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Nature as Privilege: How Environmental Racism Changes the Access to Fresh Air and the Effects on New York City's Communities

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Nature as Privilege: How Environmental Racism Changes the Access to Fresh Air and the Effects on New York City's Communities

Sarah Christine Morrison

Introduction: New York as Home

As a young college student studying at Fordham University in the Bronx, New York City has acted as my home for the past four years. I will not pretend to deny the tourists traps, such as the Statue of Liberty and Coney Island, that brought me endless fun and great memories. Traveling through the busy streets, searching for the nearest ice cream truck, or traveling downtown to my favorite halal cart on 57th, every element of this city has been memorable. During my time here, I tried to spend as much time as I could exploring the five boroughs, checking off a list of places to visit and food to eat, while walking hand in hand with some of my closest friends. It wasn't until the Fall of 2017 that I began understand the idea of ecojustice, and how it is displayed in urban centers. It was then that I was reminded of the privilege of nature, and how certain green spaces were more appealing to us than others. How the loud traffic and car horns coming from outside my apartment would wake me at any hour of the night. How we were warned not to travel into certain neighborhoods because they were 'dangerous'. It was then that I began to recognize the importance of urban politics and the environment, and the impact this has on all layers of society.

This paper serves to address the unfair treatment of low-income minority communities in New York City. Chapter 1 will address the global epidemic of the mistreatment of impoverished communities. From the harmful degradation of natural resources in developing countries that will exacerbate the poverty in those countries to the impact of climate change, impoverished communities are suffering. In the United States, low-income African Americans are suffering from astonishing high rates of disease and death because of several factors including lack of healthcare and high levels of pollution. Chapter 2 defines how the history and construction of New York City served to allow for subsequent segregation years later. Robert Moses and his racist agenda allowed for discrimination of public beaches and pools, limiting the access from minorities. The *de facto*

housing segregation and redlining practices after World War II confined minorities to specific regions of the city, emphasizing the ghetto boundaries. Chapter 3 will define the racial geography of asthma and other negative health effects caused by high levels of air pollution. The housing segregation in the 1900s allowed for the establishment of low-quality public housing for low-income minority families. These areas are disproportionately in close proximity to sources of air pollution, resulting in increased levels of asthma and higher hospitalization rates in minority children.

Chapter 4 states the gross disparity between green spaces in relation to minority and white neighborhoods. The unequal distribution and funding of these parks and public playgrounds can be linked to increased asthma and obesity rates in children. The Mayor's office of New York has acknowledged the disparity between parks in wealthy and poor neighborhoods. The creation of the Community Parks initiative was aimed towards recognizing underserved areas of the city and delegating funds to allow for the repair and construction of playgrounds and parks. Last, Chapter 5 introduces the idea of green infrastructure and, more specifically, green roofs, and how natural vegetation will serve to reduce air and noise pollution in the surrounding area, while working to reduce the heat island effect and provide aesthetic pleasure to residents. Green roofs are one simple solution that can assist in creating more green space in vulnerable neighborhoods to work on reducing vehicle and diesel emissions to allow for a healthier and happier New York City.

Abstract:

This paper serves to address the issue of environmental racism in relation to New York City, and more specifically comparing the South Bronx and Central Brooklyn, often characterized as low-income and high-minority populations with their white counterparts. New York, among other urban centers in the United States serves as an example of environmental racism because of the discrepancy in high air pollution levels in marginalized communities, the subsequent negative health effects (specifically asthma), and the lack of green spaces. The root of this issue is prominent in the history and construction of New York during the 1900s. The construction of public housing, discrimination in public spaces and the practice of redlining, overseen by Robert Moses, created a divided New York that is still evident today. Whether Moses was aware or not, the construction of New York would have consequences for the next years to come. The lack of access to the benefits the environment must offer has negative effects on these communities, including both health and mental consequences. The truth is, poor urban blacks have the worst health of any ethnic group in the United States, with the possible competition of Native Americans. Asthma rates are significantly higher among African American and Hispanic communities because of the disproportionate levels of air pollution. The New York State and local New York City governments are taking steps to help incorporate green spaces and roof gardens in these afflicted and underserved communities. The proposal of incentivizing the construction of green infrastructure can be encouraged through tax breaks as the services these elements add to the city are innumerable.

Keywords: environmental, ecojustice, racism, green space, South Bronx, New York City, asthma, public health, green infrastructure, Robert Moses, vehicle exhaust, air pollution

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Chapter 1: Marginalizing Poor Communities: New York City’s Social and Health Epidemic

In 2000, the United Nations Secretary General Kofi Annan called for the publication and funding of the “The Millennium Ecosystem Assessment” to study the changing impact that human beings have had on ecosystems, and how this has affected the livability and quality of life of the planet¹. The study and publication took place between 2001 and 2005 to establish “the scientific bases for actions needed to enhance to conservation and sustainable use of ecosystems and their contributions to human well-being”². The United Nations define an ecosystem as a dynamic web of plants, animals, microorganisms, and the nonliving environment and how these individual units adapt to interact as one functional entity. The conceptual design of ecosystems for this report believe that people are an essential part of any ecosystem because of the dynamic relationship that exists between them and the forces that are changing because of human interaction. The purpose of this report is to improve the overall well-being of all populations through a multitude of programs: reducing poverty, hunger, child and childbirth mortality, increasing accessibility to education, managing diseases, addressing gender disparity, promoting environmental sustainability, and encouraging global partnerships.

The degradation of ecosystems and natural resources is an aspect of “The Millennium Ecosystem Assessment” that is intersectional between rights for impoverished populations and environmental protection. The harmful effects of ecosystem service degradation are borne by impoverished countries and are contributing to the growing disparity of quality of life and wealth between high and low income countries. This is an example of an environmental justice issue. This

¹ United Nations, *Millennium Ecosystem Assessment*, (Washington, D.C.: Island Press, 2005), ii.

² United Nations, *Millennium Ecosystem Assessment*, V.

is based on the idea that “every person is entitled to protection from environmental hazards regardless of race, age, national origin, income, social class, or any political factor”³. The impoverished communities are victims of environmental injustice because larger and wealthier countries are taking advantage of their vulnerable situation. Further, the deterioration of these resources will exacerbate the poverty of developing countries, while neighboring industrial countries will begin a slow and progressive economic growth. This growing gap between developed countries and impoverished countries will enhance social conflict, resulting in a negative outcome for all.

One aspect introduced by the report is the increasing levels of air pollution because of fossil fuels, a direct result of increased development and population in developed countries. Pollution levels in cities are generally higher because the high density and small area does not allow for the dispersion and dilution of the pollution⁴. Carbon dioxide is one of the most common fossil fuels that results as a byproduct of coal burning, fossil fuel combustion, changing land use, and vehicle exhaust. Since 1750, the atmospheric concentration of carbon dioxide has increased by about 32 percent, with about 60 percent of that increased occurring after 1959⁵. When fossil fuels are burned, they release nitrogen oxides into the atmosphere, which contribute to acid rain and smog. In addition, nitrogen contributes to the creation of ground-level ozone, which is responsible for severe loss of agricultural and forest productivity. Nitrogen is responsible for the destruction of the ozone layer of the Earth’s stratosphere, which leads to increased ultraviolet radiation on earth leading to increased cases skin cancer and climate change.

³ Miller, G. Tyler, *Living in the Environment*, (Boston, MA: National Geographic Learning/Cengage Learning, 2009), 580.

⁴ Miller, *Living in the Environment*, 595.

⁵ United States, *Millennium Ecosystem Assessment*, 16.

The most severe health effect caused by the depletion of the ozone layer because of the introduction of nitrogen into the atmosphere is the ozone pollution. This category of pollution has severe consequences on respiratory functions, such as increased asthma rates and asthma attacks, increased allergies from heightened pollen production, and chronic diseases from nitrates leaked into drinking water that cause a variety of pulmonary and cardiac diseases. These negative health effects are concentrated on the impoverished communities because they lack the health resources that allow for preventive measures. The developing countries that are facing the severe health consequences of ecosystem degradation because of increased fossil fuel use and resource abuse by developed and wealthy countries. This injustice and disproportionate risk that impoverished communities face is not singled to the planet.

The United States struggles with a racist history that is still engrained in several elements of the country; police brutality, access to fresh food, legislation, and social stigmas. There are many disadvantaged groups in the United States, but urban minorities are among the most at-risk. The urban African American health epidemic has been overshadowed for several years because lack of interest and a wide variety of sources clawing to find their limelight. The truth is, poor urban blacks have the worst health of any ethnic group in the United States, with the possible competition of Native Americans. This is because of chronic diseases that include strokes, diabetes, kidney disease, high blood pressure, asthma, and certain types of cancer. In New York City, there are certain neighborhoods where the poor families are predisposed to several social issues, such as drug abuse, truancy, persistent joblessness that leads to an unbreakable cycle of crime and incarceration. These neighborhoods include East Harlem, Central Brooklyn, and the South Bronx.

The South Bronx exhibits symptoms of environmental injustice because of the disproportionate number of environmental burdens located near marginalized and vulnerable communities. Environmental conditions have been shown to contribute to producing and strengthening health disparities. It is widely accepted that environmental stressors can contribute to negative health outcomes and compromise the quality of life⁶. These stressors come in several different forms: traffic volume, traffic safety, residential density, poverty, crime rates, and residential cohesion. The Bronx is home to more than 1.4 million people, and one of the nation's poorest urban counties, with over 30% of residents living below the federal poverty line. Not only is the Bronx the poorest of the five boroughs, but it is home to the highest percentage of minorities, about 89 percent minority population, but also the highest percentage of poorly educated residents, with 30 percent of adults not high school graduates. Residents of the South Bronx are suffering from poor health outcomes because of their conditions, with 29 percent reporting high cholesterol and 33 percent high blood pressure. Additionally, the South Bronx is home to the two neighborhoods with the highest rate of diabetes in the five boroughs, Hunts Point and Mott Haven⁷. The South Bronx has suffered major health consequences because of the structure of the built environment and potential environmental injustices.

The South Bronx is not alone in facing environmental injustices as a result of the high poor minority population. In these low-income communities, the health issues are inevitable because they start at birth. From a young age, minority children are battling a lower quality of life that affects their life expectancy. The infant rate of black children in Westchester County is three times

⁶ Maroko, Andrew R., et. al, "Direct Observation of Neighborhood Stressors and Environmental Justice in the South Bronx, New York City." (2014), 478.

⁷ Maroko, "Direct Observation of Neighborhood Stressors", 479.

that of the entire county⁸. In Central Brooklyn, a predominantly black area, four times as many people die of diabetes when compared to the predominantly white Upper East Side of Manhattan. African American in New York are not alone. Youths in Harlem, Central Detroit, and the South Side of Chicago have the same probability of dying by the time they reach 45 as their white counterparts do by the age of 65. This disparity in life expectancy is not due to violence, rather to illness related deaths. In addition, a third of all low-income 16- year old black girls in urban areas will die before their 65th birthday. Most concerning is that the disparities in quality of life maintain effects through adulthood. Studies have found that adults who were poor as children, and no longer living in disadvantaged neighborhoods, are more commonly prone to stroke, kidney disease, and hypertensive heart disease. These health disparities between white and minority communities have several plausible triggers.

