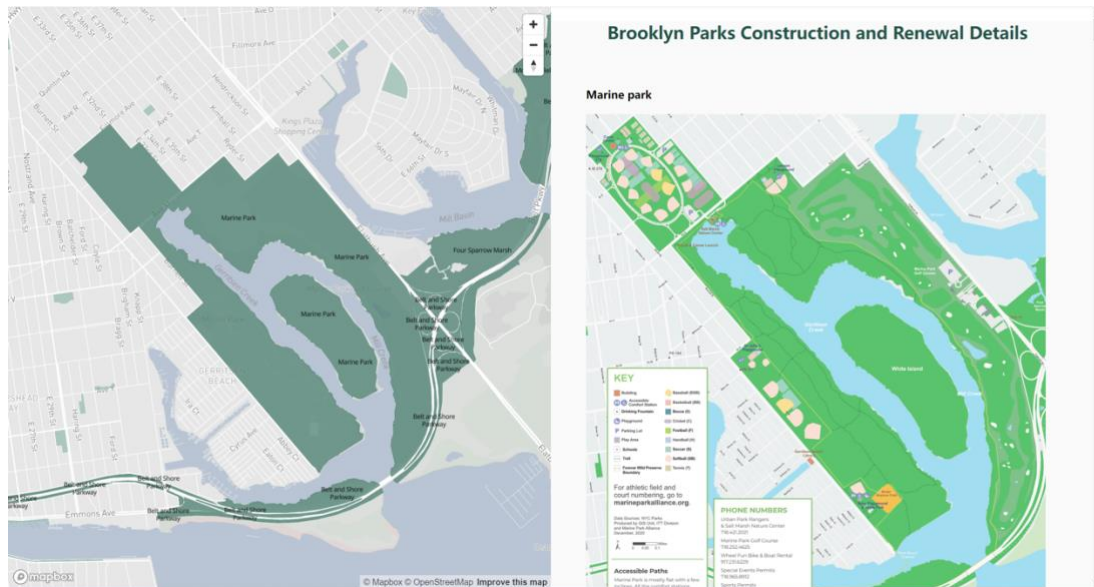
The park renewal history maps include two main aspects: analysis of spatial formation characteristics over time, and analysis of park-specific renewal information and

location. In this project, we mainly focus on the renewal of the top 24 largest parks because of their larger impact. Top 24 means their areas are larger than 100,000 sq m. The newly built park, Brooklyn Bridge Park, is slightly below this level but is still under construction, so it is also counted.

The historical evolution of the park is generally illustrated by a combination of a bar graph and a map (figure 2). This visualisation allows the reader not only to compare the historical course of the different parks in parallel but also to compare their spatial distribution characteristics at the same time in space. Meanwhile, in detail, a fly-to map is made with more information about the various parks' locations, characteristics, historical renewal process and websites (figure 3). The effect of the mouse swipe drives the reader to further exploration.



### Figure 2: Brooklyn Parks' Initial Construction and Renewal



**Figure 3: Brooklyn Parks Construction and Renewal Analysis**

In Brooklyn, park formation, as in many areas, is largely determined by government action, land use and other macro factors. First of all, most of the large parks with complete infrastructure and recreational facilities were often developed in the 19th century when the land was acquired or donated to the government for use as a park. They have been built and updated over a long period of time to create the environmentally friendly urban park landscape that Brooklyn has today, where people and nature coexist. Many of them could not have been built without the contribution of Robert Moses in the mid-1900s. Secondly, some of the parks that do not have many recreational and leisure facilities are often located as conservation areas, like Fresh Creek Nature Preserve, which is usually located in the southeast coastal area of Brooklyn and has good natural beauty. Their renewal process is also usually short. Thirdly, a unique urban parkland feature in Brooklyn is the long stretches of parkways - the Ocean Parkway running north-south and the Belt and Shore Parkway that surrounds the southern half of this coastline. built Brooklyn Bridge Park is also attractive for their good urban views.

### 3.4.2 Infrastructure

Infrastructure is the foundation of a city's success. It enables people to go about their daily lives, connecting them to vital services such as schools, hospitals, and places of work. It also provides access to important recreational activities, like parks and cultural attractions. Good infrastructure is essential for a city to thrive, as it can reduce traffic congestion, improve safety, and reduce pollution. It can also boost economic growth by improving access to services and providing new job opportunities. Without infrastructure, cities would not be able to function as they do today (Brooks, 2010).

