

**Does Access Imply Usability? Evaluating Social and Physical Barriers to Park Access and Usability within Atlanta, Georgia**

by

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A thesis submitted to the Graduate Faculty of  
Auburn University  
in partial fulfillment of the  
requirements for the Degree of  
Master of Science in Geosciences

Auburn, Alabama

May 3<sup>rd</sup>, 2024

Keywords: Parks, Access, Usability, Green Infrastructure, Mixed methods

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## **Abstract**

The mere existence of green spaces doesn't guarantee their usage, and access to them isn't solely dependent on their proximity. This study investigates park use in Atlanta, Georgia with a focus on understanding how park accessibility and usability as well as green infrastructure implementation impact overall park use. Four parks in Atlanta were selected for this study and represented diverse urban characteristics as well as socioeconomically distinct block groups. A mixed-methods comparative case study analysis, including in-situ observations, user surveys, and geospatial analysis was employed to assess contributions and barriers of both usability and accessibility. Findings from this study indicate that parks in low-income and minority neighborhoods face more challenges to park usability while parks located in higher-income areas with well-maintained green infrastructure have increased usability and accessibility. As urban areas, like Atlanta, Georgia begin to implement additional sustainable measures to combat the effects of the urban heat island, addressing barriers to park usability within urban parks becomes essential. Findings from this study highlight the importance of creating inclusive and enjoyable green spaces for all communities.

## **Acknowledgments**

I am immensely grateful to my family for their unwavering support throughout my academic journey. To my brothers and my mom, your constant encouragement, belief in me, and sacrifices have been the cornerstone of my success. Your love and support have been the driving force behind my accomplishments. To my dear friends, your support and encouragement have meant the world to me. Through the ups and downs of this journey, your presence has been a source of strength and inspiration. I am incredibly fortunate to have so many friends who feel like family to me. I also extend my heartfelt thanks to the community of friends I have built here. Your camaraderie, companionship, and willingness to spend countless late nights and early mornings with me have made this journey not only bearable but also memorable. A special mention goes to my beloved cat, Princess. Your comforting presence and unconditional love have been a source of solace during the stressful times of graduate school. Your purrs and playful antics have lifted my spirits and provided a much-needed respite from academic challenges. Finally, I would like to express my deepest gratitude to my advisor, Dr. Jake Nelson. Your guidance, mentorship, and patience have been invaluable to me. Beyond your expertise in the field, your jokes and understanding have lightened the load and made the academic journey enjoyable. Thank you all for believing in me.

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## **List of Abbreviations**

OFW      Old Fourth Ward Park

UHI      Urban Heat Island

## 1. Introduction

In Atlanta, Georgia, a city known for its vibrant culture and rapid urban development, a staggering 17.7% of the population lives below the poverty line<sup>1</sup>. Simultaneously, the city grapples with rising temperatures and increased frequency of heat waves, which contribute to environmental challenges like the urban heat island (UHI) effect<sup>2,3,4</sup>. The urban heat island effect intensifies the heat experienced in densely populated urban areas and often disproportionately impacts vulnerable communities (Figure 1)<sup>2,3</sup>. Temperatures in Atlanta have been recorded to reach up to 10 degrees hotter than in surrounding areas, resulting in unique weather patterns within the city that include thunderstorms and severe smog<sup>3</sup>. The dark, heat-absorbing materials commonly used for city roads and roofing in Atlanta amplify the UHI effect during a heat wave<sup>3</sup>. A recent study conducted in 2022 have documented a correlation between the hottest areas of the city and the most economically vulnerable<sup>3</sup>.

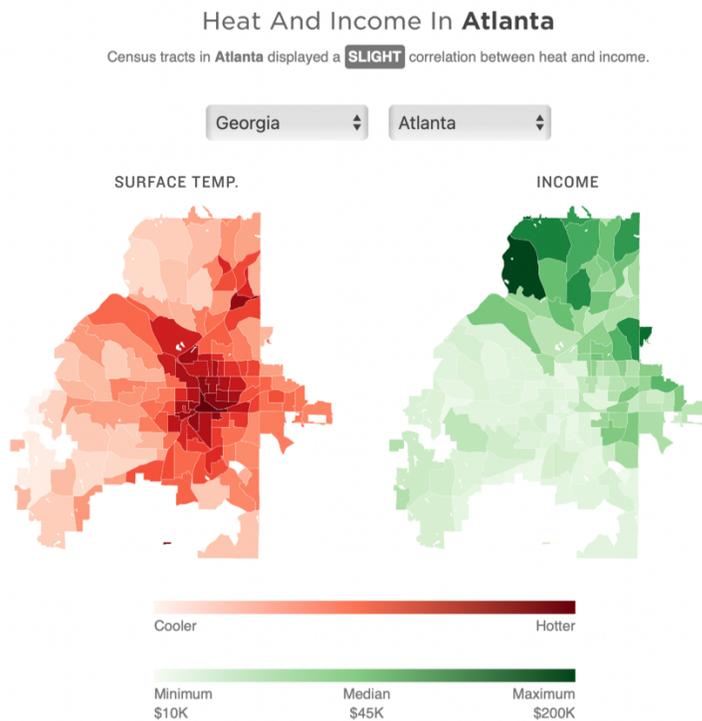


Figure 1 Census tracts and surface temperature within Atlanta, Georgia obtained from NPR<sup>3</sup>

Amidst these intertwined social and environmental challenges, sustainability practices such as the implementation of green infrastructure and the provision of green spaces have been promoted as a remedy. Sustainable urbanism practices are implemented at global, regional, and local scales. At the global scale, international initiatives like the United Nations Sustainable Development Goal 11, which advocates for “making cities safe, resilient, and sustainable,” underscore the significance of addressing urban and rural issues on a global scale<sup>5</sup>. This global perspective emphasizes the need for sustainable urban practices, particularly in the face of

challenges such as climate change, biodiversity loss, and social inequalities<sup>5</sup>. However, the realization of such global goals often falls within the purview of local planning entities, particularly in the United States, where national guidelines for sustainability practices are limited<sup>3</sup>. The responsibility for decision-making in crucial areas like land use planning, urban greenspaces, infrastructure, and public safety rests largely on local planning entities<sup>3</sup>. This decentralized approach leads to discrepancies in the implementation of sustainability practices such as green infrastructure which neglects demands tailored to specific needs and challenges faced by individual communities. International directives for this reason offer insights into how global sustainability goals can be translated into tangible benefits for communities at a community-led level<sup>5,6</sup>.

Greenspace is defined by the Environmental Protection Agency (EPA) as an open space that is accessible to the public with no buildings or structures and includes elements of grass, trees, shrubs, as well as other forms of vegetation<sup>3</sup>. Examples include community gardens, parks, green streets, and even cemeteries. Greenspaces provide a multitude of benefits for mediating the effects of climate change by increasing air and water quality, enhancing biodiversity, reducing noise levels, and lessening the impact of urban heat islands<sup>5,6</sup>. There are also social benefits that greenspaces bestow on their proximal environment such as community cohesion through social gatherings and interactions which strengthens a sense of belonging as well as community bonds<sup>6</sup>. In metropolitan areas, urban and community parks may be the only form of greenspace<sup>3,6,7</sup>, providing recreational opportunities for community members that are directly linked to better physical and mental well-being<sup>8,9,10</sup>.

For urban areas, parks emerge as crucial greenspace components that contribute to a sustainable, resilient, and equitable cityscape. Urban parks not only provide accessible greenspaces for residents but also serve as vital tools in mitigating the effects of climate change and the urban heat island<sup>10,11,12</sup>. Strategically placed parks contribute to cooler microenvironments, reducing overall temperatures in the city<sup>11</sup>. They offer physical and mental health benefits but also foster social cohesion, providing spaces for community engagement, cultural events, and recreational activities<sup>9,10</sup>.

Access to and use of public urban parks refers to the ease with which individuals can reach and use them<sup>10</sup>. However, access and use are conceptually different. Greenspace *access*, specifically urban park accessibility, encompasses a variety of factors, including proximity to residential areas, availability of ADA-compliant and convenient pathways, and the absence of physical or social barriers that prevent or diminish the enjoyment and benefits of parks<sup>10,12</sup>. Physical barriers to access include limited parking, non-ADA compliant sidewalks, and blocking off of park areas<sup>10,11,12</sup>. Social barriers that impact park access include lack of signs near or at the park, and vacant and unfavorable buildings near or directly adjacent<sup>9</sup>. To that end, not all parks are equally accessible. Equal access to parks requires equity considerations that ensure all members of a community, regardless of socioeconomic status, race, ethnicity, age, or ability, have equal opportunities to access and enjoy the recreational, health, and environmental benefits of parks<sup>10</sup>. In some cases, access and use of parks are arranged along socio-demographic factors such

that higher-income, predominately white areas often have better access. Although there is some indication that accessibility is becoming more equal, there is limited research focused on the *usability* of accessible parks<sup>10,12</sup>.

Park *usability* refers to how individuals and communities can effectively and comfortably utilize and engage with parks and green spaces<sup>10</sup>. It encompasses factors such as the design, amenities, maintenance, safety, and inclusivity of parks that contribute to a positive user experience<sup>10</sup>. Park usability is closely linked to environmental justice, which emphasizes the fair distribution of environmental benefits and the involvement of marginalized communities in decision-making processes. Even if a park is accessible, social and physical barriers can prevent communities from fully utilizing the park and its benefits<sup>9,10,13</sup>. For example, social barriers that impede the usability of parks may be the presence of vandalism or evidence of drug or alcohol use in the park, while physical barriers may be unmaintained facilities. Moreover, residents in urban areas are often mismatched with parks they do not want or use, which poses another social challenge<sup>12</sup>. A mismatch occurs when the amenities provided in the park do not align with the needs, preferences, and characteristics of the local community<sup>12</sup>. This mismatch can occur due to inadequate community engagement during the planning and design phases, budget constraints, changing demographics of the local neighborhood, limited maintenance, and insufficient data and research on the surrounding community<sup>11,14</sup>. The reasoning behind these challenges is complex and involves racially charged histories of land use, zoning practices, and redlining<sup>15</sup>.

Green infrastructure integrates natural and sustainable elements within park design by incorporating ecological features, sustainable infrastructure, and functional landscapes to enhance the environmental benefits of the park<sup>16</sup>. Green infrastructure plays a crucial role in enhancing park usability by managing stormwater, enhancing biodiversity, and providing diverse recreational activities, natural amenities, social gathering spaces, as well as health benefits. It also contributes to the overall sustainability and resilience of urban environments<sup>16</sup>. Parks with green infrastructure features, such as permeable pavements, green walls, bioswales, solar panels, tree canopies, native plantings, and pollinator gardens, can help mitigate the effects of climate change and enhance environmental quality, making the parks more enjoyable for users<sup>14</sup>. By incorporating green infrastructure into park design and management, communities can create multifunctional spaces that provide recreational opportunities and bestow positive benefits to the surrounding community such as enhanced resilience, improved public health, and overall sustainability<sup>14,16,17</sup>.