Several studies and researchers have searched to find why minorities are at a higher risk of dying more frequently and earlier than their white counterparts. To begin, there is no evidence that suggests these populations are genetically different in terms of managing the clear majority afflictions that are reducing minority populations. One researcher proposes that the quality of the disadvantaged neighborhoods serves as a predictor of life expectancy and the presence of diseases. For example, it found that neighborhoods that had a higher percentage of buildings boarded up and abandoned had higher rates of premature death from cancer and diabetes when compared to neighborhoods with similar poverty rates but with intact housing⁹. Abandoned buildings do not directly cause disease, but they are an indicator of the neglect the neighborhood is witnessing. This neglect that can be seen in buildings can be translated to public spaces and health care as well. As the living conditions of blacks have improved over the past century, their health has seen a similar

⁸ Epstein, Helen. "Ghetto Miasma: Enough to Make You Sick?" (New York Times, October 12, 2004), par. 7

⁹ Epstein, "Ghetto Miasma", par. 9

trend and improved; when their conditions deteriorate, so does their health. One researcher proposes that neglected buildings and housing conditions induce stress, which is known to have severe impacts on the well-being of a population.

Bruce McEwen is an neuroendocrinologist at Rockefeller University in New York City who argues that stress hormones are a major threat to low-income families, especially blacks and Hispanics. Stress hormones are natural and even healthy, but when produced in mass quantities can have severe consequences on the body¹⁰. These hormones are produced by the adrenal glands in response to a signal from the brain, which then speed the heart rate, narrow the arteries, which causes blood sugar to rise. When blood sugar rises, it rushes the energy stored in the sugars to the muscles and other organs. This leaves non-essential bodily functions, such as digestion and strength in bones and other tissues, inhibited. McEwen suggests that constant release of stress hormones will impair the immune system and damage the brain's ability to function. In addition, chronic stress leads the body to accumulate abdominal fat, which worsens chronic health problems such as diabetes and heart disease. The stress of living in poor and underserved neighborhoods will influence these poor communities and cause negative health effects, such as chronic health disease and increased rates of obesity.

In addition to chronic stress, impoverished people are more likely to maintain unhealthy lifestyle habits, as the makeup of the built environment shapes the communities. Fast food and cigarettes are cheap and abundant in these communities, with healthy alternatives limited and unaffordable¹¹. Urban areas are prone to lack trees, shrubs, grass, and other plants in order to make way for buildings, roads, parking lots, and other elements of the built environment. This means that areas lacking green space in cities do not benefit from the potential air pollution vegetation

¹⁰ Epstein, "Ghetto Miasma", par. 14

¹¹ Epstein, "Ghetto Miasma", par. 17

absorbs and the subsequent release of oxygen, reduced soil erosion, shade coverage, and general aesthetic pleasure¹². Further, in low income communities, green space is severely limited, making it difficult to find time for exercise and outdoor recreation. Not only are overweight children more prone to develop asthma, but they are less likely to exercise resulting in growing obesity rates. In addition, a recent study conducted of four regions in the United States found that there are three times as many bars in poor neighborhoods as the rich ones, and four times as many full-service supermarkets in white neighborhoods as black ones. An important study that measured the effect of the built environment on the health of surrounding communities was developed by the United States Department of Housing and Urban Development.

Moving to Opportunity for Fair Housing (MTO) was a randomized social experiment conducted in the 1990s among low-income families living with children in at-risk neighborhoods. The study was designed to determine if moving would have an influence on these children, such as whether performance in school would dictate crime rates in adolescents. In the study, there were several alarming but educational results published. First, children in Baltimore that moved to better neighborhoods improved their standardized tests scores, while adults were more likely to get off welfare¹³. In Boston, poor children who moved to neighborhoods with low poverty rates were less likely to experience a severe asthma attack. Additionally, adults who also experienced this move were less likely to suffer from symptoms of depression and anxiety and those adults that stayed in the low-income communities. These adults that experience the move described feeling calm and peaceful in their new residence. This study served as an introduction to the change that can occur in families when displaced from the toxic environments that are creating health issues.

¹² Miller, *Living in the Environment*, 595.

¹³ United States. Department of Housing and Urban Development (HUD). *Moving to Opportunity for Fair Housing Demonstration Program*. (Bronx, NY, 2011).

New York City is one of the most segregated urban areas in the United States. All different ethnic groups live within the confines of a small metropolitan area, but to a large extent they live separate lives, never interacting. Since 2000, millions of jobs have been lost, accounting for nearly three million people joining the poor. These people account for 12 percent of the United States population and 24 percent of African Americans. An brief study conducted over the past century had groundbreaking results, stating, “white people who live in cities with large black populations have higher death rates than whites with the same income who live in cities with smaller black populations”. The unfair treatment of low-income communities in New York is affecting the country as a whole. The foundation of this unfair treatment can be found in the construction and racist housing segregation that built New York from the ground up.

Chapter 2: The Power of History and the Construction of New York City

The idea of environmental injustice in relationship to cities is one that has its roots in the construction of individual cities for the past century. The burden of residential segregation is one that was not a result of a collection of individual choices, but rather of hidden public policy that allowed for segregation in metropolitan areas in the United States¹⁴. During the construction and major developmental periods of cities in the United States, including New York, the federal and state governments had the ability to define where whites and colored residents could live¹⁵. Racist construction practices condoned by Robert Moses allowed for the city to be further built for the white man. The concept of residential segregation was not based on one decision, but rather a

¹⁴ Rothstein, Richard. *The Color of Law: A Forgotten History of How Our Government Segregated America*, (NY: Liveright Publishing Corp., 2017), VIII.

¹⁵ Rothstein, *The Color of Law*, VII.

collection of regulations, laws, and government practices that created a system of urban ghettos surrounded by white suburbs. Although residential racial segregation violates the constitutional rights of all Americans, it was ignored for the better half of a century. New York was no exception, with laws and regulations that allowed whites to monopolize all the desirable places to live, leaving the impoverished and poorly managed sections to African Americans and other minorities in most American cities.

Robert Moses was often deemed the Master Builder because of his lifetime dedication to improving the city of New York and offering citizens elements that would improve their quality of life. Before Moses entered the scene, the city was undergoing severe changes with no course of action. Between 1910 and 1920, New York City had increased in population by about 1 million, and the rate was accelerating¹⁶. Public parks and vacant land was vanishing from the city. The invention of the Model T allowed families to escape the city, although there were no bridges across the Hudson. These severe changes needed to be dealt with by updating and modernizing the city, a task taken on by Robert Moses.

After serving in the public eye for several years, Alfred E. Smith, twice elected governor of New York State appointed Moses his Secretary of State¹⁷. Once in a position of power, Moses understood the changes he could force on the city and the faith that came with it. At the time, the primary concern in the 1930s was the construction of parkways and additional conventional highways because it proved to be a source of great wealth for politicians and would make the city more accessible. Parkway meant real estate transaction and development. Areas that were once long static because of their inaccessibility soon became desirable locations for housing

¹⁶ Caro, Robert A. *The Power Broker: Robert Moses and the Fall of New York*. (London: Bodley Head, 2008), 144.

¹⁷ Christin, Pierre. *Robert Moses: The Master Builder of New York City*. (London: Nobrow, 2014), 14.

developments and factories. Overnight, land in these areas became valuable. In order to make the dream of parkways a reality, Moses would drain public funds in order to complete his large infrastructure plans. During this time, Moses was responsible for the construction of an overwhelming number of highways and bridges in New York City: Cross Bronx Expressway, Brooklyn Queens Expressway, Long Island Expressway, Triborough Bridge, Throgs Neck Bridge, and Cross Bay Bridge to name a few¹⁸.

One element of Robert Moses' monstrous construction spree that is often overlooked is his mis-delegation of public work projects in white neighborhoods. His racist discrimination against minorities led to unfair construction of resources and in predominantly white neighborhoods, and unequal amenities. One example of Moses and his unfair distribution of resources is the construction of public pools, parks and playgrounds.

In his role as Secretary of State, Moses acknowledged the lack of public spaces accessible for the New York City residents. During the 1930s, Robert Moses was responsible for the construction of 255 neighborhood playgrounds. For bragging purposes and to dramatize his achievements, Moses numbered the playgrounds and put a dot on a blown-up map of the city that represented one playground he built. This map served as a billboard to highlight the unequal distribution of the playgrounds¹⁹. The area on the maps with the most dots were high-income neighborhoods, while the areas with the thinnest layout of dots corresponded to the underdeveloped low-income and high density areas of the city. The areas on the maps that had the fewest dots represented the areas of the city that inhabited the 400,000 African American families. Robert Moses built 255 playgrounds in New York City during the 1930s. He built one in Harlem. He built one in Stuyvesant Heights. He built no playgrounds in South Jamaica. These three

¹⁸ Christin, *Robert Moses*, 37.

¹⁹ Caro, *The Power Broker*, 510.

neighborhoods had high concentrations of minorities, low-income, and very high density as the residents were forced into ghettos with poor living conditions.

Once the pattern of the maps that Robert Moses used for bragging purposes was acknowledge, his critics began to spread word that Moses was a bigoted racist with the power to impact the lives and general health of children by denying them access to public playgrounds. Robert Moses responded to these claims:

The fact is that Harlem and it's adjacent neighborhoods have not been overlooked and neglected or discriminated against. The tendency has been in just the other direction, that is to give more attention to Harlem than to other sections which are in just as great need of recreation²⁰

Children with black skin had been overlooked and not provided with the resources that they needed more than the white and comfortable children.

In addition to the construction of playgrounds, Robert Moses was responsible for the construction of public swimming pools throughout the city. Robert Moses built several pools in the city, among them were one in Colonial Park in Harlem, and one in Thomas Jefferson Park in East Harlem. Moses built the pool in Harlem because he didn't want African Americans 'mixing with white people in other pools', and this pool would serve as a pool specifically for the minorities in Harlem. Moses implemented racist measures to ensure that the minority families living in Harlem would not come to the Thomas Jefferson park pool, which was built specifically for the white families. These included only employing white lifeguards and attendants, as done at Jones' beach, to discourage minority families from using the facilities because of a lack of trust. Additionally, Moses was under the impression that "[Colored people] don't like cold water"²¹.

²⁰ Caro, *The Power Broker*, 512.

²¹ Caro, *The Power Broker*, 514.

Thus, he kept the pool at Colonial Park around seventy degrees, and left the pool at Thomas Jefferson park unheated. Moses believed that this would leave the water cold enough to limit the amount of minority families, but not too cold as to disrupt the attendance of white families. As the Secretary of State, Robert Moses used his unchallenged authority to create disparities between playgrounds and pools in white and colored communities.

Another way in which the construction of New York City created segregation between whites and minorities was through housing segregation. It began with the increasing population and lack of available housing after World War II because of economic depression and world conflict. During this time, families that lived in the cities began to move to the suburbs to find more space. When the white families moved out of the cities, the minorities replaced their spot²². The heart of the cities were now predominantly minorities who had no other housing options. The suburbs became very selective, and would not allow certain groups to buy houses in these areas. It was a known agreement “among members of the real estate and home-building industries, federal and local governments, and, in most cases, those people already in resident, low-income families, regardless of race or origin were kept out of the new suburbs”²³. Through redlining practices and urban sprawl that was limited to high-income white families, minorities and low-income families were limited to the metropolitan areas. With these groups confined to certain areas of the United States, this allowed for environmental racism to flourish.