Brooklyn is one of the five boroughs of New York City and is renowned for its diverse and dynamic infrastructure. From its transportation networks to its urban facilities, Brooklyn's infrastructure has been instrumental in supporting the borough's vibrant communities. It has grown and developed over time to become an important part of the city's landscape and continues to serve as a foundation for the borough's economic and cultural success. Over the course of the past few decades, Brooklyn has seen significant growth and development in terms of its infrastructure. This expansion has been necessary to meet the demands of a growing population and an ever-changing urban landscape.

In this map (Figure 4), we added four layers in this map with Mapbox including parkland, subway lines and stations, drinking fountains and the boundary of Brooklyn. In addition, we also highlighted the highways, airports and green space in different colours which can make a clear visualization of the infrastructure around the parks in Brooklyn.



**Figure 4: Parkland and Urban Infrastructure**

Brooklyn offers numerous parks and green spaces where residents and visitors can relax, play sports, and enjoy nature. Prospect Park is the largest park in Brooklyn, covering 526 acres and featuring a lake, a zoo, playgrounds, sports fields, and trails. Other notable parks include McCarren Park, Brooklyn Bridge Park, Marine Park, and Fort Greene Park. In addition, Brooklyn has a well-developed transportation network. The New York City Subway serves the borough with multiple subway lines, allowing residents to easily travel within Brooklyn and to other parts of the city. Several bridges, including the Brooklyn Bridge and the Williamsburg Bridge, connect Brooklyn to neighbouring areas.

Overall, it is clear that parkland and urban infrastructures are now present across Brooklyn. Brooklyn's parkland and urban infrastructure contribute to its appeal as a vibrant and livable borough, offering residents and visitors a wide range of recreational, cultural, and economic opportunities.

### 3.4.3 Economy

Amidst the bustling urban landscape, Brooklyn's parks stand as verdant oases, providing a refreshing escape and contributing to the borough's thriving economy. These parks not only offer recreational opportunities and natural beauty but also play a

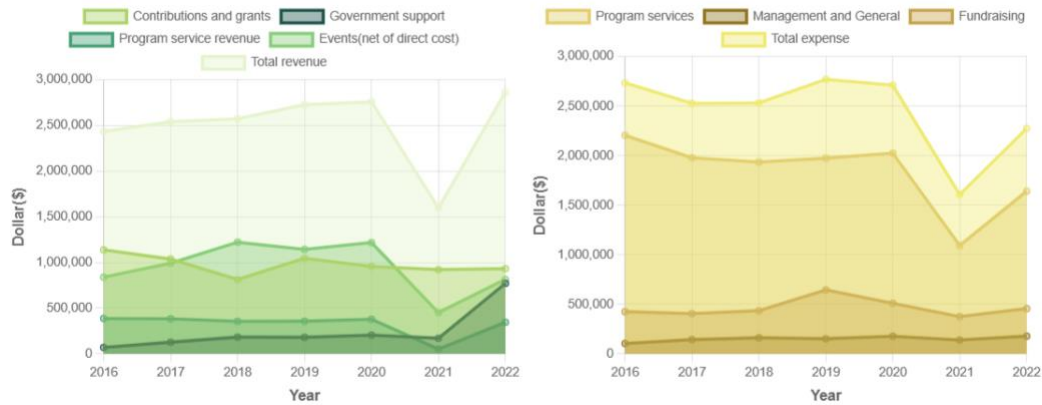


significant role in attracting visitors, stimulating business growth, and enhancing the overall well-being of residents. Studies have established a clear connection between property values and the proximity of green spaces such as parks and urban forests, which is an indication of parks' importance to the quality of a neighbourhood (Walker 2004). The value of housing in certain neighborhoods decreased proportionately to the distance from the greenbelt, by an average of \$4.20 per foot (Correll, Lillydahl and Singell, 1978).