### *1.1 Objectives*

Urban parks make cities more vibrant – yet the access and use of these parks is not always equal. In fact, ensuring equal access to and usability of parks remains a critical challenge. Disparities in the spatial distribution of parks, along with other attributes that would prevent one from taking advantage of it, often impact communities of color and low-income populations by limiting their ability to partake in all the benefits that parks provide<sup>9,10,13</sup>. While park access has emerged as a compelling environmental justice concern, many studies have focused on either the dimensions of park access or usability while overlooking their interconnected nature. This study

aims to address this gap by considering accessibility and usability as related, but conceptually distinct, to further assess potential disparities in park use.

This study investigates the interconnected issues of park accessibility and the physical and social barriers that hinder the usability of urban parks in Atlanta, Georgia. Through a comprehensive exploration of quantitative and qualitative methodologies, as well as an emphasis on the pivotal role of green infrastructure, this research seeks to provide insights into fostering inclusive and resilient urban communities. This work will address the following research questions:

**Research Question 1:** How does park use change within communities in Atlanta, Georgia when considering both the accessibility and usability of such spaces?

**Hypothesis 1:** *Parks within high socioeconomically disadvantaged block groups will have equitable access to parks but more physical and social barriers to usability, directly impeding their use.*

**Research Question 2:** How has the implementation of green infrastructure within these selected community parks impacted the park's usability?

**Hypothesis 2:** *The implementation of green infrastructure within urban green space within selected community parks increases both usability and accessibility of parks.*

## 2. Literature Review

### 2.1 Park Use

#### 2.1.1 The distinction between Accessibility and Usability

Park use is a critical aspect of the overall park experience as it reflects the park's effectiveness in meeting the recreational and social needs of the community it serves<sup>10,12</sup>. Park use patterns are multi-dimensional and are impacted by two important concepts – accessibility and usability – which are both critical for determining the overall level of park use<sup>9,10,13</sup>. Park usability and park accessibility are two distinct but related concepts<sup>10</sup> (Figure 2). Socioeconomic factors such as race, income level, and transportation access directly impact park accessibility therefore impacting the usability of the park<sup>9</sup>. A park's usability is influenced by the park's quality and by the presence or absence of amenities. Both usability and accessibility influence park use, which is the engagement between the park and parkgoers (Figure 2). While park accessibility is extrinsic to parks and focuses on ensuring that parks are physically and logistically accessible to all individuals through features such as proximity to bus stops, parking lots, walkability, and overall spatial distribution; park usability is intrinsic to the park explores the degree to which a park meets the needs and preferences of its users<sup>18</sup>.

Generally speaking, park access and usability are often stratified along socio-demographic lines such as income, race, age, and gender, which pose challenges as well as opportunities for cities as they tackle sustainability, environmental quality, and social inequities<sup>10</sup>. Communities of color and low-income populations are especially likely to live in park-poor neighborhoods, isolating them from the services parks provide<sup>16</sup>. Many recognize the importance of considering park accessibility and usability together when seeking to disentangle the environmental, social, and infrastructural components that drive park use; however, the integration of the two can present several challenges, such as developing standardized accessibility metrics, temporal considerations, and usability criteria<sup>11</sup>.

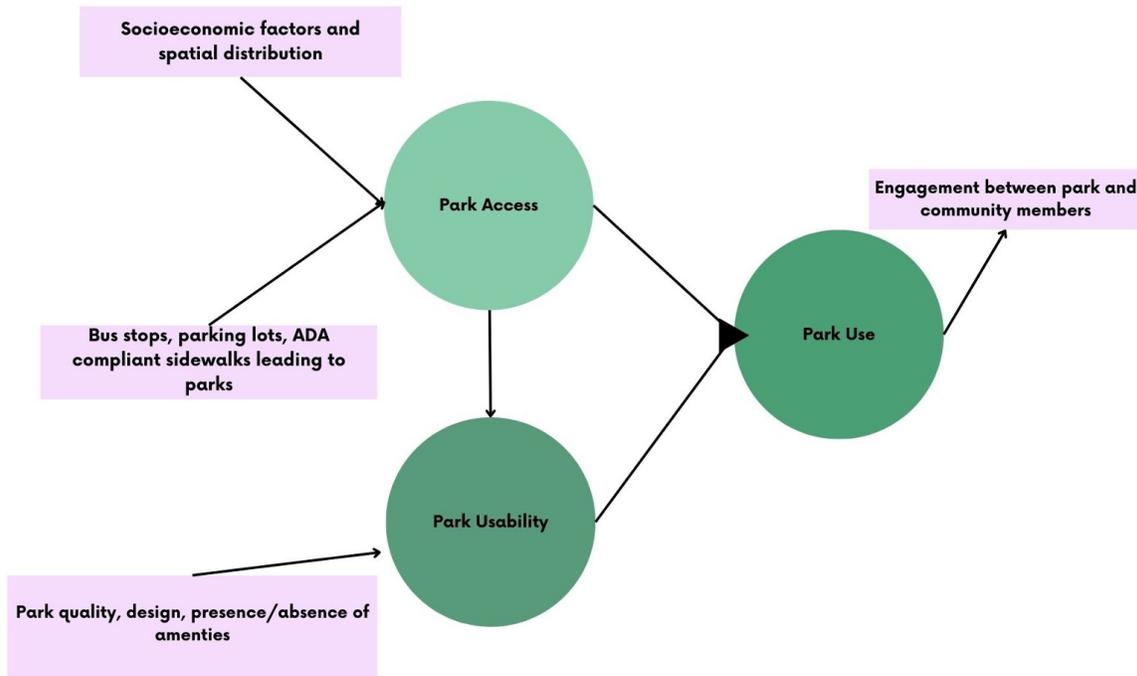


Figure 2 Conceptual model illustrating the relationship of accessibility and usability to park use

### 2.1.2 Accessibility

Studying park accessibility provides valuable insights into the distribution and availability of green spaces. Park accessibility is a complex issue influenced by various socioeconomic factors, historical racial inequities such as redlining, and community engagement<sup>9,10,13,15</sup>. Research surrounding park accessibility has identified disparities in the distribution of parks among different neighborhoods and demographic groups<sup>10,15</sup> while highlighting areas lacking adequate green spaces. Prior research also provides evidence for policymakers and green space advocates to promote more equitable access to parks and reduce environmental injustices<sup>15</sup>.

Varied criteria and methodologies to measure park accessibility are present in the literature, leading to a lack of consensus on the most appropriate approach<sup>10</sup>. Researchers measuring park accessibility tend to focus on spatial proximity, density, and or the delineation of service areas associated with a set of parks in a metropolitan region<sup>9,10,13</sup>. For example, Boone et. al.<sup>13</sup> examined

the distribution of parks in Baltimore, Maryland, from an environmental justice lens. They employed a novel park service area approach that used a quarter-mile distance threshold to identify the likely walkable area proximity, which was estimated as a five-minute trip. To determine the demographic characteristics of those with access to parks, they identified the census block groups with a population centroid within the quarter-mile buffer using Thiessen (Voronoi) polygons to delineate a service area for each park<sup>10</sup>. Their results indicated that African Americans and high-need populations have better walking access to parks but less park acreage per capita compared to white and low-need populations<sup>10</sup>. Other commonly used methods include distance-based measures, and walkability scores, but again these largely disregard measures of park usability<sup>13,24</sup>. Studying park access requires consideration of not only quantitative metrics but also the distribution of parks and amenities relative to the needs and preferences of different populations<sup>9,10,13,15,23</sup>. Therefore, consideration for park usability is needed<sup>19</sup>.

### *2.1.3 Usability*

Park usability refers to the extent to which communities can utilize and engage with parks<sup>9,10,13</sup>. It encompasses various factors that contribute to a positive user experience and emphasizes user behavior, preferences, and design elements such as pathways, seating and rest areas, playgrounds and recreational facilities, open areas, green fields, signage, natural elements, and multi-functional spaces<sup>9,10,13</sup>. It also includes the descriptive attributes of the park design and amenities such as safety, inclusivity, environmental quality, aesthetics like maintenance and cleanliness, and community engagement. Simply put, park usability depends on the quality and variety of amenities.

Users' perceptions of the park, such as park safety, influence whether people feel comfortable using a park. Factors such as lighting, maintenance, and security play an important role in this regard. User preferences can also be affected by social and cultural norms, including preferences for certain types of activities or the park's relevance to community events<sup>14</sup>. The park's layout and design can have a noticeable impact on user flow and overall engagement with different features, which can affect the overall park experience<sup>9,10</sup>. Studies that account for these types of less tangible park features are less prevalent in the literature compared to studies focusing solely on quantitative metrics for park access<sup>21,29</sup>. Researchers assessing park usability often deploy surveys, observational studies, focus groups, environmental audits, and performance metrics<sup>10,23,24</sup>.

Prioritizing park usability is essential for creating inclusive, enjoyable, and sustainable spaces that contribute to communities' physical and mental well-being while promoting equitable access. It can also highlight important but less recognizable barriers impacting the usability of parks. By identifying those barriers, unseen disparities in usability may be uncovered and insight is gained into the unique needs and preferences of various population groups.

## **2.2 Methodologies used to measure park access and usability**

### *2.2.1 Quantitative Methods*

Quantitative approaches to park access research often rely on standardized metrics and predefined variables to measure important aspects related to park use<sup>29</sup>. These include spatial analysis techniques to assess park access which include catchment area analysis, proximity measures, spatial regression analysis, and spatial autocorrelation analysis<sup>13,19</sup>. Catchment area analysis involves defining an area around the park within a specific distance or travel time. Researchers then use Geographic Information Systems (GIS) tools to determine the population or the number of households within an area with access to the park<sup>28</sup>. Proximity measures assess the distance between residential areas and specific points of interest such as public transportation stops and parks. Euclidean distance or network distance calculations can also be used to quantify proximity, with more explicit considerations of structural features such as sidewalks, pedestrian-friendly infrastructure, and transportation networks<sup>28</sup>. Spatial regression models analyze the relationship between, for example, social factors and other variables while considering the impact of spatial interactions<sup>20</sup>. Spatial autocorrelation analysis, such as Moran's I, assesses whether social factors and populations are clustered, dispersed, or random across geographic space to aid in identifying spatial patterns and potential spatial dependence related to park locations<sup>13</sup>. These metrics are useful for understanding basic accessibility in terms of geographic distance and ease of reaching parks<sup>13</sup>.

While quantitative research using proximity metrics offers valuable insights, it has limitations in capturing the complexity of the built environment, transportation networks, and spatial relationships that influence access and usability<sup>29</sup>. For example, a park's physical availability does not necessarily guarantee that it is used<sup>21,24</sup>. Other complex factors can also impact whether a park is used, such as the quality of amenities, perceived safety, social factors such as the presence of homeless persons, and park layout<sup>11</sup>. For example, Piedmont Park is an iconic park in Atlanta that offers a variety of passive and active areas for park users to engage within the park using the many high-quality amenities such as a lake with paddle boats, a botanical garden, a dog park, multiple sports fields, and paved walking trails<sup>22</sup>. Piedmont Park also has a reputation for being safe and well-patrolled during peak hours of the day<sup>25,26</sup>. The presence of uniformed security personnel, proper lighting, and visible law enforcement contribute to a sense of security, making individuals and families feel comfortable visiting the park<sup>26,27</sup>. The park's design encourages social interaction through open green spaces and picnic areas. Additionally, Piedmont Park hosts many community events, like music festivals, leading to increased park use<sup>26</sup>. These varying qualities of the park positively impact park use by increasing park usability which may be missed if only assessed through a purely quantitative lens.