One of the origins of the unintentional creation of ghettos was the formation of public housing. The concept of public housing was founded on the principle of providing decent housing to those could not find it because of overcrowding in major cities²⁴. In order to provide public

²² Grier, George. *Equality and Beyond; Housing Segregation and the Goals of the Great Society*. (Chicago: Quadrangle Books, 1996), 30.

²³ Grier, *Equality and Beyond*, 32.

²⁴ Rothstein, *The Color of Law*, 18.

housing during a war-time country, current president Franklin D. Roosevelt created the Public Works Administration (PWA) during his New Deal political campaign. The focus of this organization was to alleviate the country of the growing pressure of the housing shortage, while simultaneously creating jobs in construction. It was during this massive construction of public housing that the segregation of neighborhoods is rooted. The PWA began to construct integrated neighborhoods and then used the public housing programs to make the integration solidified by designated sections as white or black only²⁵. This separation dependent on skin color resulted in increased density in African American neighborhoods and the future creation of slums.

Another federal government policy that introduced housing segregation was another New Deal initiative where Franklin D. Roosevelt founded the Home Owners' Loan Corporation to help decrease the number of home foreclosures²⁶. The HOLC would purchase existing mortgages that were in imminent foreclosure and then issue new mortgages in order to assist a struggling economy and encourage homeownership²⁷. This allowed working and middle class families to gradually gather equity and establish solid financial records. One of the appeals of the mortgages dispensed by the HOLC was the low interest rates. However, the borrowers still had to ensure their ability to make monthly payments against the mortgage. The basis of HOLC mortgage program was based on an assessment of risk on return and whether the borrower's ability to avoid default. To determine the risk of certain neighborhoods, the HOLC investigated the condition of the house and the quality of the surrounding neighborhood to determine if the property would maintain value. With these conditions, it is unsurprising that race was a large determinant on the gauge of risk for certain neighborhoods.

²⁵ Rothstein, *The Color of Law*, 22.

²⁶ Aaronson, Daniel. "The Effects of the 1930s HOLC 'Redlining' Maps". *Working Paper Series*, 1.

²⁷ Rothstein, *The Color of Law*, 64.

The HOLC made maps to determine the level of risk of certain neighborhoods that could be used to show public organizations, such as real estate agencies. These maps aimed to show the areas that were most fit for financial investments based on an array of variables²⁸. These maps arranged areas in four sections; green, blue, yellow, and red. The colors signified desirable, still desirable, declining, and most risky, respectively. With the maps outlining sections of cities in colors, the concept of redlining was born.

The term *redlining* can be defined as “those lending practices that constitute an arbitrary denial of financing not justified based on economic criteria such as risk or rate of return”²⁹. It was established that a neighborhood received a red rating if African Americans lived in it, even if the families were of middle-class of single-family homes³⁰. Thus, the color-coded maps had little to do with risk of the situation and more to do with racial composition of the neighborhood. This simple map had the ability to create slums and change the composition of a city in a short time because of the drastic change it caused to the neighborhoods. Thus, banks deemed these areas as unfit for investment and the area was left underdeveloped and began to lose property value and appeal. New businesses would avoid these areas because they were considered too risky for small-scale business ventures³¹. These areas soon began to diminish. The housing market became obsolete because property value began to decrease and the only groups that could afford these properties were low-income families of color. The abandon houses served as shelter for illegal drug use and crime, which further increased the reluctance of banks to invest in these areas³². With

²⁸ Aaronson, “HOLC ‘Redlining’ Maps”, 3.

²⁹ Phares, Donald. *A Decent Home and Environment: Housing Urban America*. (Cambridge, Massachusetts: Ballinger, 1977), 32.

³⁰ Rothstein, *The Color of Law*, 64.

³¹ Phares, *A Decent Home and Environment*, 43.

³² Aaronson, “HOLC ‘Redlining’ Maps”, 5.

these areas considered undesirable, ghettos were formed. Redlining practices established solidified changes in the composition of neighborhoods and created unequal housing for families of color.

Often, the only groups that could afford to live in these areas were low-income families of colors. The impact of redlining is still present today. Aaronson states that there is “evidence of a long-run decline in homeownership, house values, and credit scores along the lower graded side of HOLC borders that persists today”. The redlining practices condoned by the United States government during the late 1930s would allow for the establishment of ghettos and later allow for environmental injustice to occur within them.

Practices such as redlining were condoned and even encouraged by the United States government, despite the evidence that it was unfair and left low-income families in dangerous neighborhoods. However, individual private agreements between homeowners were a larger trigger for the aggressive mood of the country at that time because it enhanced the notion that the idea of housing segregation was rooted strongly in urban culture. For the first half of the twentieth century, property and housing owners would include in housing contracts that the sale to African Americans was prohibited. These deed clauses were part of ‘restrictive covenants’, or lists of obligations that the buyer or renter are held to in regards to appearance of the structure, such as what color the exterior of the house is, what kind of trees are planted³³. Individual neighborhoods believed that by creating a pact not to allow African American families into the community, it would ensure the property value of their homes for years to come. New York was no exception. In a survey conducted of 300 developments in suburban areas surrounding the city, it found that 56% had racially restrictive covenants. Of the larger subdivisions surveyed (those that contained more than seventy-five units), 85% had them.

³³ Rothstein, *The Color of Law*, 78.

Along with the practice of redlining and racially restrictive covenants, the exponentially increasing population of the United States in the period following World War II will allow for the creation of housing segregation. As the nation's population increased, the inhabitants began to flock to the cities for work and residential needs, in part because agriculture had decreased and could no longer provide employment in the rural west³⁴. The workers that came to these areas were predominately minorities. Thus, each one of the nation's fifteen largest metropolitan areas reported a larger increase in black populations than white. The increase of residents in all the metropolitan areas resulted in 'super cities', also known as the urban sprawl that resulted from lack of land but increasing populations. Once available space began to decrease, an alternative solution was much needed.

From 1957 to 1968, Congress granted civil rights laws for African Americans to allow them public accommodations such as transportation, voting, and employment rights. Although these laws were met with conflict and widespread disagreement, they were effective. Housing segregation, however, is something much more complicated because of the long-standing history and difficulty of undoing past actions of gentrification³⁵. The first step was the passing of the Fair Housing Act of 1968, which prohibited the private discrimination in housing sales and rentals per racially restrictive covenants. Although this was a legal win for African Americans, it had little impact on the previous racial segregation. The areas that were previously restricted to African Americans by these covenants were now unaffordable. From 1973 to 1980, the average income of African Americans fell by 1%, while the average price of a home grew by 43%. This income disparity continued until the 1960s, by which time the process of suburbanization was complete

³⁴ Grier, *Equality and Beyond*, 35.

³⁵ Rothstein, *The Color of Law*, 198.

and African Americans were once again not included. This segregation that occurred more than 50 years ago is still evident in the current structure of the city. Housing segregation is something that cannot be solved overnight, nor will it be solved for centuries to come. From the initial construction of the city to the continued gentrification, housing segregation is still alive in New York.

The Fair Housing Act is an example of federal legislation that succeeded in preventing future instances, but failed to treat the source of the problem. Racial segregation is one that has made limited progress in improving and for several reasons. First, African Americans' economic status is replicated in the next generation because of restrictions from their access to fully participating in the free labor market in the mid-twentieth century. Thus, African Americans were forced into inheriting depressed incomes for generations to come. In fact, African American families are less upwardly mobile than their white counterparts because low-income African Americans are more likely to be trapped for multiple generations in poor neighborhoods³⁶. In fact, 67% of African American families coming from the poorest quarter one generation ago are still living in such neighborhoods. Of their white counterparts, only 40% of white families who lived in the poorest quarter of neighborhoods still do today.

The structure of the city and the segregation that allowed for the creation of ghettos and the separation of marginalized groups has created a system dedicated to keeping impoverished families in their current economic position. This housing segregation has led to segregation in other aspects of the city, such as schools. Segregation is more commonplace in schools today as it was forty years ago because the neighborhoods are more segregated as a response to the excessive distribution of wealth and access to amenities.

³⁶ Rothstein, *The Color of Law*, 187.

Next, the value of white-working and middle-class families' suburban houses appreciated, or increased in value, over time because of a severe increase in demand and lack of supply. This resulted in a vast wealth disparity between whites and blacks that lead to permanently define their living arrangements. By the time African Americans were legally permitted to buy or rent homes outside of the urban center, it was unaffordable. The racial wealth gap only will continue to worsen over time because children inherit assets from their parents, and property will continue to increase and value.

Lastly, our current federal, state, and local programs are unknowingly aimed at reinforcing the residential segregation rather than diminishing it. Federal subsidies provided to low-income families are dedicated to assist in their ability to rent apartment in minority areas where opportunities for them to enhance their economic status is low. These subsidies are rarely, if ever, provided to help minority low-income families into integrated neighborhoods. Additionally, funds allocated to public housing projects are used to buy apartment buildings and convert them into affordable housing for low-income families in poor neighborhoods. The delegation of funds by the government is explicitly promoting segregation.

The most important impact that housing injustice has on minority and low-income families is the health consequences associated with these regions. It has been well known that both race and socioeconomic status play a vital role in the distribution of disease within a society³⁷. However, a recent survey indicates that race is a stronger factor in determining levels of poor health in a community, above income level. For example, this study concluded that at every income level, life expectancy of blacks was three years lower than that of whites. The lower quality of

³⁷ Williams, David R. "Miles to Go Before We Sleep: Racial Inequities in Health." *Journal of Health and Social Behavior* (2012), 178.

health among blacks is a result of perceived discrimination in society. The perceived racism present in the United States has affected communities of color because of their inability to provide health services for their family because of the wealth gap. Per a study, “between 2005 and 2009 the median wealth of white households declined by 16%, compared to 53% for black and 66% for Hispanic households”. Thus, the median household income of whites is 20 times that of black and about 18 times that of Hispanics. These numbers show that minority families will be less likely to handle environmental injustice and increased pollution due to their race or class status because the wealth gap inhibits their income.

Environmental injustice has a powerful hold on communities of color and those in poverty because it affects their quality of life to a deadly extent. Studies have been conducted to study the harmful effects of noise and air pollution on its victims, who are most likely communities of color and low-income. The last impact of Robert Moses and the redlining practices condoned in the city have enhanced the ability to segregated minority communities from their white counterparts, allowing for the marginalization of certain communities based on their ethnicity and income level.

Chapter 3: The Racial Geography of Asthma and Air Pollution

Over the past decade, asthma has become a major health concern affecting Americans of all ages. Asthma can be defined as ‘a chronic inflammatory disorder of the airway characterized by intermittent, recurrent episodes of wheezing, breathlessness, chest tightness, and coughing’³⁸. Since the 1980s, the Center for Disease Control has defined the rise of asthma in the United States as an epidemic³⁹. The focus and most severely affected group are children and adolescents, and

³⁸ Berg, Bruce, *Healing Gotham: New York City’s Public Health Policies for the Twenty-First Century* (Baltimore: John Hopkins University Press, 2015), 72.