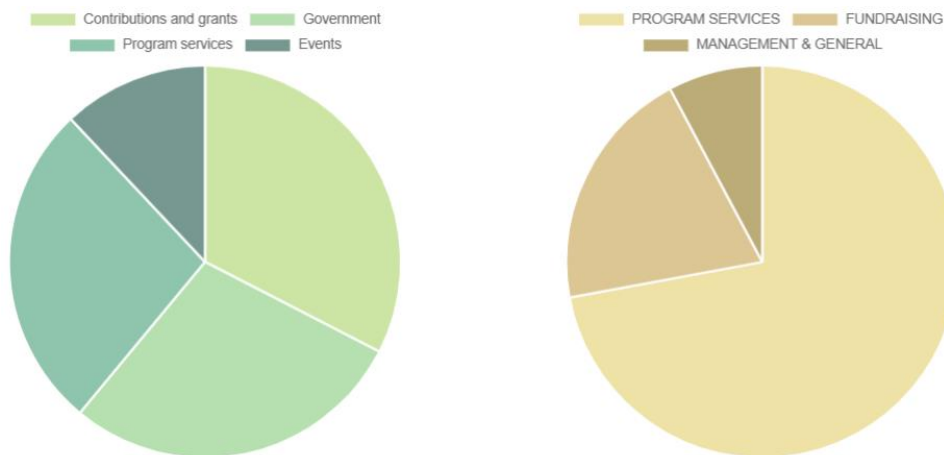
Brooklyn's parks, including the renowned Prospect Park, the scenic Brooklyn Bridge Park, and the vibrant McCarren Park, draw in both local people and visitors. Brooklyn's parks greatly benefit from tourism's economic contributions. Tourists from all corners of the globe flock to the spectacular parks of this borough, captivated by its stunning scenery, cultural activities, and recreational facilities. The influx of visitors to Brooklyn to experience its parks has had a positive economic impact on the borough, with tourists spending on hotels, food, shopping, and other services. The surge of tourists has a knock-on effect, helping to stimulate the economy of the borough and providing a boost to local businesses.

To make the chart visualization, firstly we imported the chart.js library, then create an html canvas element on which the chart will be rendered. Next, define the data that we want to visualize in the charts, this could be an array of values or an object containing labels and datasets. Finally, create a JavaScript variable to store the configuration options for the charts. This includes information about the chart type, data, labels, colours, and any other customizations. The line charts display the revenue and expense of Brooklyn's parks from 2016 to 2022 (figure 5). We can see that both the revenue and expense reached the peak in 2020, then declined significantly in 2021 (figure 6). The pie charts display the revenue and expense components of Brooklyn parks in 2021. The revenue consists of four parts: contributions and grants, government support, program service revenue and events. The expense includes three parts: program services,

management and fundraising. It is clear that the ‘contributions and grants’ area achieved the highest revenue and the ‘program services’ achieved the highest expense.