Integrating park attractions or attributes into accessibility models involves considering additional qualitative and subjective elements that contribute to the overall park experience. One reason for the dearth in studies integrating park amenities or attributes into accessibility models is the subjectivity involved in quantifying these factors<sup>28</sup>. Unlike proximity metrics, which are relatively straightforward to measure using geographic data, park attributes require more comprehensive data collection, often through on-site observations, surveys, and community engagement<sup>10,23</sup>. Quantitative metrics alone may not capture the complex interaction of these

factors, which can significantly influence park use and user satisfaction<sup>23,27</sup>. To gain a more comprehensive understanding of park accessibility and usability, it is essential to complement quantitative metrics with rich qualitative data.

### 2.2.2 *Qualitative Methods*

Qualitative measurements of park use involve capturing assessments, perceptions, and experiences of the people who actively engage with or live in proximity of a park. In order to assess park's usability qualitative visual assessments, user perceptions and experiences, safety assessments and natural and environmental considerations are needed<sup>18,24</sup>. Visual assessments observe the physical condition of park amenities such as landscaping, signage, and park structures, which can provide insights into the overall park condition which can impact their usability<sup>19,20,24</sup>. User perceptions and experiences can capture how park visitors perceive and interact with the parks<sup>24</sup> while factors such as safety and security, perceived level of upkeep and maintenance, and overall status of the park can be ascertained through interviews or focus groups with park goers<sup>14</sup>. Previous studies have been used to gather unique insights on park users' feelings of safety, their observations of security measures, and any concerns or incidents related to personal safety assessments within the park environment<sup>23,24</sup>.

One way to examine the natural and environmental elements present in a park is through interviews and observational exercises<sup>14</sup>. Users' perceptions and experiences of natural features, such as trees, vegetation, water bodies, wildlife, or ecological diversity lead to insights into individual perceptions of nature which researchers believe lead to more informed decisions on park design, management, and planning<sup>14,18,22</sup>. Additionally, examining natural elements found within a park can contribute to a better understanding of environmental sustainability or the park's ability to provide a respite from urban settings<sup>16</sup>. A study by Gidlow Et. Al.<sup>18</sup> emphasizes the importance of using *in situ* audits to provide objective measures of quality because GIS indicators offer limited insights into the presence, absence, and quantity of features or facilities. Gidlow et. al.<sup>18</sup> make a critical point about the importance of *in situ* assessments in objectively capturing park features, amenities, as well as their conditions, which can be indicative of their use. While users' perceptions are valuable<sup>14</sup> they can be subjective and vary from person to person highlighting the need to combine *in situ* assessments with user feedback to enhance our understanding of park access and usability<sup>18</sup>. A systematic review of protocols for evaluating urban parks by Chen et al.<sup>22</sup> emphasizes that to achieve a better understanding of a park's usability, researchers should include both physical and non-physical, spatial and non-spatial dimensions in their assessments. Integrating qualitative and quantitative approaches can help bridge the gap between accessibility and usability research and address these challenges.

### 2.2.3 *Mixed Methods*

The mere presence of green space does not guarantee its usage and access to green space does not solely depend on geographic proximity<sup>20</sup>. It is influenced by multiple factors such as

socioeconomic and demographic status, as well as characteristics intrinsic to the greenspace such as safety and quality, as well as accessibility. All of these factors can be indicative of how and if parks and green spaces are ultimately used across urban areas<sup>20</sup>. Moreover, low-income neighborhoods and communities of color often face additional barriers such as limited transportation options, safety concerns within the park, lack of amenities, and programming that discourages park use<sup>23</sup>. Thus, there are both objective measurable aspects of accessibility and usability as well as subjective aspects and this necessitates the use of a mixed-methods lens when exploring the factors that influence park usability<sup>28</sup>. Mixed methods integrates qualitative research such as interviews and observations with traditional quantitative methodologies allowing for contextualized insights and comprehensive understanding.

Qualitative methods can uncover new dimensions of park access and usability; however, qualitative research alone lacks the statistical relationship and objective measures necessary to uncover some of the access measures that are related to the spatial characteristics of parks and any associated disparities<sup>10</sup>. On the other hand, quantitative methods permit more objective measures of park accessibility, such as the amount of greenspace available to the surrounding community or the average time it takes to reach the closest park from a given starting point. Many scholars interested in green space use agree on the need for comprehensive strategies and interventions to address park access and usability, including the combination of qualitative and quantitative methods to provide the greatest understanding of park usability and accessibility<sup>13,19,20,22,24</sup>.

A mixed methods study by Perry et. al.<sup>23</sup> used spatial analysis techniques to measure community park accessibility based on proximity to residential areas, pathways, and the distribution of parks within the community. They combined that with a qualitative park assessment using the customizable Parks for Activity and Recreation in The Community (PARCs) tool, which was developed by the University of Otago, Wellington, New Zealand, to evaluate the intrinsic characteristics of a community park. The aim of this study and development of the PARCs tool was to assess park usability, amenities, accessibility, safety, and overall quality. By integrating these two components Perry et. al.<sup>23</sup>, identified concerns related to car parking inaccessibility, poor path surfaces, play equipment access and usability, play richness, fencing, and lighting in 21 parks. In every park, these concerns related to both accessibility and usability, and the use of mixed methods provided an important lens from which to glean an in-depth understanding of the factors influencing the accessibility and usability of parks.

### ***2.3 Environmental Justice and Urban Parks***

Environmental Justice (EJ) is an important framework used to address park inequities and promote fairness in the distribution of environmental resources, including parks. EJ frameworks, specifically those involved with distributive justice, can be used to evaluate the fair distribution of environmental hazards and amenities (including urban parks) and to promote inclusive planning efforts that locate such hazards and amenities in an equitable manner<sup>24,27</sup>. In recent years, the ongoing conversation on EJ has extended from solely the natural environment and its hazards to include the built environment<sup>9,10</sup>. The built environment is an essential cornerstone in

environmental justice efforts because it encompasses everyday elements that human beings utilize, such as housing, forms of transportation, and recreational spaces<sup>9,10,13</sup>. For urban green space, EJ focuses on understanding and rectifying unequal access to parks and other forms of green space with respect to the social and demographic characteristics of communities<sup>10,13,20</sup> and the many benefits that parks provide.

Considering the direct impact of park availability and quality on communities' mental and physical well-being, park planning must prioritize equity, which ensures public access for all, regardless of race, location, and socioeconomic background<sup>12,31</sup>. Numerous studies have explored park-community relationships through an EJ lens by analyzing disparities in access, amenities, maintenance, and programming<sup>10,20,22</sup>. Many of these studies focus on neighborhood-level inequities, often revealing that low-income and minority communities do have equitable *access* to parks, but wealthier white communities enjoy advantages in terms of park amenities, quality, maintenance, and safety<sup>9,10,12,13</sup>. In other words, there is an important distinction between those who can access a park and those that can use the park they are able to access. The underlying social and systemic factors contributing to these disparities include historical disinvestment in marginalized communities, discriminatory land-use practices, and gentrification processes<sup>20,32</sup>.

One primary example of research investigating disparities in urban park systems' quality is exemplified in the work of Rigolon, Browning, and Jennings<sup>20</sup>, who employed a quantitative research approach to investigate disparities in the quality of urban park systems across cities in the United States. Utilizing the park score index created by the Trust for Public Land<sup>21</sup> the researchers statistically analyzed relationships between demographic variables (such as income, race, and ethnicity) and the quality of urban park systems. They found that cities with higher median incomes and lower percentages of Latino and Black residents had higher park quality than other cities<sup>20,21</sup>. The study underlines the relationship between social and economic factors that shape these disparities, which point to a history of disinvestment in marginalized communities and system inequities<sup>20</sup> while highlighting the importance of using quantitative and qualitative measures of park access and use as a crucial environmental justice aspect<sup>22</sup>.

## ***2.4 Green Infrastructure***

The implementation of green infrastructure within urban parks plays a crucial role in enhancing park usability and promoting strategies for community climate adaptation and resilience<sup>9,10,35</sup>. Green infrastructure strategies integrated into parks, such as rain gardens, constructed wetlands, and bioswales, serve as nature-based solutions that have been shown to effectively manage stormwater runoff, reduce flooding, and improve water quality<sup>9,10,35</sup>. When green infrastructure is implemented with tree canopy and vegetation it can reduce urban heat island effects<sup>3,34</sup>. These solutions not only contribute to the enhancement of climate resilience for urban areas but also provide additional recreational and ecological benefits for the surrounding communities<sup>35,36</sup>.

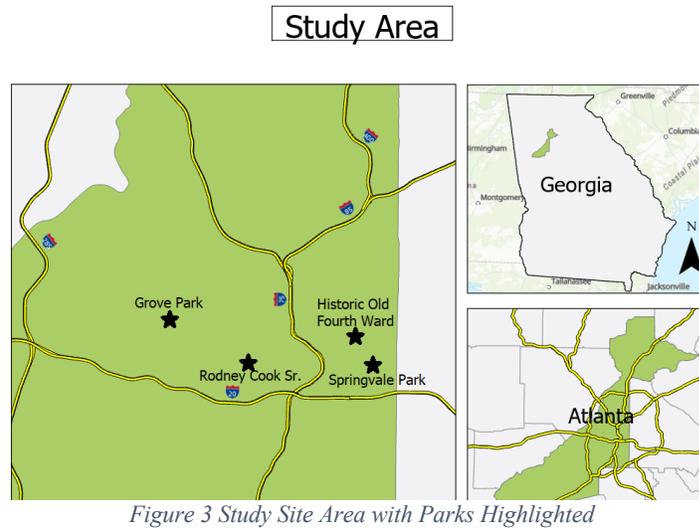
Of particular interest for this study are UHIs. UHIs form when cities replace the natural land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and

retain heat<sup>2</sup>. This effectively increases the local temperature, increases consumer energy costs, and worsens air pollution<sup>2</sup>. Studies suggest that climate change will likely lead to more frequent, severe, and longer heat waves during the summer which will ultimately increase the severity of the effect of UHIs<sup>2,3,3</sup>. That said, greenspaces can act as essential mitigators to urban heat islands. Through tree-planting initiatives and thoughtful park design, parks can offer shade, cool the environment, and improve air quality, providing much-needed relief during heat waves<sup>3,33</sup>. Incorporating green infrastructure optimizes vegetation cover and shade, which can provide a reprieve for communities with access to the park, mitigating the UHI effect during extreme heat events<sup>14,35</sup>.

Incorporating green infrastructure enhances park usability and contributes to the overall sustainability and resilience of urban areas. Achieving successful climate adaptation in urban areas involves a multifaceted and dynamic process of integrating nature-based solutions that simultaneously reflect community needs, conserve biodiversity, and foster collaborations between local communities and urban planners<sup>35</sup>. By incorporating multiple green infrastructure types within green spaces, they can become more usable, enjoyable, and inclusive spaces for community members<sup>29</sup> while serving as a more effective climate hazard mitigation tool.

### 3. Methods

For this study, primary and secondary data were collected to assess park accessibility, usability, and their relationship with physical and social barriers among select parks within Atlanta, Georgia.