³⁹ Sze, Julie. *Noxious New York: The Racial Politics of Urban Health and Environmental Justice* (Cambridge, MA: MIT Press, 2007), 94.

elderly populations⁴⁰. The CDC reports that more than 4.9 million children under eighteen in the United States have been diagnosed with asthma. Marked as the most common chronic health conditions in children, it is affecting more than 10 percent of the New York City's children population. In 2000, New York City children were twice as likely to be hospitalized than the average American child⁴¹. In 2007, it was estimated that 300,000 children in the city suffered from asthma. Children are more vulnerable to the disease because of the longer proportion spent outside, inhaling more air per kilogram⁴². Additionally, young people are unable to participate in the decisions of their environment that can affect their lives. The cost of asthma is multidimensional and insurmountable, affecting all aspects of a child's life, including his or her ability to learn, play, and sleep, their social life and recreation, emotional well-being, and financial situations⁴³. The severity of asthma can be measured by how it impacts a child's quality of life. One of the most important and measurable factors is the prevalence of school absences and hospitalization rates. Asthma is a growing health concern, as it requires frequent visits to the hospital, and when left untreated or treated too late, can be fatal.

Asthma has been labeled as a racialized and gendered disease because the disproportionate rates of sufferers can be separated depending on their gender and color of their skin. More specifically, low-income and minority children are more severely affected by asthma, with a disproportionate rate of asthma compared to their white counterparts. Children of color in low-income neighborhoods have shown the highest increase in rates of asthma in recent years, with the racial disparity between their white counterparts growing steadily since 1980. According to the

⁴⁰ Sze, *Noxious New York*, 91.

⁴¹ Environmental Defense Fund. "All Choked Up: Heavy Traffic, Dirty Air, and the Risk to New Yorkers" (2007), 2.

⁴² Berg, *Healing Gotham*, 75.

⁴³ Sze, *Noxious New York*, 94.

American Lung Association, asthma attacks are 32% higher in African American than whites. Additionally, black children are four times more likely to die from asthma related complications than white children. There are several factors that contribute to these communities having higher asthma rates; including low accessibility to health care and higher air pollution levels from closer proximity to the pollution sources. Asthma air research has been divided environmental factors by sources. Air pollution levels in an urban environment can be separated into two categories; indoor and outdoor pollutants⁴⁴. Several studies have concluded that there are short and long-term effects among children from both indoor and outdoor air pollutants.

Outdoor air pollution is common in almost all industrialized urban environments because the primary source is vehicle exhaust and factory emissions. However, New York City is one of the most vulnerable because of the large and exponentially increasing population. As of yet, New York City's background air quality does not yet meet the Clean Air Standards for nitrogen oxides and particulate matter⁴⁵. Multiple studies have concluded that there are parallels between vehicular traffic intensity and rates of hospitalization due to asthma⁴⁶. Traffic congestion and diesel powered buses and trucks are responsible for a large contribution of outdoor air pollution in New York City. Additionally, children with asthma are sensitive to common outdoor air pollution such as sulfur dioxide and particulate matter. A study conducted in the Bronx found that residential proximity to major sources of air pollution, such as highways and factories, is one factor that can be used to predict children hospitalization rates due to asthma attacks. The other two factors used in this study were poverty and race. These studies conclude that outdoor air pollution is an important factor in studying the impacts of different pollutants on children and how they trigger asthma.

⁴⁴ Sze, *Noxious New York*, 95

⁴⁵ Environmental Defense, "All Choked", 2

⁴⁶ Berg, *Healing Gotham*, 74

Recent studies have concluded that there is a 500 to 1500-foot risk zone from air pollution around heavily used roadways, varying depending on the pollutant and specific health effect. For New Yorkers, this can be quantified by living within two to six blocks from a major and congested roadway. Within this zone, vehicle emissions are at higher and more concentrated levels than background concentrations. The pollutants specifically from traffic congestion are particulate matter, also referred to as soot, volatile organic compounds, and nitrogen oxides, or smog. A study conducted measured how far certain vehicle emissions can travel from a congested roadway, keeping variable factors such as meteorological conditions consistent:

Particulate matter (soot from gasoline or diesel): 500 to 1500 feet
Nitrogen Dioxide: 600 to 1500 feet
Ultrafine particulate count: 300 to 1000 feet⁴⁷

These three pollutants have all been linked to higher rates of pollution closer to congested roadways. Additionally, stop-and-go traffic reportedly releases 3 times the amount of pollution as free-flowing traffic. These high levels of vehicle exhausted related emissions have led to increased levels of asthma, including other severe impacts on health. Studies of men, women, and children have all shown increased health risks associated with residential and work proximity to a congested and busy roadway.

High levels of vehicle emissions, and especially diesel soot, have been linked to triggering severe asthma attacks and impairing general lung function. Diesel burns hydrocarbons, which release small particles into the atmospheric air. These fine particulate matters are dangerous because the small particles can lodge themselves in the lungs of vulnerable populations, such as

⁴⁷ Environmental Defense, “All Choked”, 2.

young, elderly, and the sick⁴⁸. Of these attacks, children are especially vulnerable. Studies show that children with increased proximity to a major roadway and increased levels of vehicle emissions are subject to increase prevalence of asthma, severe respiratory symptoms, and stunted lung growth. In 2005, a study found that the risk of asthma increased 89% for each quarter-mile children live to a congested and busy roadway. A similar study in 2007 found significant decrease in lung airflow in children living in the risk zone, or 1500 feet from a major roadway⁴⁹. Diesel emissions on busy roadways have been associated with triggering asthma attacks, and may play a vital role in the initial onset of childhood asthma.

Including asthma, air pollution coming from vehicle exhaust has been linked to other severe health issues. First, multiple studies have linked vehicle pollution to a higher risk of cancer⁵⁰. A study conducted in Erie and Niagara counties in New York State found that increased levels of traffic emissions was directly associated with increased risk of breast cancer in women. A study in Stockholm found a 40% higher chance of lung cancer for the individuals with the highest reported exposure to nitrogen dioxide. Lastly, a Danish study concluded that rates of Hodgkin's disease, or a rare cancer found the immune system, increased by 51% in children whose mothers were exposed to increased levels of nitrogen dioxide during their pregnancy. Vehicle emissions have a significant impact on cancer rates. Vehicle emissions contribute to more than 80% of the total cancer risk from hazardous air pollutants in New York City. Additionally, "lifetime cancer risks due to diesel exhaust in both Bronx County and Queens County is over 900 times the acceptable Environment Protection Agency standard", while New York County is more than 3,000 times that limit⁵¹. These three studies have shown that increased levels of vehicle

⁴⁸ Sze, *Noxious New York*, 99.

⁴⁹ Environmental Defense, "All Choked", 3.

⁵⁰ Environmental Defense Fund, "All Choked", 3.

⁵¹ Environmental Defense Fund, "All Choked", 6.

emissions have been linked to higher cancer rates, and even serve to highlight the risk for pregnant women.

Lastly, high levels of vehicle pollution have been linked to an increase in death from heart related complications. A recent study conducted in Los Angeles reported that if researchers were accurate with estimates to air pollution exposure based on localized rather than ambient air pollution levels, the estimated deaths from heart attacks would triple. Another study conducted in Worcester, Massachusetts found that each kilometer a subject lived to a major roadway, there was a 5% increased of risk of acute heart attack. Multiple studies conducted over the past few years have found serious health effects from increased exposure to heavy-duty diesel trucks. Among these are increased mortality rates. The increased level of vehicle emissions in urban areas, and specifically New York City, has a wide variety of serious and life-threatening health implications among the residents. New York City is particularly vulnerable because of extremely dense populations and large volume of traffic on most local roadways.

In New York City, more than two million people live within 500 feet of a congested street or highway. In Manhattan alone, more than 75% of the population live within 500 feet of a major roadway. Additionally, many schools and playgrounds reside within this zone. In Brooklyn alone, over 35% of health facilities and playgrounds live within the risk zone⁵². A study conducted by Environmental Defense mapped the proportion of vulnerable populations living within this risk zone. The maps compare the five boroughs and the percentage of minority, youth populations under 18- years- old, and elderly populations over 65- years- old living in areas of increased health risks from traffic congestion. These maps serve to report the extent of the problem, and how it impacts vulnerable communities (Figure 1). One of the most concerning aspects of vehicle

⁵² Environmental Defense Fund, “All Choked”, 2.

emissions is that New York City has a relatively low car ownership because of the accessibility to an extensive public transit system. In fact, Manhattan is the only county in the country that has more jobs than residents⁵³. This means that the high levels of exhaust are coming from vehicles passing through the city for work and personal related matters, meaning those causing the high levels of pollution are not facing the consequences of the increased air pollution.

Outdoor air pollutants are comprised of several groupings. Including the overwhelming amount of research conducted regarding increased traffic proximity and asthma attacks, studies have linked the development of asthma and high levels of secondhand smoke. This includes not only direct exposure to the smoke, but also between a fetus and a mother's smoking or exposure to secondhand smoke while pregnant. The exposure to tobacco smoke while in the utero can impact the health of the baby later in life, including an increased risk of developing childhood asthma. Secondhand smoke and vehicle exhaust are both difficult to avoid in a congested urban area.

Studies suggest that disadvantaged low-income and minority populations are those that are prone to higher levels of air pollution because of their proximity to the factors that are creating the pollution. These communities are in close quarters with environmental hazards such as landfills, medical incinerators, and diesel bus depots⁵⁴. By the late 1990s, there were seventy-five waste transfer stations in New York City. Waste transfer stations have significant impact on surrounding neighborhoods, such as dust, cockroaches, diesel emissions, traffic backup, odors, and noise pollution⁵⁵. Additionally, these neighborhoods have reported home invasion by fat and aggressive rats because of the endless supplies of garbage nearby. In 2004, New York City residents generated

⁵³ Environmental Defense Fund, "All Choked", 7.

⁵⁴ R. Charon Gwynn, and George D. Thurston. 2001. "The Burden of Air Pollution: Impacts among Racial Minorities." *Environmental Health Perspectives*, 501.

⁵⁵ Sze, *Noxious New York*, 110.

about 43,000 tons of waste per day, which is shipped to waste transfer stations⁵⁶. These stations are disproportionately dispersed throughout the city, placing the stress on low-income and minority communities. The neighborhoods specifically vulnerable to garbage politics are the Williamsburg and Greenpoint neighborhoods in Brooklyn and the South Bronx. A map provided by the Pratt Center for Community Development helps visualize the heavy burden of waste transfer stations placed on these neighborhoods (Figure 2). The South Bronx is home to thirteen waste transfer stations, while Greenpoint and Williamsburg have twenty-four. These two neighborhoods are responsible for managing about 73% of the city's total debris.

Another factor that influences the levels of diesel rates along certain roadways is the placement of the Metropolitan Transportation Authority (MTA) bus depots. Currently in New York City, six out of the nineteen bus depots are in Harlem and Washington Height, which are in Northern Manhattan and classified as predominantly African American and Hispanic communities per the United States census. These bus depots house more than 4,000 buses that leave once a day, traveling far distances to begin their day's work⁵⁷. The placement of these toxic structures has impacted the quality of life and medical wellbeing of the residents that are surrounded by them. The disparity between air pollution levels between blacks and whites is astonishing, and can be assumed to be the cause of the large differentiation in asthma rates between the two groups.