**Figure 5: Revenue and Expense of Brooklyn Parks from 2016 to 2022**



**Figure 6: Revenue and Expense Components of Brooklyn Parks in 2021**

## 3.5 Impacts

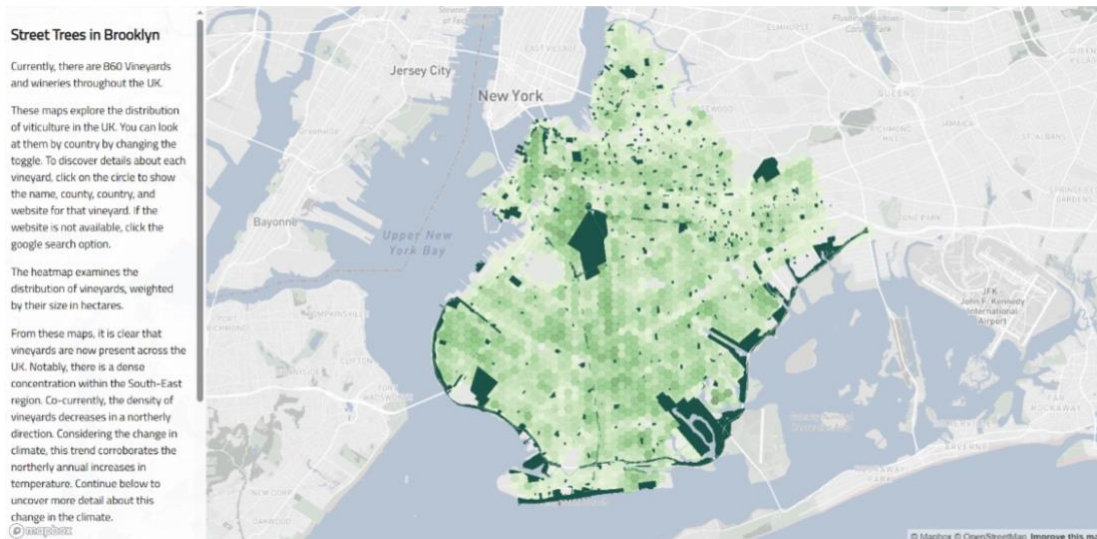
### 3.5.1 On Urban Green

Urban green spaces play an important role in providing a variety of important ecosystem services. Parks, forests, green roofs, streams, and community gardens are all examples of urban green space. These spaces can help purify air and water, absorb carbon emissions, reduce noise, regulate climate, and provide habitats for wildlife. Green spaces can help reduce the urban heat island effect and improve the well-being of city dwellers. Therefore, it is important to prioritize the preservation and protection

of urban green spaces for the benefit of both the environment and society. Green space has been demonstrated to be a valuable asset to urban residents. Not only does it provide an aesthetically pleasing environment, but it also contributes to overall public health. Consequently, cities are beginning to recognize the importance of green spaces and are actively investing in preserving, protecting, and creating more of these spaces. By doing so, cities will be able to provide their residents with the opportunity to enjoy the benefits of green spaces and improve their quality of life (Wolch, Byrne and Newell 2014).

Urban green spaces provide a range of important ecosystem services that not only help to protect the ecological integrity of cities but can also play an essential role in safeguarding public health. From reducing air pollution to providing a source of recreational activities, urban green spaces are an invaluable resource for urban populations and help to ensure that people have access to the services they need to maintain their health. Furthermore, green spaces can also help to reduce the risk of heat-related illnesses, improve mental health, and even reduce the risk of some chronic diseases. In short, urban green spaces are an invaluable asset to cities and their populations and should be protected and promoted for the benefit of everyone. Green spaces have the potential to purify the air, reduce contaminants, muffle sound, lower temperatures, capture rainfall, and replenish aquifers; moreover, they can provide food (Escobedo et al. 2011, Groenewegen et al. 2006).

In the visualization map, these green areas represent parkland and these small circles represent the street trees. The shade of green polygons represents the number of street trees. There are more trees if the green is darker. We can observe from the map that the number of trees in Brooklyn increased a lot from 1995 to 2015 due to the park renewal in Brooklyn in recent decades (Figure 7).



**Figure 7: Impact on Urban Green**

As for the General Method for the following three maps, we developed a series of interactive maps that offer valuable insights into the impact of parks on various factors. Our map creation process follows a consistent set of procedures to ensure accuracy and reliability.

We collect relevant data on the selected topics and convert it into GeoJSON files, which contain geographical coordinates of sub-districts in Brooklyn for precise mapping. These files are uploaded to Mapbox. We configure a suitable base map style on Mapbox and import it into an HTML file for seamless integration. To enhance interactivity, we incorporate JavaScript to include tilesets and implement a time-slider, enabling users to view specific data for a particular year and analyze temporal changes effectively.

We enrich the maps with two layers of park data: one showing all parks in Brooklyn and another representing the 24 largest parks. These layers are colour-coded based on construction and renewal statuses, providing insights into the distribution and impact of parks. Legends and a scale are incorporated for easy comprehension of the mapped information.