#### 3.1 Study Sites

The study took place in Atlanta, Georgia, (Figure 3) and all parks selected are managed by the City of Atlanta Parks and Recreation Department to ensure consistency in management practices. All parks ranged between 15-20 acres in area which helped to ensure that the parks were of similar spatial scale which contributed to meaningful comparisons across the various attribute categories. Parks were also selected to ensure the representation of diverse urban characteristics. During the selection process, parks were chosen with consideration of the socioeconomic characteristics of the communities surrounding the parks. One Park was selected to represent each

of the following community characteristics: a park embedded within a high population density with high socioeconomic disadvantage, a neighborhood park with high socioeconomic disadvantage, a neighborhood park with low socioeconomic disadvantage, and a high population density park with low socioeconomic disadvantage (Table 1). This approach provided a mechanism for conducting a comparative case study where cases were separated and chosen by the socioeconomic factors that are often found to influence park accessibility, utilization, and perceived barriers to access and usability. The selection of Old Fourth Ward Historic Park, Grove Park, Rodney Cook Sr Park, and Spring Vale Park as study sites aligned with the research objectives by providing a diverse representation of urban characteristics, park features, and sociodemographic contexts within Atlanta, Georgia.

<b>Park Name</b>	<b>Park Typology</b>	<b>Socioeconomic Characteristics</b>
Grove Park	Neighborhood Park	High Socioeconomic Disadvantage
Springvale Park	Neighborhood Park	Low Socioeconomic Disadvantage
Old Fourth Ward Park	High Population Density Urban Park	High Socioeconomic Disadvantage
Rodney Cook Sr. Park	High Population Density Urban Park	Low Socioeconomic Disadvantage

*Table 1 Park description*

Atlanta has over 300 greenspaces serving its residents. As Atlanta continues to grow it has adopted many sustainability practices and projects most notably the BeltLine Project. The Atlanta BeltLine is one of the largest urban redevelopment programs in the United States. The BeltLine project is a network of public parks and multi-use trails along a transformed 22-mile railroad corridor to increase overall walkability and connect various neighborhoods together<sup>37</sup>.

### *3.1 Primary Data Collection.*

Three primary data sources were collected in an effort to validate any of the findings uncovered during the analysis. The first data source was collected using an in-person multidimensional park instrument that was developed from several validated survey sources. The second data source was the photos taken to capture the unique attributes of each park and monitor changes during the study period. Finally, a survey was administered to a subset of park users to collect feedback on several aspects of the park as viewed by those who use it (or not) as a local greenspace. Each of the three primary data collection strategies are detailed below.

#### *3.1.1 In-person park survey instrument*

A multidimensional park quality assessment instrument was created to collect observational data inside selected parks. The instrument was optimized to provide insights into the physical attributes and conditions of the park contributing to or impeding the usability and accessibility of the park that can only be obtained through observation. The study used a qualitative instrument (Figure 4) created through the integration of elements from previous studies that have assessed park access and usability. Measures were derived from the following validated instruments:

- Kansas State University Community Park Audit Tool which was created to assess the physical features and amenities of parks, including their layout, pathways, seating, lighting, and recreational facilities<sup>36</sup>,

- ADA accessibility guidelines to evaluate park accessibility for people with disabilities to ensure compliance with standards<sup>38</sup>,
- The EPA Green Infrastructure Guidelines for Parks emphasize assessing a park's green infrastructure, encompassing various elements such as trees, community gardens, rain gardens, and sustainable stormwater management features<sup>39</sup>,
- The Public Parks Aesthetic Value Index evaluates a park's aesthetic features, considering factors like landscaping and visual appeal<sup>41</sup>,
- Metro Action Committee on Public Violence Against Women and Children Safety audit focuses on evaluating the park's safety and security features such as lighting, visibility, and perceived safety<sup>42</sup>.

The combination of these instruments allowed for the observational documentation of the park's physical features, accessibility, green infrastructure, aesthetics, and safety.

During the study, the qualitative instrument was utilized to conduct in-situ assessments of selected parks to identify and document barriers and contributions to access and park usability. Examples of specific physical and social barriers used to assess park access and usability are delineated in Table 2. Figure 4 provides an example of the hard copy notes taken using the instrument during the observational study periods. A total of 22 visits from *February 2023- March 2024* were made to each park with the goal of achieving data saturation<sup>43</sup>. Theoretical data saturation is achieved when no additional findings occur, and the same examples are found over and over again<sup>43</sup>

Basic Information	SAFETY APPEARANCE	
2/4/23		
Morning		
Start: 9:50	Shade structure	no picnic area
End: 12:50	Age Marked Play Areas	no playground rules
Length of visit: 3hrs	Proper or Poor Lighting	
Weather: Sunny, Clear	Types of Signage	Park hrs playground rules
<p>Grave Park Pilot Study 2-4-23 Morning 3hrs</p>	Graffiti present	No @ rec. @ park
	Enforced Rules	Bridge
	Vandalism	some on bridge, no rotting wood
	Surveillance	no? no cameras present
	Excessive litter	no necessarily but there's litter
Park signs bordering park	Clear Sightlines	YES
on stop signs	Heavy Traffic	NO near park entrance
	Maps of park	NO
	Excessive Noise	NO
	Vacant/Unfavorable buildings nearby	YES
	How maintained are facilities	? rec center closed?
	Park monitored	NO
	Emergency Devices in park	NO
	Evidence of alcohol or drug use	YES
	Homelessness presence	YES @ picnic shelter x2
		3 homelessness
		Construction! @ playground

heard 2 car alarms go off nearby

Figure 4 Example page one of Instrument used for field observations.

<b>Physical Barriers to Access</b>	<b>Social Barriers to Access</b>	<b>Physical Barriers to Usability</b>	<b>Social Barriers to Usability</b>
Lack of Public Transit	Main land use around the park	Presence of shade structure	Evidence of Drug Use
Limited Parking	Vacant/Unfavorable Buildings nearby	Public Bathrooms	Evidence of Alcohol Use
Excessive Noise	Hours of Operation	Maintained Facilities	Presence of Homeless Persons
Heavy Traffic	Lack of landscaping	Lack of Emergency Devices in the Park	Lack of Events at the Park
Lights inside/near the park /Activity Areas lit	Lack of signage	Lack of Clear Sightlines	Vandalism
Mismatched Amenities to community wants		Lack of Green Infrastructure in the Park	Lack of Surveillance, Enforced Rules, Authorities Present
Excessive Litter		Blocked Off Amenities	Nearby/ On Site Construction

*Table 2 Observable physical and social barriers that can be found using the observational instrument*

### *3.1.2 Photographic documentation*

The user experience and perspectives were captured through an array of photographs. The focus was on the amenities and walking paths that park visitors interact with the most. Additionally, pictures were taken to complement and enhance the qualitative insights acquired from observations and surveys. The objective was to capture a comprehensive and representative portrayal of the barriers and contributions to park access and usability. Photos allow for capturing visual information in a tangible form which observational rubrics cannot fully capture.

Along with the systematically recorded observations, photos were taken at the parks to document the amenities, park features, and park conditions that related to the physical and social barriers of park access and usability. The photos were recorded on an iPhone 14 Pro with location services turned on which allowed for photos to be geotagged at each of the parks. Photos from each of the parks were placed into their albums and uploaded into BOX. In addition, the location of barriers and contributions were also collected using FieldMaps – an online web mapping application available through the ESRI suite of products<sup>44</sup>. The process of recording the location of each observation provided additional data points to analyze where and to what extent each barrier and contribution was present across the parks using analysis techniques within GIS.

### *3.1.3 Park user survey*

An IRB-approved survey was also distributed to park visitors during park visits to gather perspectives and experiences related to park access and usability for the selected study sites. Participants for the survey were recruited through face-to-face interactions, flyers, as well as a display placed at the Fulton County Library. A total of 80 responses was the goal although only 21 were collected (Table 3). The survey included questions about park usage patterns, perceived barriers to access and enjoyment, preferences for park amenities, as well as overall satisfaction

with park experience. The park user survey was designed based on similar surveys in the field such as the park satisfaction survey used by Cernicova-Buca et. al. <sup>14</sup>. Responses to each question were recorded on a Likert scale with the option of providing additional details where necessary. An example of the survey questions are illustrated in Figure 5 below and the full survey can be found in the appendix.



Figure 5 Example survey questions from IRB approved survey to gauge park user perceptions and needs

<b>Park User Survey</b>	
<b>Park</b>	<b>Number of Respondents</b>
Grove Park	5
Springvale Park	2
Rodney Cook Sr Park	6
Old Fourth Ward Park	8

Table 3 Number of respondents across parks

### 3.2 Secondary Data

Demographic and socioeconomic data for the neighborhoods surrounding the selected parks were obtained from the US Census at the block group level which is the smallest geographic unit in which Census Bureau tabulates demographic data<sup>46</sup>. In addition, data containing all park boundaries in Atlanta were collected from data provided by the City of Atlanta This information complemented the primary data by providing additional contextual information relating to the parks' demographics. More information on the data types and sources is detailed below (Table 4).

<b>Data Type</b>	<b>Data Source</b>	<b>Purpose</b>
Observational Data	Field observations inside selected parks	Visualize social and physical barriers pertaining to park usability and accessibility
In-Person Surveys	Survey responses from park visitors	Understand park user perceptions
Census 2020 Data	US Census Bureau website and databases	Understand where minority and low-income communities are located within Atlanta
Greenspaces in Atlanta	City of Atlanta official websites and publications	Visually display locations of greenspaces and parks within Atlanta
Observational photos	iPhone 14 Pro	To validate observations found within selected parks

*Table 4 Data types and Usages*

**4. Methods**

*4.1 Analysis*

Methodological triangulation was employed to validate the data combining quantitative analysis with qualitative insights. The qualitative data provided real-time perspectives on the challenges of park usability and accessibility faced by community members. The overarching objective of this analysis was to provide a comprehensive understanding of park accessibility and usability by integrating both objective quantitative-based measures and subjective user perspectives.

As previously mentioned, this study employed a mixed methods approach using a comparative case study framework. To evaluate the qualitative data, a coding framework was designed to identify the park’s barriers, and contributions, as well as their nature (physical or social) across the collection of primary data sources (Figure 6). This process took place over several steps.

First, handwritten notes were reviewed, cleaned, and transcribed. The notes were then coded to identify evidence of barriers and contributions to park usability and accessibility at each study location. Second, the photos taken during each park visit were organized and uploaded into Nvivo 14.23.3 qualitative analysis software<sup>47</sup>. Nvivo allows one to systematically assess and apply codes to different features within the photos. Similar to the handwritten notes, each photo was coded to identify barriers and contributions to park usability and accessibility. The nested coding structure is detailed in Figure 6 with an example of how each photo was coded illustrated in Figure 7 below. For each photo and handwritten note codes were applied based on what was encapsulated in the photo. Each photo was coded for if it was a barrier or contribution to usability or accessibility then further coded for if it was a social or physical barrier or contribution. Finally, the photo or handwritten notes were coded for exactly what it was i.e. litter, abandoned buildings, broken park furniture, amenities, or bus stops.