The link between waste transfer stations and bus depots is that the high volume of diesel truck exhaust can lead to higher air pollution levels, and thus trigger asthma attacks in the surrounding populations. Additionally, they create the ideal conditions for roach and rodent infestations. Thus, the low-income and minority populations of New York City are

⁵⁶ Sze, *Noxious New York*, 112.

⁵⁷ Sze, *Noxious New York*, 99.

disproportionately impacted by outdoor air pollution levels because of their proximity to high volumes of traffic due to placement of bus depots and waste transfer stations.

One of the most important aspects of asthma is the contribution of indoor air pollution. Several different studies of asthma research have found that indoor air pollutants have demonstrated a stronger link with the onset of asthma more so than outdoor pollutants. Indoor air pollutants can contain a collection of different particles that contribute to the onset of the disease. Indoor air pollution coming from the indoor environment includes tobacco, mold, water damage, chemical irritants, dust, pets, cockroaches, and can be enhanced by poor ventilation. Among these indoor factors, cockroaches are the most dangerous because of their overwhelming presence in housing in New York City. One study conducted in Harlem found that approximately 85% of the homes of inner city children diagnosed with asthma have contained detectable cockroach allergen levels⁵⁸. An article published in *New England Journal of Medicine* concluded that cockroaches may be the leading cause of childhood asthma, with more than 40% of children allergic⁵⁹. Per the study, asthma in children is typically caused by an allergic reaction to a substance, or an antigen. Of all the antigen-producing agents that make up an urban residence, cockroach droppings and particles are the most powerful. In the same study, it was found that 50.2% of homes had high levels of cockroach allergens when measuring the indoor air quality. Those children that were both allergic to cockroaches' allergen were exposed to higher levels of allergens and had a significantly higher rate of hospitalization⁶⁰. Thus, the allergic reaction caused by cockroach particles in lower-quality housing is the most dangerous, if not fatal.

⁵⁸ Berg, *Healing Gotham*, 75.

⁵⁹ Sze, *Noxious New York*, 100.

⁶⁰ Berg, *Healing Gotham*, 73

The issue of indoor air pollutants is relevant and controversial because of the lack of care found in public housing. In addition, low-income areas of the city are more commonly affected by hazardous indoor air pollutants because of the deteriorating quality of housing. These housing units are characterized by their poor indoor air quality because of mold, mildew, dusty, and cockroaches, all which are known to trigger asthma attacks. There is a defined positive relationship between housing deterioration and allergen levels, meaning that as housing quality declines, the allergen levels that trigger asthma attacks increase exponentially. Of the communities most affected by increasing indoor air pollution, low-income minority families are most affected. In 2008 the New York City Department of Health and Mental Hygiene conducted a study and reported that at lower-income levels, there is an increase in reported cockroach level, as well as the presence of at least one smoker⁶¹. In sum, the contribution of indoor air pollution works in connection with the increased outdoor air pollution levels and highlights the disparity of pollution levels among low-income minority communities when compared to their white counterparts.

There are several social and physical consequences that the children face when diagnosed with asthma as result of the poor living conditions that led to the diagnosis. Several studies have examined the role that stress can play in the development of childhood asthma caused by air pollution levels. The rationale of the study is that the low socioeconomic status of families are prone to high stress levels, which can lead to the children being more susceptible to asthma development. The study, conducted in Southern California, found that the risk of asthma due to traffic-related pollution was higher for the children whose parents reported having higher stress levels. In addition to stress levels, the obesity epidemic has visible ties to the asthma epidemic that is plaguing the United States. Obesity has been defined as a strong predictor of the presence of

⁶¹ Berg, *Healing Gotham*, 78.

asthma in an adolescent⁶². Asthma diagnoses limit a children's ability to spend time outdoors and remain active, and can lead to increased levels of obesity.

The prevalence of asthma in the United States has increased over the last quarter of the twentieth century. The National Health Interview Survey reported that for all age, racial and, ethnic groups the prevalence of asthma increased seventy five percent between 1980 and 1994. Additionally, in 2011 the Center for Disease Control reported that childhood asthma, affecting those under the age of eighteen, had increased about 10 percent. During the period when childhood asthma rates were increasing, the disparity between white and black children grew.

Children living in urban areas, specifically inner-city minority children, have disproportionate rates as well as more severe cases of asthma. Finding higher rates of asthma in communities of color marked the condition as controversial and racialized. By 2000, black children had an asthma rate that was 44 percent higher than non-white Hispanic children. For black children, asthma prevalence increased from 11.4 percent in 2001 to 17 percent in 2009. These comparable rates between the average of all children and the average of black children shows that the rate of asthma in minority-communities started with a higher average and has increased above the national average. The easiest way for one to examine the asthma diagnosis disparities between races and ages is by hospitalization records.

The consistency and duration of data collection of hospitalization records for asthma makes this the most viable proxy used to measure the severity of the condition. The national average for childhood asthma rates have increased throughout the 1980s and 1990s, peaking at 32.7 per 10,000 residents in 1995 and 32.4 in 1997⁶³. Since then, the national average of asthma hospitalization

⁶² Berg, *Healing Gotham*, 76.

⁶³ Berg, *Healing Gotham*, 78.

rates for children has leveled off approximately around 30.0. New York City's hospitalization rates for asthma have always been drastically higher than the national average, causing much needed alarm. In 2000, the city's childhood asthma hospitalization rate was 60.6 per 10,000 residents, while the United States' rate for the same group was just 33.6. This is just less than double the rate of the national average. While the average has fluctuated at nearly half that of New York City's, the city's hospitalizations rates peaked in the mid-1990s and have since declined, but have remained much higher.

Like asthma rates varying by geography, the childhood asthma hospitalization rates vary by race. In 1998, the asthma hospitalization rates for black children was 3.6 times the rate of white children. In New York City, the hospitalization rates of children that are a result of asthma can be divided by boroughs. Consistently, the Bronx is the borough with the highest asthma hospitalization rates. On the contrary, Staten Island reports the lowest rates for hospitalization, with less than 4.0 per 1,000 for the ten-year period. When comparing the 2007-8 averages across the five boroughs, there is a clear distinction between the hospitalization rates. In the Bronx, the average hospitalization rate for this period was 9.2 per 1,000 residents. In comparison, Manhattan was 4.0, Brooklyn 4.1, Queens 3.9, and Staten Island 2.0. This drastic difference in the hospitalization rates between boroughs shows the disparity between asthma throughout the city of New York. The table below is a detailed account of asthma rates per borough:

New York City Childhood (0-14 years) Asthma Hospitalization Rates by Borough and Selected Neighborhoods (rate per 1,000), 1995-2008

	1995	1997	2001	2004	2007-8 Average
Bronx	16.1	15.4	9.2	10.7	9.2
Kingsbridge	6.8	6.6	3.6	4.8	4.6
Hunts Point/ Mott Haven	22.5	22.6	9.4	12.8	11.5
Brooklyn	9.0	8.3	5.5	6.1	4.1
Bedford-Stuyvesant/ Crown Heights	15.4	14.0	10.3	10.8	7.7
Bensonhurst/ Bay Ridge	2.6	2.4	1.1	1.5	1.1
Manhattan	13.4	12.3	6.9	6.3	4.0
East Harlem	36.5	29.2	16.9	13.3	11.2
Upper East Side	3.1	4.0	2.3	1.9	1.2
Queens	6.9	6.4	4.9	4.7	3.9
Bayside / Little Neck	2.7	1.4	1.5	1.9	2.3
Jamaica	0.2	9.3	7.8	7.6	6.2
Staten Island	3.8	3.7	2.8	2.6	2.0

Source: New York City Department of Health and Mental Hygiene, Asthma Initiative, 2009 Asthma Hospitalizations, New York City, by UHF Neighborhood; New York City Department of Health and Mental Hygiene, Asthma Initiative, 2010, 2000-2008 Asthma Hospitalization Tables and Figures (Bureau of Environmental Surveillance and Policy), May.

The study does note that although the differences between the borough is great, the differences within the same boroughs are greater. The communities in all five boroughs that are recording the highest asthma hospitalization rates are the neighborhoods with higher percentage of minority residents, while those neighborhoods recording lower asthma rates are the communities with fewer minority residents⁶⁴. The statistics regarding the frequency of hospitalization rates per borough found that the asthma hot-spots in New York city had high concentrations of minorities, composed of individuals living below the poverty line, living in public housing and deteriorating housing.

For asthma patients, one of the most important resources that can help them to manage their disease, as well as make medication accessible, is the presence of medical resources in a

⁶⁴ Berg, *Healing Gotham*, 81.

neighborhood. Although there is no known cure, the main aspect of asthma management is properly taking medication, monitoring air flow, reducing indoor and outdoor pollution triggers⁶⁵. Additionally, if recognized early, taking preventive medication has proven the most effective treatment regimen. The lack of health care for these communities has created a treatment and resource gap, forcing those that are suffering with severe asthma attacks to continue without treatment⁶⁶. The lack of pediatricians and primary-care physicians has created a climate of reliance on emergency services. In 1988, a study was conducted that found that low-income children were more likely to use the hospital based clinics in their neighborhoods, as opposed to receiving care in a doctor's office. These low-income families cannot afford treatment and the necessary diligence required to treat and manage severe asthma and are dependent on the emergency facilities in their communities. The disparities in the access to a primary care physician and routine check-ups has left low-income families at a disadvantage when combating asthma.

Environmental racism is an artifact of the urban economic and residential development that has created a city with distinguished and separated neighborhoods with varying levels of air pollution. The segregation of minorities and low-income communities because of *de facto* segregation created residential areas prone to health risks, such as severe and even fatal asthma attacks. Additionally, the disproportionate arrangement of neighborhoods and the distribution of toxic and hazardous air and water qualities is highlighted in New York City. This concept is based on the fact that environmentally hazardous sites, such as the waste transfer stations and bus depots, are not equally spaced through the city. Rather, they are placed in areas of low-income and typically minority because these communities do not have the political power to fight these issues and lack the financial and physical ability to move.

⁶⁵ Sze, *Noxious New York*, 102.

⁶⁶ Charon, "The Burden of Air Pollution", 501.

The United States Environmental Protection Agency has defined nonattainment areas as designated sites where the air quality does not match the national average due to increased levels of air pollutants. In a study conducted throughout the country, it found that 62.2% of African Americans and 71.2% of Hispanics have residences in these marked zones, compared to 52.5% for their white counterpart⁶⁷. This shows that the disparity between air quality is not confined to New York City, rather, it is a national epidemic of environmental racism and the mistreatment of low-income and minority communities.