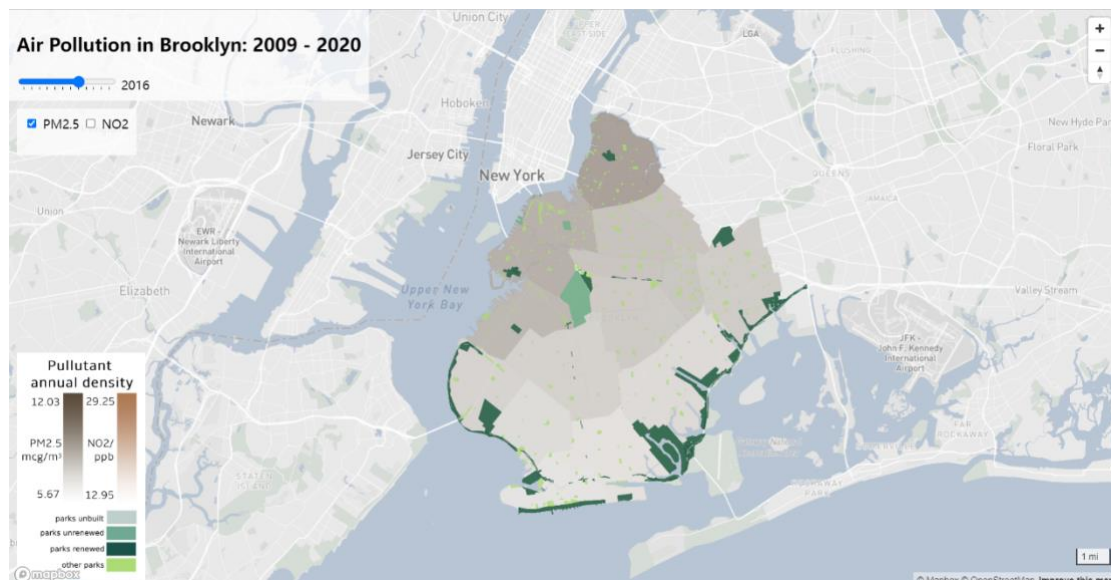
Our interactive maps empower users to explore, analyze, and draw meaningful conclusions from the data, enhancing their understanding of the impact of parks on various aspects of urban life.

### 3.5.2 On Air Pollution

#### *Method*

To map the impact of parks on air quality, we collected data on PM2.5 and NO2 pollutants from NYC Open Data (2023). This data provides annual average pollutant concentration information aggregated by community districts. We merged this data with the GeoJSON file representing Brooklyn's sub-districts to visualize the spatial distribution of air quality.

We added a checkbox feature to the map, allowing users to switch between viewing PM2.5 and NO2 pollution levels. This interactive element empowers users to explore and compare the impact of different air pollutants across Brooklyn's sub-districts (figure 8).



**Figure 8: Air Pollution in Brooklyn: 2009-2020**

## ***Findings***

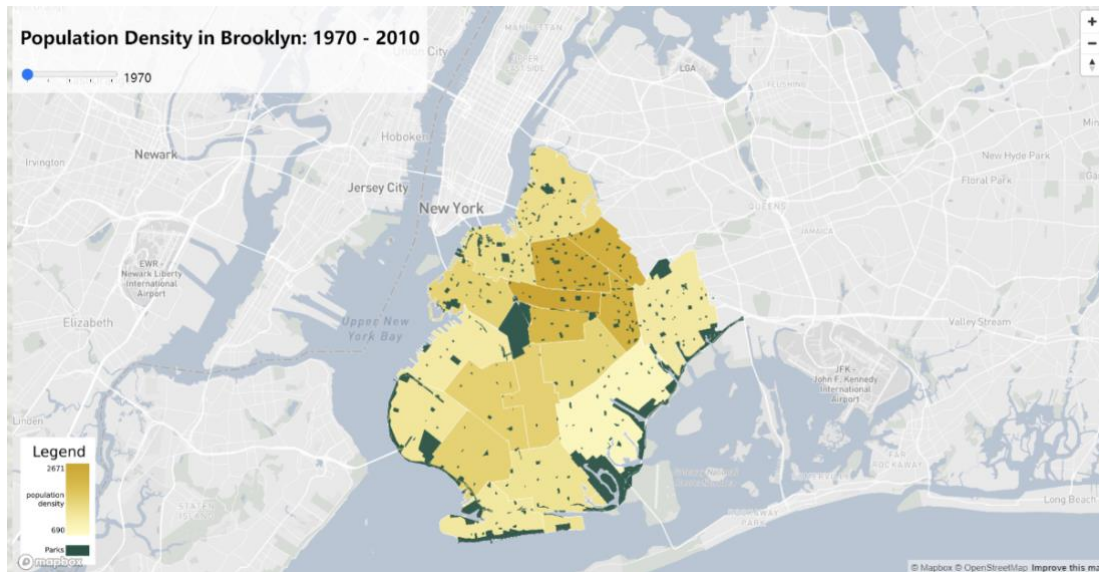
The interactive map illustrates air quality in Brooklyn from 2009 to 2020, focusing on PM2.5 and NO2 pollutants. It reveals higher concentrations in northern regions, suggesting greater air pollution compared to the south. Over time, both pollutants decreased, indicating improved air quality. Parks act as natural filters, reducing pollutants by absorbing particles and promoting dispersion. Although parks are not explicitly shown on the map, their influence is inferred. Targeted park development in high-pollution areas can create green corridors and buffer zones, enhancing overall air quality.