Figure 7 provides a detailed view of the coding process used for the collected photos. In the image there are two barriers to usability. Hostile infrastructure is added to park benches in an effort to prevent homeless persons from sleeping on them and graffiti on the construction fence behind the bench is present. Landscaping features, like the boulder along this pathway in Figure

7, improve the park's aesthetics likely contributing to increased user satisfaction and park usability<sup>41</sup>.



Figure 6 Codes used in Nvivo to systematically code photos taken during park observations.

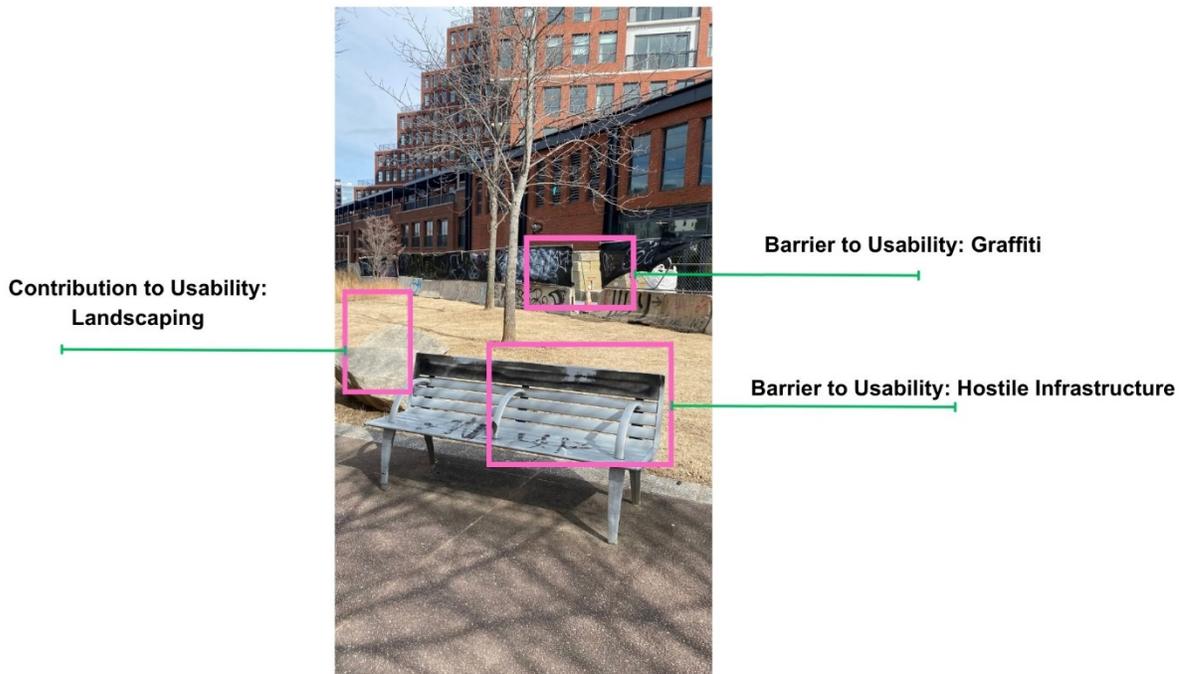


Figure 7 Example photo and codes that would be assigned to it

#### 4.2 Geospatial Analysis

Preprocessing and geoprocessing of the selected Census dataset and Atlanta Greenspace datasets were performed in ArcGIS Pro 3.0. This involved creating a geodatabase, importing census block groups, TIGER/Line files, and the greenspace dataset, and reprojecting all data sets to NAD 1983. Utilizing the American Community Survey (ACS) 5-Year Estimates for 2017-2021 from the National Historical Geographic Information Systems (NHGIS), data were extracted describing the race and income of block groups across the study area<sup>48,49</sup>. The initial data processing phase involved cleaning and refining the ACS dataset to focus on relevant block groups within the target counties (Fulton, Dekalb, and Cobb). Upon importing this data set into the GIS a table join was performed between the cleaned sociodemographic data and the geographic block group polygons obtained from the Census Bureau's TIGER/Line blockgroup boundaries. Buffers of one and five miles were delineated around the selected parks, serving as the primary measure of park accessibility and a method for capturing the demographic composition of the community that can access each park. The 1-mile buffer was chosen as it is considered to be a reasonable walking distance that has been used across other studies<sup>50</sup>. The 5-mile buffer was used as a way to capture the reasonable driving distance to a park within a city like Atlanta<sup>21</sup>. The incorporation of community demographic data into the analysis provided a mechanism for developing a deeper understanding of how park accessibility and usability intersect with local population characteristics. Linking demographic information with spatial analysis the study aimed to uncover any potential disparities in access and usage patterns across different demographic groups.

In a second geodatabase, points obtained during the observational period were recorded in the ESRI FieldMaps app and imported into the GIS. Each of the points were represented the location of either a barrier or contributor to park access and usability within each park (Table 5). The point features within each park were spatially joined to a grid overlying the park boundary using the

City of Atlanta’s Greenspace dataset. Each grid cell was 25m x 25m. This step facilitated a detailed examination of the spatial distribution of features contributing to or detracting from park accessibility and usability within the parks themselves.

In order to see how the points were distributed across the park they were first categorized as barriers or contributions during initial data collection. For example, if a barrier such as graffiti was identified during the park visit, I took a GPS of the barriers location along with a brief description of the barrier. This was done during each park visit over the course of the study period. The total number of barriers and contributors identified in each park using GPS collection approach is detailed in Table 5 below.

The point distribution for each category (Barriers and Contributions) was assessed using the geoprocessing tool “Clustering and Outlier Analysis (Anselin Local Moran’s I)”. The tool works by assessing both the spatial distribution and attribute value of each area of interest and the surrounding neighbor values (in this case the park grid). The attribute of interest (dependent variable) for each grid cell was the count of points associated with each barrier and contribution falling within the bounds of the grid cell. A K-Nearest Neighbors (KNN) rule was then used to assess the spatial significance of clusters of barriers and contributions in each park. A value of 8 was assigned to the KNN. KNN was selected to represent the spatial structure of the data as it is better suited for localized spatial patterns.

The Local Moran’s I assigns input units of analysis to five different possible cluster categories. High-High denotes areas where the focal cell has a high count of barriers or contributions and is surrounded by other cells of high values. Low-Low clusters are the opposite – low count values surrounded by cells of similarly low values. There are also two spatial outlier categories; Low-High identifies areas where there is a low count of barriers or contributions surrounded by cells with high counts, and High-Low which is an area of high values surrounded by areas of low values. Lastly, cells can also be assigned to clusters of non-significance. The degree of clustering and their significance is assessed using the z-score and a pseudo-p-value assigned to each cluster category and based on a Monte Carlo procedure (n = 999).

The results of the clustering can be visualized on the grid to show the spatial patterns of hotspots (High-High) or cold spots (Low-Low). This provided insight into the spatial arrangement of park barriers and contributions that promote or hinder park usability and accessibility at a local scale. The placement of barriers to usability can affect accessibility, visitor experience, and safety within a park. If barriers are spread out, it can disrupt the overall visitor experience, making it more difficult to navigate the park, access amenities, and enjoy recreational activities. Conversely, if barriers are concentrated in one area of the park it may limit the access to specific amenities or areas for park visitors.

<b>Points Collected in FieldMaps</b>		
<b>Park</b>	<b>Barriers</b>	<b>Contributions</b>
Grove Park	42	23
Springvale Park	5	28
Old Fourth Ward Park	19	28
Rodney Cook Sr Park	40	33

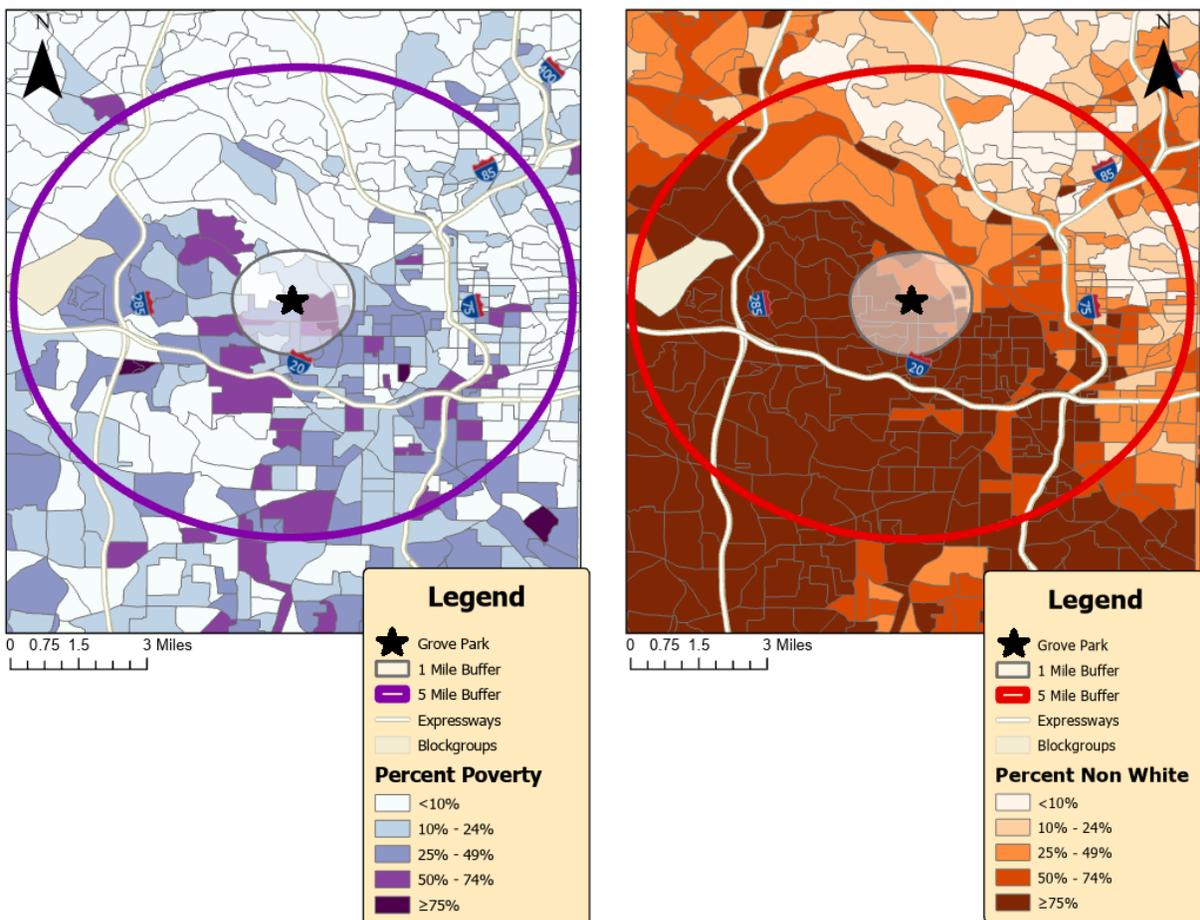
*Table 5 Points collected using FieldMaps*

## 5. Results

Using methodological triangulation, patterns began to emerge across the qualitative data. Methodological triangulation was used to validate the findings by examining the consistency or convergence of themes across different methods (Appendix A Table 1).