Chapter 4: Inconsistencies in Green Space Quantity and Quality: A Local Issue

There are several elements that make a city livable, including public transit access and economic factors, but arguably the most important is the presence of green space. New York City is defined by large public spaces such as the High Line and Central Park, however, New Yorkers must acknowledge and respect the small, local neighborhood parks that serve residents and visitors alike. These small parks serve as epicenters for children and adults, and are vital to make a city more livable⁶⁸. They provide space for neighbors to meet, physical activity, and social development. However, there are negative aspects that surround public green spaces. The stressors that impact the residents of the neighborhood can be divided into two categories. First, the built environment includes land-use, traffic volume, housing density. The social environment is comprised of factors including poverty, crime rates, residential cohesion. Green space can be

⁶⁷ Charon, "The Burden of Air Pollution", 501.

⁶⁸ Leicht, Holly. *Understanding Playground Utilization*. (New York University. New York City: New Yorkers For Parks, 2013), 13.

labeled as vital because it is part of the built environment, but has lasting impacts on the social environment as well. Green space can transform a community and can appear in many ways, especially in a city such as New York. The term green space can refer to parks, grass, trees along roads and walkways, and community gardens. The access to green space impacts every resident in a city, and the lack of said space can have severe impacts on both mental health and physical wellbeing of those communities. The presence of green space in a designated area has lasting impacts in several respects, including mental and physical health, air quality, and connectedness to the neighborhood.

The presence of green space in a community also has an impact on the physical wellbeing of the residents. To begin, nitrogen dioxide is a main contributor to urban air pollution, along with carbon monoxide. These two gases are considered fossil fuels and can come from a variety of sources, but most important in a city is from motor vehicle exhaust. As discussed earlier, the presence of vehicle emissions increases local air pollution. The levels of air pollution in an urban environment can be combated by increasing green space because plants absorb nitrogen dioxide to be used in photosynthesis, or the creation and introduction of oxygen into the atmosphere. Thus, it can be concluded that high levels of green space in a community will be linked to decreased levels of air pollution because the plants will absorb the toxic chemicals and use them to create an essential element to all beings; oxygen. As predicted, the study concludes that the percent of grass in a neighborhood is strongly negatively correlated with nitrogen dioxide⁶⁹. Additionally, nitrogen dioxide was weakly positively correlated with income, consistent with other literature provided in this analysis.

⁶⁹ Reid, Colleen, et. al., "Is All Urban Green Space the Same? A Comparison of the Health Benefits of Trees and Grass in New York City.", (2017), 6.

Access to nature and spending time outdoors is intuitively linked with mental wellbeing, and in cities this access is limited to green space. Countless sources agree that potential health benefits, such as decreased mortality, better mental health, fewer adverse birth outcomes, and lower obesity rates are associated with living near green space⁷⁰. For example, the odds of hospitalization are 37 percent lower among adults with a high percentage of greenness around their home, when compared to those with significantly lower levels⁷¹. Higher tree density within 1,000 meters was associated with residents reporting ‘very good’ or ‘excellent’ health. This suggests that trees and grass influence resident’s self-reported health conditions. In the same study, it found that as the number of parks within the neighborhood increased, the residents self-measured mental health wellbeing increased significantly. Among the benefits to green space are lower obesity rates, better mental health, and lower crime rates.

Evidence consistently suggests a relationship between green space and higher levels of physical activity and better mental health⁷². A significant study conducted worked to study the relationship between green space and how it can predict obesity rates in preschool aged children in New York City. This study chose to use preschool children because their young age will make them more responsive to the elements home environment, while older children have the ability to take advantage of facilities out of their home neighborhood. The data used in the study was taken from the 2004 New York Census to determine the height, weight, ZIP code, and other determining factors that were used in this study. The study used 11,562 between ages 3-5 living in 160 different residential ZIP codes in the surrounding New York area. The study worked to determine a link

⁷⁰ Reid, “Is All Urban Green Space the Same?”, 2.

⁷¹ Wood, Lisa, “Public Green Spaces and Positive Mental Health—Investigating the Relationship between Access, Quantity and Types of Parks and Mental Wellbeing”, (November 2017), 6.

⁷² Gert-Jan, Vanaken, “Impact of Green Space Exposure on Children’s and Adolescents’ Mental Health: A Systematic Review.” (2018), 12

between the level of tree density and obesity rates in children in order to conclude that green space improves the overall health of neighboring populations. Trees were chosen for the study because they play a major role in providing shade and encouraging spending time outdoors despite the weather.

The study concluded that the neighborhood street tree density is directly associated with lower obesity prevalence. The difference in street tree density from the 25th to the 75th percentile can be linked with a 12 percent lower likelihood of obesity. This means that communities that have higher levels of green space, even if it is simply trees planted along a roadway, are less likely to have health problems that affect the children, such as obesity and a lower quality of life. Increasing green space and decreasing grey area will allow for an increased health record and improved quality of life from a very young age, as cited by this study.

Although green space has been linked to various health benefits, the impact on children is particularly important because the introduction of green space and persisting health impacts will impact their decisions as adults. Mental health problems in children puts a significant burden on these individuals, and their families. Access to green space has also been linked to improved mental health in children and adolescents. Evidence suggests that there is beneficial association between green space exposure and children's emotional and behavioral issues, especially hyperactivity and inattention problems⁷³. Thus, when children are introduced to green space, this can improve mental disabilities that will impact other realms of their lives, such as their academic performance and social life. Additionally, studies have suggested a beneficial association between mental wellbeing in young adults and adolescents suffering from depressive symptoms.

⁷³ Gert-Jan, "Impact of Green Space Exposure", 1.

Additionally, higher quantities of green space allow neighbors to create a community within their neighborhood. Social interactions that take place in these urban areas can be both incidental, such as casual conversation, walking dogs, adults and children congregated in a playground, or more planned, such as picnics among friends and walks with family⁷⁴. These green spaces act as a welcoming environment to forge new connections with neighbors and enhance the social cohesion of the community. This social cohesion leads to a protective factor of mental wellbeing, where individuals can feel safer in their neighborhood and feel a sense of community among those they live with. For children, time spent among playing in the green space, as opposed to the availability of green spaces, was associated with fewer problems with peers.

An important additional aspect is how high crime rates can be linked to higher obesity rates in New York City neighborhoods. The idea revolves around the prediction that areas with less green space will have higher crime because there is decreased levels of citizens spending time outdoors and less community development. This translates to higher obesity rates because parents are less likely to allow their children to play outside, in the limited amount of green space, when there is a higher crime rate. This study used homicide rate as a determinant of crime level because these rates would be a strong factor in the safety profile of a community⁷⁵. The study found that among preschool low-income families, neighborhood homicide rates were associated with higher obesity rates. A specific neighborhoods socioeconomic disadvantage measured by using percent poverty was directly linked to a higher BMI score and a higher risk of obesity compared to other neighborhoods⁷⁶.

⁷⁴ Wood, "Public Green Space", 62.

⁷⁵ Wood, "Public Green Space", 190.

⁷⁶ Lovasi, Gina, et. al., "Neighborhood Safety and Green Space as Predictors of Obesity among Preschool Children from Low-Income Families in New York City" (September, 2013), 190

Although the introduction of green space is universally agreed to improve the wellbeing of communities, it has been addressed the quantity and quality of parks do matter. The overall count of parks in proximity to a certain neighborhood is associated with positive mental health, where every additional park in a neighborhood sees an increase in mental wellbeing. These findings are supported by the idea that people seek out public green space to spend time with children and fellow neighbors, but it can also act as a ‘pass by’ area and induce restorative mental health benefits. Unfortunately, New York City falls behind other American cities when it comes to providing green spaces and playgrounds. Amongst the 100 largest cities in the United States, New York ranks a low 48th in playgrounds per capita. In total, there are about 2,060 public playgrounds in the five boroughs, managed by a variety of government entities such as New York City Department of Parks and Recreation, New York City Housing Authority, and the Department of Education. As a borough, Brooklyn is the most underserved, with only eight playgrounds for every 10,000 children under the age of ten, compared to Manhattan’s fifteen and Staten Island’s eleven⁷⁷.

The size, quality, and number of playgrounds varies dramatically from neighborhood to neighborhood throughout the five boroughs. While some communities enjoy the luxury of dozens of playgrounds within walking distance from their homes, others must travel a significant distance to reach their destination. In New York City, there are fewer than five playgrounds per 10,000 children in eight districts: Crown Heights South, Prospect Lefferts, Flatbush and Midwood, Bensonhurst, Borough Park, Jackson Heights, Woodhaven, and Richmond Hill⁷⁸.

The city of New York blames the immense underserved neighborhoods to the failure to anticipate and prepare for the increasing population and changing demographics of the city. For

⁷⁷ United States. Bureau of Policy and Research. New York City Comptroller. *State of Play: A New Model for NYC Playgrounds*. By Adam Forman, 4.

⁷⁸ United States, *State of Play*, 3.

example, the fifteen neighborhoods with the lowest ratio of playgrounds per children saw an increased in children by about 14 percent in recent years⁷⁹. As a comparison, the fifteen community districts with the highest ratio of playgrounds per 10,000 children saw a children population decrease of six percent. In the New York City Parks Department study, a map was created to give a visual representation of the unequal dispersal of parks throughout the five boroughs and community districts (Figure 3). On this map, it is clear the areas lacking attention from government developments. However, just the high volume of parks is not the sole factor in contributing to positive green space.

It is imperative that the playgrounds are accessible, clean, and safe. Although New York City is home to about 29,000 acres of parkland, encompassing about 17% of the city's total area, not all parks are treated the same⁸⁰. In 2018, New York City Parks Department conducted a study of the parks to determine the condition and accessibility. The study reported that 159 playgrounds were 'unacceptable'. The inspectors found that over 500 parks had at least one hazardous feature that required immediate attention from government personnel⁸¹. These poor ratings typically coincide with the demographics and income level of the surrounding communities⁸². Again, the most concerning borough was Brooklyn, with 24 percent of all playgrounds and parks receiving the 'unacceptable' rating because of poor sanitation and a severely lacking sense of security. This was nearly triple the rate of Staten Island. The poor condition of parks and playgrounds can limit the user population and limit the potential positive health benefits that they can provide to communities. Whether due to demographic shifts and increasing populations, as New York State

⁷⁹ United States, *State of Play*, 10.

⁸⁰ De Blasio, Bill. "De Blasio Administration Launches Community Parks Initiative to Build More Equitable Park System." Bowne Playground, Queens, NY.

⁸¹ United States, *State of Play*, 8.

⁸² De Blasio, "De Blasio Administration Launches Community Parks Initiative".

believes, or the rezoning of neighborhoods, the New York City park's system is in constant flux and must be properly maintained.

In order to study the use and impact that parks have on surrounding communities, in 2009, New Yorkers for Parks partnered with New York University and studied ten parks and how residents used them, and to what extent they depend on the neighborhood playgrounds as their sole source of outdoor recreation. The study states that playground users report that playgrounds are a vital neighborhood resource, with important assets for lower-income households⁸³. Although some parks in the study are more likely to be heavily utilized than others, they are frequently used. Of those in the study, 79 percent report using their respective playground once a week. However, there are apparent disparities in specific parks and volume visitation. For example, there is a large disparity in visitor count between the busiest days for Matthew's Playground, about 235 visitors, and on the busiest day and Carmansville Playground, about 2,582 visitors (Figure 4). Despite the uneven distribution of visitors to the parks, they are all important for providing an outdoor atmosphere for the community residents.