### **3.5.3 On Population**

#### ***Method***

To create the impact on the population map, we sourced data from NYC Open Data (2023) on the population of 18 community districts in Brooklyn from 1970 to 2010. By merging this data with a shapefile containing polygon data for each community district, we created a GeoJSON file. Using the shapefile data, we calculated the area of each community district on QGIS to determine the population density for each sub-district in Brooklyn.

The population map incorporates an interactive feature where users can hover over a community district to view a popup window displaying the corresponding population density (Figure 9).



**Figure 9: Population Density in Brooklyn: 1970-2010**

### ***Findings***

The population density map of Brooklyn from 1970 to 2010 reveals intriguing spatial and temporal patterns. The map showcases notable changes in sub-districts influenced by factors like park regeneration. Neglected parks in areas with declining populations lacked attractiveness, contributing to negative trends. Conversely, revitalized parks became catalysts for neighbourhood revitalization, attracting residents and potentially reversing population decline. Parks such as Prospect Park, Brooklyn Bridge Park, McCarren Park, Domino Park, and Highland Park became symbols of resurgence, influencing population growth in adjacent areas. These spatial patterns highlight the significant role of park regeneration in creating desirable living environments and attracting residents, ultimately impacting population changes in Brooklyn's sub-districts.

### **3.5.4 On Housing**

#### ***Method***

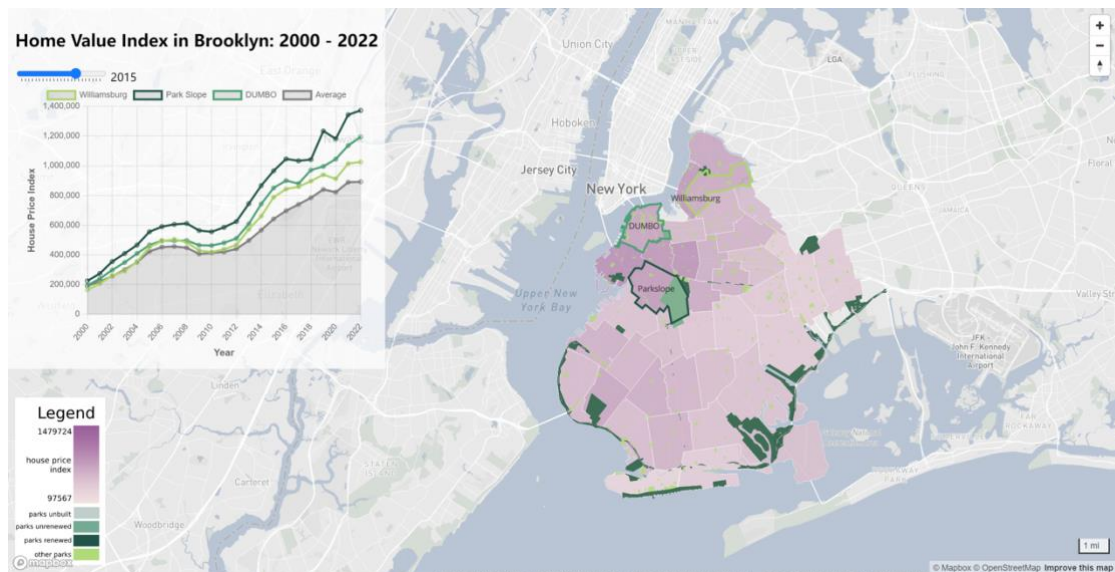
To develop the housing impact map, we utilized comprehensive data from Zillow, a leading real estate marketplace. This data provided detailed monthly information on Zillow Home Values (2023) in the United States, categorized by room numbers. We focused on Brooklyn's ZIP codes and applied filters to narrow our analysis. By



calculating the average Zillow Home Value Index for each year and merging it with polygon data for each ZIP code, we created a GeoJSON file for mapping purposes.