### 5.1 Grove Park

Grove Park, a neighborhood park spanning 17 acres, occupies a location within an area characterized by significant socioeconomic disadvantage. The surrounding community is predominantly nonwhite (81%), with a notable portion (27%) experiencing poverty within the one-mile buffer encircling the park (Figure 8). Within the five-mile buffer encircling the park, the surrounding community is also predominately non-white (65%) with 19% living in poverty putting the park in an area with high socioeconomic disadvantage. Observational field research at Grove Park uncovered many issues that hinder access and the usability of the park including decaying amenities, widespread trash problems- particularly in and around Proctor Creek, and overall neglect in maintenance efforts as outlined in Table 6.



Map created by Ansleigh Bright. Data retrieved from IPUMS NHGIS.

Figure 8 Sociodemographics of Grove Park

<b>Barriers to Access</b>	<b>Barriers to Usability</b>	<b>Contributions to Access</b>	<b>Contribution to Usability</b>	<b>Green Infrastructure</b>
Play area was completely blocked off for watershed management project for 11 Months of the Study	Litter present but spread out through park, heavy litter near stream and stairs	YMCA, School next door, Neighborhood food pantry next to park	5-12 Play area set, jungle gym, swings	Trash trap which has been full during visits but is routinely cleaned up
No sidewalks around park	Liquor and beer bottles littered throughout park	Large parking lot	Trails	Riparian buffers at the bridge near the creek
No Marta stop	Homeless persons present in park		Tennis court	
	Broken park furniture – two benches; one table		Mural	
	Broken and dirty water fountain		Three sheltered picnic areas with tables	
	Closed rec center		Creek flowing through park	
	No available bathrooms		Hot coals	
	Abandoned community garden		Many trees present creating shade	
	No trail or stair maintenance lots of debris from trees and storms		Baseball field	
	Graffiti present		Open field	
	11 lights out of 23 lights in and around park are inoperable			
	Free library had broken window which exposed the enclosed books to all the elements, it was later removed completely			
	Creek flowing through park prohibits fishing and swimming due to sewage overflows			
	One of two murals destroyed during observation period			
	Poor lawn and trail maintenance			

*Table 6 Barriers and contributions observed within Grove Park*

### 5.1.1 Barriers

Grove Park displayed a number of inadequacies in its amenities and infrastructure, which impact the park's access and usability (Table 6). The effect of the inadequacies was apparent during each of the observational periods when extremely minimal foot traffic recorded during the park visits. Qualitative insights obtained from the park user survey shed light on a myriad of concerns regarding park safety, quality of amenities, and overall park cleanliness. Three out of five survey responses expressed concerns about personal safety, while four respondents rated the park's play equipment as poor. One survey response said: "*Park equipment should be updated to ensure safe use.*" Additionally, two respondents disagreed with the statement that the park is normally clean which was supported by the in-person observations.

Grove Park was unique in that there was a recreational center adjacent to the park. However, during the observational period, it remained closed for the majority of the time, perhaps permanently. The planters outside the center were becoming overrun by unmaintained weeds which indicated an overall lack of facilities management. Lack of facilities management was also exemplified by the litter scattered throughout the park. The tree-shaded picnic area located outside of the Recreational Center exhibited various signs of neglect as well. This included the stairway leading into the picnic area displaying evidence of warping and breaking down (Appendix B 2), picnic tables and benches showing signs of deterioration (Appendix B 1), as well as the presence of discarded liquor and beer bottles in this section of the park (Appendix B 3). Throughout the park only 11 of the 23 lighting fixtures were operable. The lack of attention to these amenities is likely contributing to the low visitation observed at the park.

The west side of the park, where many unique amenities were located, had many areas showing signs of needed improvement. During the study period, the play area was blocked off for eleven months with adjacent benches showing signs of disrepair (Appendix B 4). When surveyed about the park, one respondent highlighted the need for improvements when exclaiming "*Everything about this park needs improvement. It is completely inaccessible.*" The park bulletin board was routinely checked during observations and it was noted that it had not been updated in several years, reflecting a lack of attention to park communications.

Other amenities that showed signs of needing improvement included the inoperable and visibly dirty water fountain (Appendix B 6), debris-filled stairs leading back to the recreational center (Appendix B 7), and a damaged mural at the tennis court which was left on the ground for an extended period of time (Appendix B 8).

Grove Park was also distinguished from the other parks by the presence of the community garden. But even this exhibited signs of severe neglect and numerous educational signs associated with the garden were scattered throughout the grounds along with broken planters and the stairway entrance to the garden. The weed growth dominating the planters was noticeable even during my visits to the park in February which would be the beginning of the planting season (Appendix B 9). Within the community garden, there was also a free library although the broken window exposed the free books to the elements, leading to their destruction (Appendix B 10). Several months into the study the free library and discarded planters remained adjacent to the community garden shed (Appendix B 11). During the observational period, the Atlanta watershed management group worked on a project in Grove Park which could be indicative of a recognition of needed improvement. However, even after the project came to completion there were still things left awry. Workers moved a broken bench into a new place instead of discarding of it (Appendix B 12). Workers also left behind many tools along the park's pathways along with construction debris including wood and nails scattered throughout the proximal area (Appendix

B 13). Finally, there was an occasional occurrence of unhoused persons present and camping inside the park.

### 5.1.2 Contributions

Grove Park does excel in several contribution categories. It has ample parking at both entrances to welcome its visitors. The east entrance of the park features a modest picnic area surrounded by trees, providing ample shade. The picnic area is also adorned with a sculpture and a limited number of benches and tables nearby. On the west side of the park, several amenities were also present, which included the community garden, a mural, baseball field, tennis court, walking trail, multiple picnic shelters, and a play area. Near the end of the observational period, the previously mentioned Atlanta Watershed Project was completed, and the playground was once again accessible to visitors. Interestingly, changes made to the park included multiple drains intended to divert the stormwater from accumulating onto the park's sports fields. New trees and grass were also planted, and the parking lot received a fresh coat of paint upon the project's completion.

### 5.1.3 Green Infrastructure

During the observational period, observed green infrastructure elements were scarce. For instance, even days after rainfall, the park had flooded areas which included the playground, the open field, and the baseball field. There are also not enough trees near the amenities on the west side of the park to provide shade when the sun is overhead. This observation was supported by the park user survey. One survey respondent stated that: *"Better water drainage after heavy rains, and I wish it had a few more trees"* While another said: *"The barriers I have with the park is the lack of shade, so during hot days I will choose another park."* These observations and comments highlight the importance of additional green infrastructure improvements and how they could play a role in making the park more usable. Some green infrastructure elements that were present included trees bordering the park, a stream trash trap, educational signage, and the community garden (although in bad shape during the time of the study). If these elements were maintained, they could contribute to the park's overall usability and environmental quality. That said, the City did seem to be aware of the drainage issues because they had installed new drains although their efficacy could not be observed due to the project time constraints.

### 5.1.4 Quantitative Results

Data collected from observational fieldwork in Grove Park reveals a range of physical and social barriers affecting the parks accessibility and usability. These included deteriorating amenities, litter accumulation, and poor facilities management. A significant portion of the photos taken in the park (49%) showed barriers to usability, while 16% identified barriers to access. On the other hand, 20% of the photos captured showed positive contributions to the park's usability, while 14% showed contributions to access. The remaining 11% of photos were categorized as green infrastructure (Figure 9).

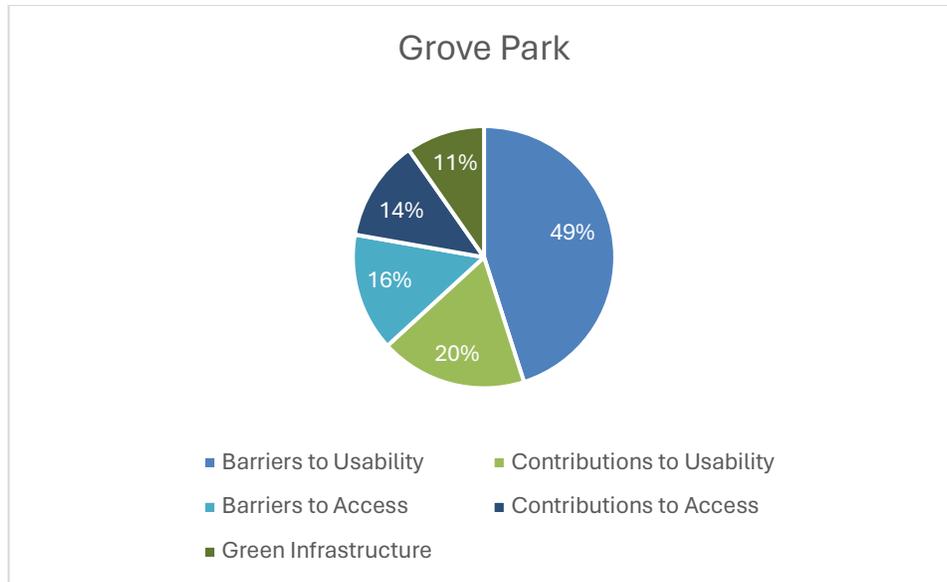


Figure 9 Coded percentages from NVivo for Grove Park

The clustering of observed barriers along the west side of the park, as depicted in Figure 10, indicates that certain sections of the park are more heavily affected by accessibility and usability issues than others. This clustering suggests that barriers to usability, such as deteriorating infrastructure or neglected amenities, are concentrated in specific areas within the park. Area of High-High clustering in the western corner of the park is due to the neglect of the community garden. The other High-High clustering occurs in areas where the water fountain did not work, where play areas were blocked off, and where abandoned construction waste had accumulated. There is one High-Low cluster which appears when clustering on the contributions and barriers locations. This highlights the semi-fluid relationship between barriers and contributions. In this area is a nice set of amenities which include a bridge going over Proctor Creek to increase the parks accessibility, however there is also an abundance of graffiti on the bridge and an accumulation of litter. Many of the locations of High-High clustering of barriers do not coincide with areas experiencing High-High clustering of contributions which implies a spatial disparity in the distribution of park features. Some sections of the park may offer amenities or enhancements that contribute to accessibility and usability, but these positive attributes are not evenly distributed throughout the park. Conversely, areas with the most pronounced barriers may lack corresponding features that enhance accessibility or usability. There was an accumulation of litter near the Recreational Center where clustering of barriers and contributions can be seen towards the north of the park.