An important aspect of the parks that was incorporated in the study was the accessibility in the respective neighborhoods. About 75 percent of the visitors walk to the playground. Additionally, 67 percent of visitors live within a 10-minute travel time of the playground. Close proximity to the playground is important because it impacts the frequency of use. Responders who travelled for more than 10 minutes to the playgrounds had lower odds of being frequent users when compared to those than travelled less than 10 minutes⁸⁴. In addition, 75 percent of those surveyed report living in the neighborhood in which the playground resides. These reports show that neighborhood parks rely heavily on local residents as their primary source of outdoor recreation.

⁸³ Leicht, *Understanding Playground*, 10.

⁸⁴ Leicht, *Understanding Playground*, 14.

The parks used in this study were most important for adults and children coming from low-income households. This can be determined by comparing the visitation frequency from different household income groups. According to the study, adults from households that earned more than \$80,000 per year are half as likely as those reporting their frequent use of neighborhood playground when compared to adults from households that earned \$20,000 or less per year⁸⁵. Additionally, when compared to the lowest-earning income families, those earning more than \$60,000 per year had lower odds of stating that their public neighborhood playground was the main place of outdoor recreation for their child. Thus, the public neighborhood playgrounds are vital resources for low-income families because of the high frequency of visitation and limited options for outdoor recreation.

The disparity in the funding and overall quality of parks was brought to the attention of local government. In 2014, the New York City's mayor's office launched Community Parks Initiative, or CPI, that was aimed to improve the historically under-funded parks that are typically located in high density and growing neighborhoods with high concentrations of low-income families. The initiative has an initial investment of \$130 million, with \$110 million coming from the mayoral capital budget and \$20 million from the city council of borough presidents. In order to determine those parks worthy of the investment, an invasive study was conducted to determine accessibility, use, and past funding of parks in New York City. The 35 parks that would be assisted under this initiative have received less than \$250,000 in funding in capital investment in the past twenty years. They are in high density neighborhoods, with reported high levels of potential children population growth in coming years.

⁸⁵ Leicht, *Understanding Playground*, 11.

As stated earlier, it is clear that parks are an important addition to outdoor recreation for many, most specifically low- income families because of limited alternatives. This initiative marks the first of its kind that is geared towards park and green space equity. The parks commissioner Mitchell J. Silver, states the benefits of the program:

For health, for relaxation, and for happiness, great neighborhoods need the great neighborhood spaces the Community Parks Initiative creates. This is why CPI is not only an investment in parks-- it is an investment in the wellbeing of millions of New Yorkers for generations to come⁸⁶

The improvement of green spaces and public playgrounds will have profound positive effects on the city and the neighborhoods. By increasing green spaces in vulnerable and at-risk communities, this will provide profound impacts on health and physical well-being. As reported, the presence of green space serves to reduce air pollution, childhood obesity, and can be linked to increased overall health of the community. New York City has acknowledged the limited public playgrounds and green spaces because of unfair dispersion of funds, however, initiatives have been implemented in order to increase the quality and quantity of parks in underserved areas.

Chapter 5: Solutions to an Unsolvable Issue: The Introduction of Green Roofs

In order to address the issues of high asthma rates and increased negative health consequences in areas of low-income and high-minority populations, the link between these consequences and the general lack of green spaces and public playgrounds must be acknowledged. Increasing the amount of green space in any urban environment has innumerable positive effects on the surrounding community. The basis of green infrastructure is to strategically plan and manage greenways, such as parks, trees, and working lands, in order to maintain the natural

⁸⁶ De Blasio, “De Blasio Administration Launches Community Parks Initiative”.

ecological cycle of the ecosystem by sustaining air and water quality and contributing to the overall quality of life of an urban area⁸⁷. It includes a system of management practices, such as green roofs, trees, and rain gardens that can capture and filter rain. It is generally accepted through all platforms that the presence of natural vegetation in urban areas reduce air contaminant levels, and the overall quality of air and life in a city⁸⁸. Green infrastructure has been used in urban planning because of the large number of benefits, which can be broken down into three categories: environmental, economic, and social.

Environmental benefits of increasing green infrastructure include reducing the amount of storm runoff, reducing the heat island effect, and improving air and water quality. These benefits are a result of the presence of green in an urban environment because it is an essential part of any ecosystem, and urban areas have removed greenness to make space for the built environment⁸⁹. Economic benefits include increase property value near trees and greenways and increased sales along green corridors. By increasing the amount of greenness in a city, the property value of the residential and commercial sites will increase because of the added benefits it provides to the community. These added benefits are the social gains that come with the increase of green infrastructure. These include reduced mental and physical stress, improved health for nearby neighbors, promotion of social interaction, and promotion of environmental education. The benefits of increasing green infrastructure in a city are endless and provide evidence as to why urban areas should consider these options.

⁸⁷ Kim, Jinki, "Exploring Green Infrastructure Benefits at House and Neighborhood Scale: Case Study of Illinois, USA." (*Landscape & Ecological Engineering*, 2018),165.

⁸⁸ Currie, Beth Anne, "Estimates of Air Pollution Mitigation with Green Plants and Green Roofs Using the UFORE Model." (*Urban Ecosystems*, 2008), 410.

⁸⁹ Kim, "Exploring Green Infrastructure", 166.

One of the several elements of green infrastructure that has added to the overall quality and livability of the urban environment is green roofs. This is a popular addition to green infrastructure because it does not require the destruction or alteration of any important aspects of the built environment. Roofs occupy about 20 to 25 percent of urban surface area, the transformation of this space could substantially impact the local environment⁹⁰. Manhattan is about 70 percent impervious, these surfaces serve no good to the health of the city. Storm water runoff is one of the leading sources of water pollution in cities throughout the United States. By adding more green infrastructure, this would decrease water pollution because of the higher levels of permeable surfaces for rainwater to be absorbed and filtered through. One of the most effective forms of green infrastructure is green roofs. A recent study indicates that introducing green roofs to an urban area increase air pollution mitigation, with a more significant impact than street level trees and shrubs⁹¹. Thus, the possible addition of green roofs to New York City would have a handful of health and ecological benefits to the surrounding neighborhoods.

There are two types of green roofs, and both provide a specific benefit to the neighboring urban area. The first type is extensive, often defined by the lightweight and thin layer of soil (less than fifteen centimeters), that typically consist of drought-resistant plants in order to minimize weight, costs, and overall maintenance. Although these do not require a large quantity of work, they still provide benefits to the neighborhood. The second type is an intensive green roof, which are heavier and designed to support grass, flowers, shrubs, trees, and even crops. This type of green roof is more expensive to install and maintain because of the required irrigation system⁹². In addition, there are a rigorous and long set of structural demands necessary to begin construction

⁹⁰ Spiegel-Feld, Danielle, and Lauren Sherman. "Expanding Green Roofs in New York City: Towards a Location-Specific Tax Incentive." *New York University Environmental Law Journal*, 2017, 198.

⁹¹ Currie, "Estimates of Air Pollution", 410.

⁹² Spiegel-Feld, "Expanding Green Roofs", 302.

on intensive green roofs because of the heavy weight. For this reason, extensive green roofs are more common because of their affordability and accessibility.

One of the most common benefits of a green roof addition is the reduction of energy consumption. The addition of green roofs will assist in advancing the climate change mitigation goals by reducing the amount of fossil fuels released by the metropolitan area. Green roofs help reduce energy consumption during both hot and cold seasons. First, in hot summer months, the natural cooling process will reduce the heat transfer from the roof to the interior of the building, therefore decreasing the cooling needs. In cold weather, green roofs serve as an extra layer of insulation, which maintains the buildings warm internal temperatures and reducing the demand of heat⁹³. The natural effects the urban green roofs provide help to dramatically reduce the amount of fossil fuels produced in New York City. This is particularly important because about 75 percent of the city's greenhouse gas emissions are from building energy consumption, and nearly half of energy consumed in buildings is used from the heating and cooling systems.

In addition, green roofs can help to reduce the heat island effect, which is a direct result of high levels of impervious surfaces in an urban environment. Dark paved surfaces, such as asphalt and concrete, absorb thermal radiation, which creates an oven-like effect during the hot summer months. This in turn raises the ambient temperatures in the surrounding urban area. Due to this phenomenon, the heat island effect, "the daily minimum temperature is an average of seven degrees Fahrenheit warmer in New York City than in surrounding suburban areas during the summer"⁹⁴. Any additional benefit to green roofs is the reduction of noise pollution. The vegetation on top of buildings has natural insulating properties that specifically benefit the urban environment from noise pollution from traffic, airplanes, construction, and countless others.

⁹³ Spiegel-Feld, "Expanding Green Roofs", 309.

⁹⁴ Spiegel-Feld, "Expanding Green Roofs", 311.

The introduction of green roofs has an abundant number of positive benefits to the city. Most importantly, it can promote environmental justice when deployed in specific areas that lack access to green space. As mentioned, the lack of green space in the urban environment is disproportionately carried as a burden by low-income minority families. Thus, these families suffer medical and physical consequences because of inadequate access to public green space. The introduction of green roofs in at-risk neighborhoods would help to alleviate aspects of the built environment that cannot be changed. For example, these neighborhoods are at a higher risk from exposure to high levels of air pollution because of the placement of bus depots and waste transfer stations. By adding green roofs, they would work to ameliorate the high levels of air pollution per photosynthesis, converting these noxious gases into oxygen⁹⁵. Another element of the built environment that is force upon the low-income minority families is the placement of airports. In addition to the bus depots and waste transfer stations, these large facilities cause increased noise pollution. The introduction of green roofs would reduce the level of noise in these areas, working to create a healthier and happier environment for these communities. Lastly, the reduction of heat and cooling needs would help to make homes more comfortable during the extreme temperatures of the winter and summer. The insulation and cooling properties of a green roof would serve to force electricity bills to remain low, allowing these families to allocate their income towards other outputs.

The introduction of green roofs serves to accelerate a city in terms of increasing the quality of air and water, and thus improving the lives of the residents. Most importantly, the green roofs would help mitigate instances of environmental injustice that have been proposed throughout this report. However, although green infrastructure has increase open space, enhanced the built

⁹⁵ Spiegel-Feld, "Expanding Green Roofs", 311.

environment improved water quality, and provided an educational opportunity for the community, the initial costs of construction and management are a severely limiting factor. New York City began the large task of working to encourage the presence of green roofs in the city. In 2008, Mayor Michael Bloomberg secured legislation from the New York State that would offer a property tax abatement to individuals in the five boroughs who install green roofs on their buildings. As of 2016, only seven property owners have applied for abatement in the eight years since the legislation had been passed⁹⁶. This failure to incentivize property owners to install green roofs is no shock, as there the initial cost of construction and maintenance is often too high to overcome. The abatement provided by the state does not appear to be enough to offset the cost of building a green roof.