To highlight the influence of parks on house prices, we researched three prominent parks in Brooklyn: McCarran Park in Williamsburg, Prospect Park in Park Slope, and Brooklyn Bridge Park in DUMBO. These parks have undergone significant transformations since 2000, impacting their surrounding neighbourhoods. We created line charts depicting the house price index for these areas, contrasting them with the average house price index for Brooklyn as a whole (represented in grey). These charts were placed on the left side, illustrating faster value appreciation in these regions, evidencing the positive effect of park renewal. The boundaries of these three regions were incorporated on the map, using the same colour as their respective line charts, for easy identification.

The housing map includes an interactive feature allowing users to hover over a specific ZIP code region, triggering a popup window displaying the home value index for that area. This provides users with instant access to valuable information, enhancing their understanding of housing dynamics in different parts of Brooklyn (figure 10).



**Figure 10: Home Value Index in Brooklyn: 2000-2022**

## **Findings**

The map indicates that park regeneration played a role in revitalizing neighbourhoods and potentially impacting property values. During the early 2000s, park renovations coincided with an upswing in house prices in many sub-districts. Well-maintained parks and upgraded amenities indirectly contributed to the growth of house prices by creating attractive living environments. Despite the decline in house prices during the 2008 financial crisis, neighbourhoods with park regeneration and improved amenities experienced notable increases in property values as the housing market recovered. From 2016 to 2022, rejuvenated parks and green spaces in certain neighbourhoods saw rapid house price appreciation, demonstrating the positive effect of park renewal.

## **3.6 More**

In addition to the main part of the analysis, the website is supplemented at the end with Acknowledgement, Team Member, and References covered in the website, which completes the website.

## **4 Limitation and Improvement**

Firstly, when analysing historical park data, not all parks have relatively complete historical time and construction information. Missing data can further make subsequent analysis difficult. Therefore, the project has mainly selected larger parks for the study in order to avoid the problem that information is difficult to collect for many smaller parks. It is unavoidable that this also causes limitations in the project's portrait of the whole regional parks.

Secondly, historical data on relevant infrastructure, impacts, etc. do not necessarily belong to the same period. This is mainly due to differences in the periods for which different data sets have been counted. This also makes it possible for this project to simultaneously visualise park updates with simultaneous changes in other factors, often

only showing simultaneous changes in more recent periods. The earliest analysis of the impact on the population also only goes back to 1970.

Thirdly, some of the data was too large for us to visualise directly. For example, the street tree data was too large for us to upload to GitHub for further point cluster analysis. Therefore, we tried other solutions and eventually used hexagonal maps to solve this difficulty and achieve the desired visualisation.

Fourthly, the effects studied in this study are all single-factor effects. However, it is obvious that urban greenery, air pollution, population and housing are all influenced by a combination of factors. This project only visualises their spatial relationship with park renewal separately, with the intention of providing the reader with a more visual representation of the contrasting relationships. In the future, the application of GWR, MGWR, GTMR and their spatial visualisation may be used to optimise this limitation.

Finally, in the visualisation of the combination of charts and maps in this study, the control axes have not yet been able to control both bar/dash charts and maps. This is a direction for future optimisation.

## 5 Conclusion

In general, this report is based on the corresponding visualisation website and explains and analyses its motivation, background, methodology, process and shortcomings. Based on the website and the report analysis, firstly, Brooklyn parks have experienced various historical changes and updates and can now be broadly divided into recreational parks, long parkways, and protected areas. Secondly, the investment in park renewal has improved the local infrastructure and thus benefited the wider city residents. Thirdly, while the urban park is developed and improved, the greening of other site areas is also optimised. Air pollution in the northern part of the region is likely to be improved by park maintenance and new construction, etc. Fourth, the construction and renewal of

parks often lead to the development of the human economy of the surrounding area (population growth and increased housing values).

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