# Grove Park

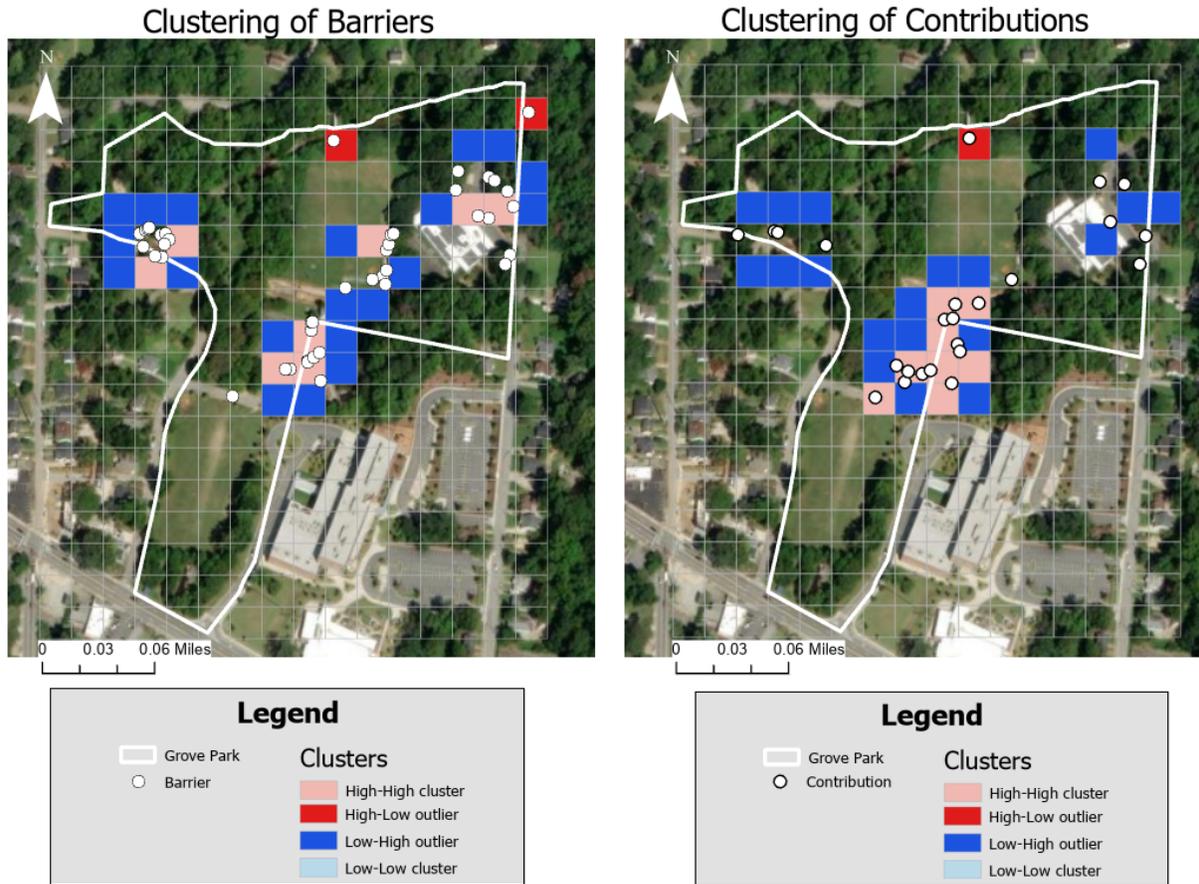
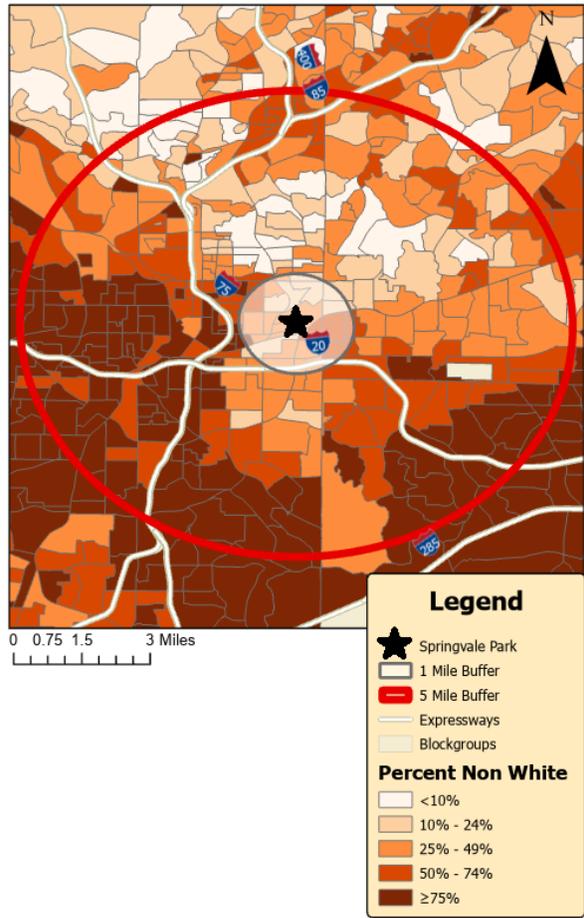
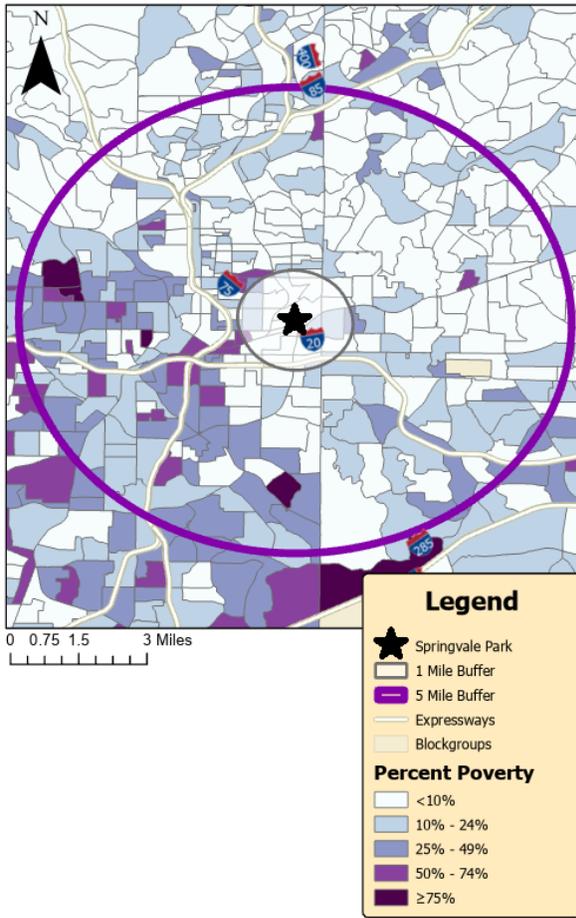


Figure 10 Local Moran's I clustering of barriers and contributions in Grove Park

## 5.2 Springvale Park

Springvale Park is a 15-acre park that occupies a pivotal location within Atlanta's historic neighborhood of Inman Park. Inman Park was Atlanta's first suburb and has many historical homes. Situated within a low socioeconomically disadvantaged area (Figure 11) the majority of the population within the one-mile buffer of Springvale Park is not experiencing poverty (91 %) and is predominately white (65%). Within the five-mile buffer, 85% of people are not experiencing poverty and 48% are white. Meaning that the area around the park is of low socioeconomic disadvantage. The findings from this park underscore a notable absence of significant barriers impeding park access, with many contributions to usability observed.



Map created by Ansleigh Bright. Data retrieved from IPUMS NHGIS.

Figure 11 Sociodemographics of Springvale Park

Barriers to Access	Barriers to Usability	Contributions to Access	Contributions to Usability	Green Infrastructure
Limited street parking	No lighting in the evening/night	Neighborhood signs, City of ATL Park signs, Keep Springvale Beautiful sign, Caterpillar club sign	Neighborhood watch	Riparian buffers around park and at drain
Construction on apartments directly adjacent to park	Non-ADA Compliant pathways	Historical sites surrounding park	Much of the park and play area are naturally shaded with trees	Storm water drain
	Noise pollution from construction site	E Scooters	Large play structure with swings	
	Stairs leading down to park are uneven, have no railing, and have lots of debris		Lots of toys donated to the park	
			Sandbox	

			Fairy wooden sculpture	
			Large wooden tree trunk sculpture	
			Ravine trail	
			Artificial fountain in pond	
			Bocce ball court	
			Large outdoor connect 4	
			Park is litter free	
			Bike rack	
			Seesaw	
			Detailed landscaping	
			Large pond	
			Benches at pond and play areas	
			Open field	

Table 7 Barriers and contributions observed in Springvale Park

### 5.2.1 Barriers

Springvale Park has a limited number of barriers to accessibility. One notable challenge is the limited availability of street parking, which appears to be a deliberate design choice to prioritize pedestrian access. Additionally, ongoing construction in the surrounding area has further reduced available parking options, but this is likely only a temporary barrier. Observations also revealed barriers to usability including a lack of lighting structures, non-ADA-compliant pathways (Appendix B 14), and debris buildup (Appendix B 15). Feedback from park users echoed this sentiment with one survey respondent expressing the need for better park maintenance and the need for “*Park clean up of excessive leaves.*”

### 5.2.2 Contributions

Springvale Park’s vibrant community is evidenced by the frequent presence of neighborhood residents who enjoy the park’s amenities. During each of my visits to the park there were at least one or multiple families observed actively engaging with the park which could be indicative of how the park’s amenities are contributing positively to its overall use.

Springvale Park features many tree-shaded areas near amenities to escape from the sun, as well as a diverse array of recreation features tailored to different age groups (Appendix B 16). The park has a range of park equipment including a seesaw, swing set, a bocce ball court, a large outdoor Connect 4, a sandbox with toys, and a play structure with a slide and jungle gym as depicted in Appendix B 16. It had the most “local” community feel in the sense that it had been created specifically for the community immediately surrounding it. Additionally, the park’s aesthetic appeal was further enhanced by the presence of a pond with an artificial fountain. This was complemented by wooden sculptures and landscaping elements made of stone that gave it an overall calming feel. Springvale Park also offers visitors an opportunity to connect with nature through its incorporation of a more “natural” trail system that extends to the south of the main recreation areas.

### 5.2.3 Green Infrastructure

Springvale Park had a noticeable lack of green infrastructure present in the park. The few observed green infrastructure elements included riparian buffers around the pond and a drain to divert stormwater away from the play areas which seemed to be working as there was no flooding observed at the park's play areas or open fields even after rainfall. There were also several tree-shaded spots within the park which could provide a refreshing break from the urban heat island effect. These natural elements could be indicative of overall positive contributions to the park's usability.

### 5.2.4 Quantitative Results

The observational data collected from Springvale Park illustrate a clear picture of the physical and social factors that contribute to its overall accessibility and usability. As depicted in, with 56% of the photos demonstrated contributions to usability, 28% illustrated enhancements to access, 5% highlighted barriers to access, 10% highlighted barriers to usability, and 5% of the codes were related to the parks green infrastructure features.