As such, there are few solutions to encourage property owners to confront the cost of construction and recognize the importance of a green roof, particularly in vulnerable neighborhoods. However, there are other ways that green infrastructure could be implemented into the city. New York City can address the vast disparity in availability and conditions of public playgrounds and parks throughout the five boroughs. By taking a more thoughtful and targeted approach to building and maintaining playgrounds, the city can find ways to create equality through the five boroughs, and more importantly, between high and low income neighborhoods. One method the city can do is to engage relevant nonprofits in the planning and funding of these playgrounds. Although the local and state funding is tight, by working with these nonprofits, they can hear the needs and demands of residents while creating a funding source for improvement and construction projects⁹⁷. Although the city has made considerable improvements in the cleanliness and safety of parks over the past several decades, there is still a significant of parks in dangerous

⁹⁶ Spiegel-Feld, "Expanding Green Roofs", 311.

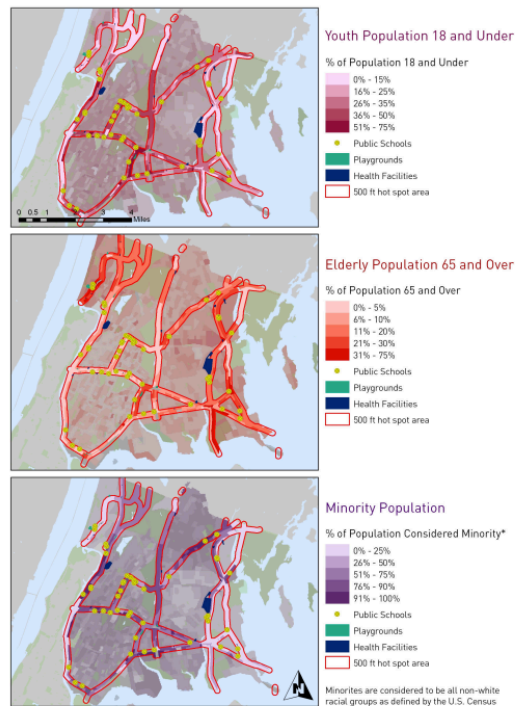
⁹⁷ United States, *State of Play*, 16.

conditions. By locating at risk communities and identifying potential plots of land to build a public park or playground, this would create a center of community in these at-risk neighborhoods.

Appendix:

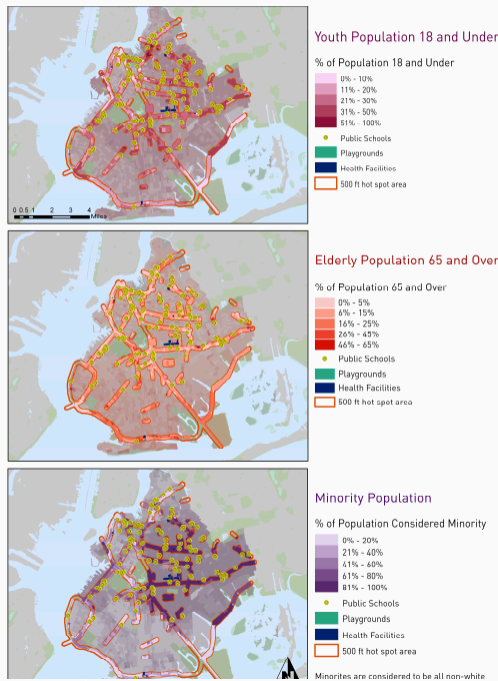
The Health Risk from Congestion in the Bronx

At-risk populations falling within 500 ft of the borough's congested roadways



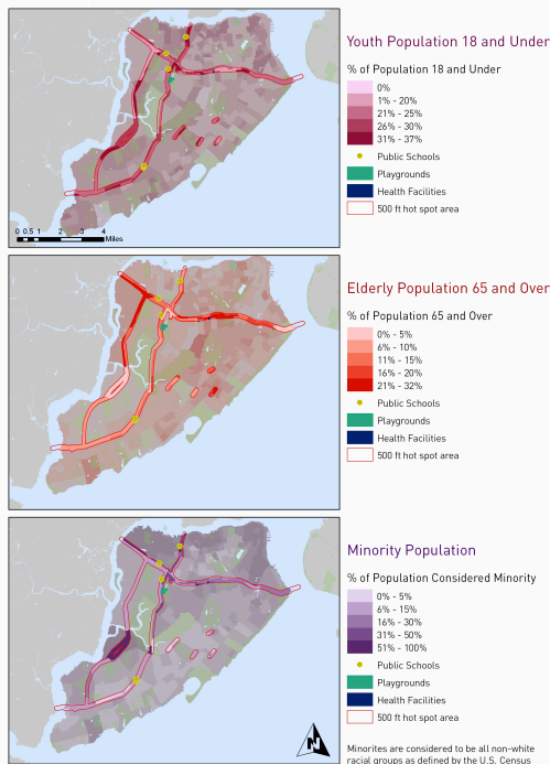
The Health Risk from Congestion in Brooklyn

At-risk populations falling within 500 ft of the borough's congested roadways



The Health Risk from Congestion in Staten Island

At-risk populations falling within 500 ft of the borough's congested roadways



The Health Risk from Congestion in Queens

At-risk populations falling within 500 ft of the borough's congested roadways

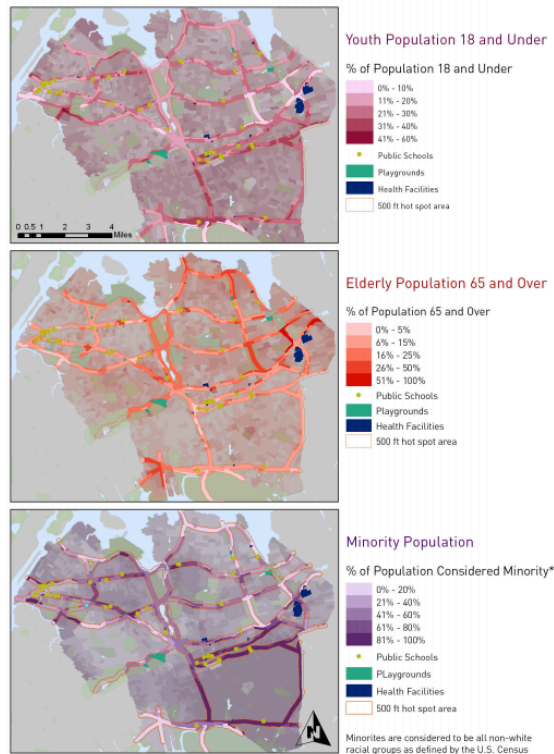
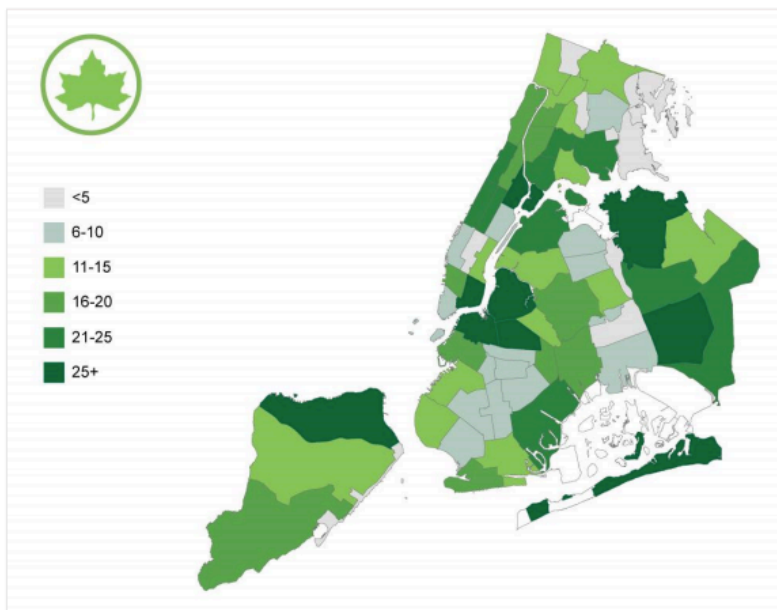


Figure 1



Figure 2

Chart 4: Total number of NYC Parks playgrounds, by Community District



NYC OpenData. "Parks Inspection Program – All Sites."

Figure 3

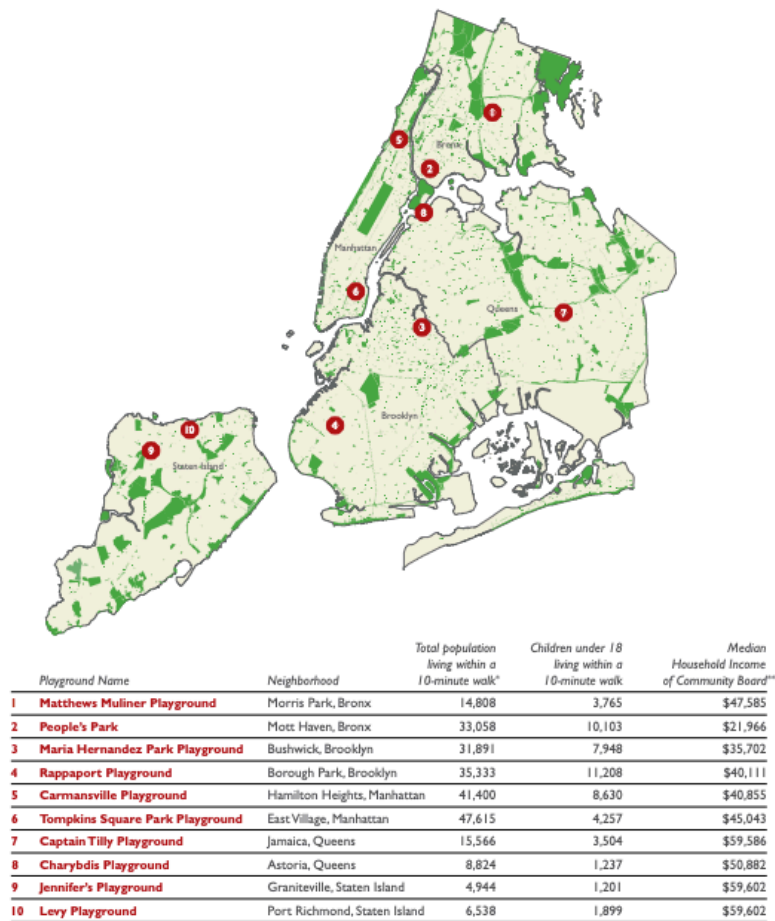


Table 3: Characteristics of adults in playground survey (n=1,627)

Sex	
Female	65%
Male	35%

Race/Ethnicity	
Black	17%
White	32%
Hispanic	38%
Asian	8%
Other	5%

Household Income	
\$0-\$20,000	26%
\$20,001-\$40,000	24%
\$40,001-\$60,000	18%
\$60,001-\$80,000	14%
>\$80,000	18%

Age	
18-25	15%
26-35	37%
36-45	30%
46+	19%

Totals may exceed 100% due to rounding

Source: "Measuring Playground Utilization in New York City: Description of Study Methods. A Report to New Yorkers for Parks." Diana Silver, Maggie Giorgio, and Tod Mijanovich, December 28, 2011.

Figure 4

*We estimate a 10-minute walk by measuring a 1/2-mile journey from park entrances along city sidewalks using GIS mapping software. The total population and youth population living within the buffer zone were obtained from the 2010 U.S. Decennial Census, SFI.

**2010 U.S. Decennial Census Median Household Income estimates for the New York Community Board in which the playground resides. Source: <http://infoshare.org>.

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