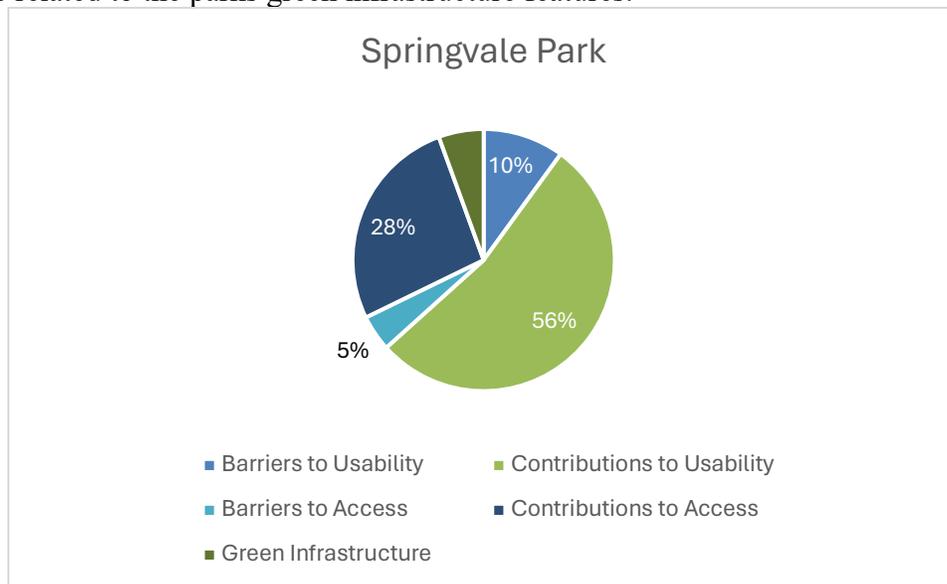
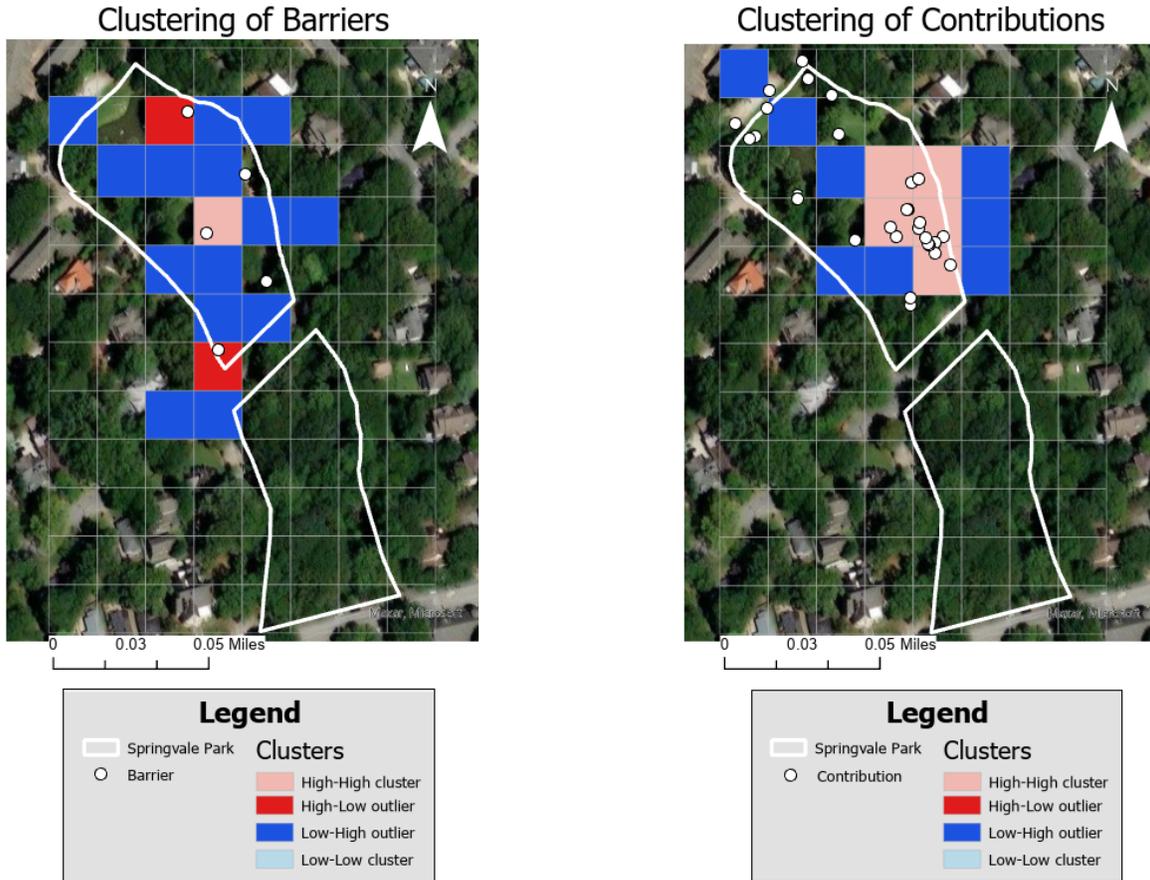


Figure 12 Coded percentages from NVivo for Springvale Park

The clustering analysis in Figure 13 revealed a significant hotspot of contributions in the eastern section of the park. The clustering of contributions in this area is related to the location of the playground, the bocce ball court, and the sandbox. These contributions, which range from recreational amenities to aesthetically pleasing enhancements, are likely elevating the visitor's experience. It is also worth mentioning that the contributions to both accessibility and usability are centrally located in the park such that those that want to interact with them must walk through a good portion of the park to reach them. The clustering of barriers is seen distributed evenly throughout the park and includes the non-ADA compliant pathways, debris-filled stairways, and absence of light fixtures. The clustering of the barriers being distributed more evenly throughout a park with a large number of contributions leads to increased park usability.

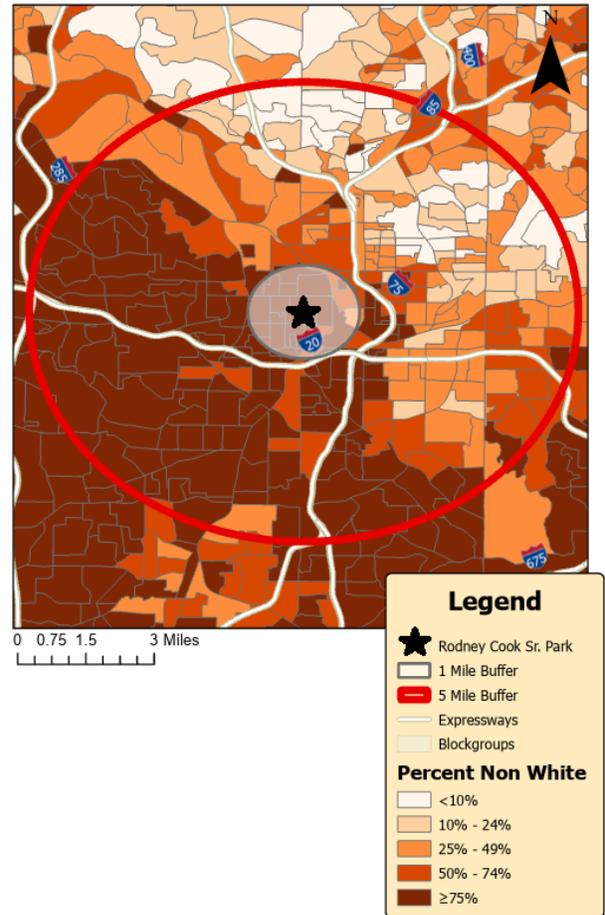
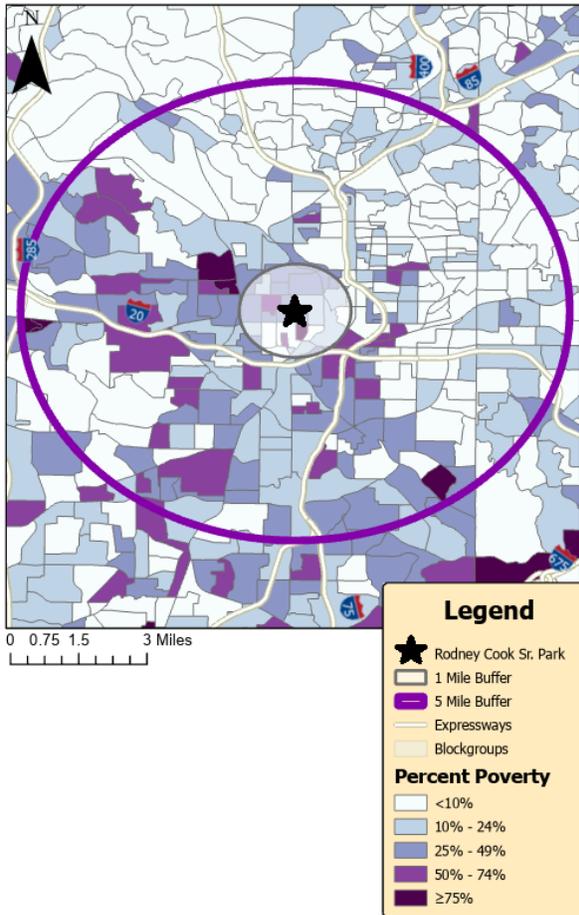
## Springvale Park



*Figure 13 Spatial clustering of barriers and contributions to park access and usability within Springvale Park*

### 5.3 Rodney Cook Sr Park

Located in a socioeconomically disadvantaged area, Rodney Cook Sr Park spans 16-acres and was built in 2021 inspired by the design of Historic Old Fourth Ward Park, it occupies a critical position in a socioeconomically disadvantaged area, as evidenced by Figure 14. Within the one-mile buffer, 81% of the population is nonwhite, with 21% experiencing poverty. Meanwhile, within a five-mile buffer the population remains nonwhite (57%) and 17% are experiencing poverty. Moreover, its proximity to the Mercedes-Benz Stadium highlights its potential as a recreational resource for the surrounding community, particularly given the amount of foot traffic attracted by large stadium events. Interestingly, there was relatively low visitation during the observational period even though it is geographically close to downtown Atlanta and the stadium. Observations revealed significant barriers to usability which likely plays a role in the use patterns observed (Table 8).



Map created by Ansleigh Bright. Data retrieved from IPUMS NHGIS.

Figure 14 Sociodemographic surrounding Rodney Cook Sr Park

Barriers to Access	Barriers to Usability	Contributions to Access	Contribution to Usability	Green Infrastructure
Street parking only	Four shade structures present over entire park two broken	Lighting throughout the park works	Two sculptures present	Bioretention cells
Broken street and park signs around the park	Graffiti Present	Designated Marta Stop	Mural on bathroom building and at basketball court	Complex drain system beneath lawn
One abandoned apartment complex on Vine Street directly adjacent to the park, liquor store across street, one abandoned house on Walnut Street bordering park, one abandoned boarded up home directly	Liquor and beer bottles littered throughout park, marijuana smell present in various areas of the park especially near the south of the park near the bridge, evidence of drug use present in bathroom	E-Scooters present	Vendors sometimes present: various food and ice cream trucks	Two-acre pond that captures 10 million gallons of storm water

adjacent to basketball court				
	Large holes in shock absorbent play area	Sidewalks completely around the park	One picnic shelter with two tables	Educational signage from City of ATL Watershed Management group
	Excessive litter		Open field	
	Dirty bathrooms, no soap or paper towels, occasionally completely closed, one working sink, removed mirrors, push to exit not working		Variety of play equipment/amenities: splash pad, basketball court, fitness equipment, playground for ages 1-3 and playground for ages 5-12, swings	
	Homeless persons present in park		Surveillance cameras by the City of ATL Police	
	Unmaintained trails and stairs lots of debris present		Walking paths within the park around storm water retention basin	
	All benches in park have hostile infrastructure			
	Lack of relief from UHI due to limited trees and shade structures			

Table 8 Barriers and contributions observed in Rodney Cook Sr Park

5.3.1 Barriers

The identified barriers within Rodney Cook Sr Park pose significant challenges to its functionality and overall appeal which affect the park’s usability (Table 8). Identified barriers to access include limited parking availability, broken street and park signs, and the presence of abandoned buildings nearby (Appendix B 17). While visiting the park these barriers left the park with a sense of neglect and mild safety concerns. The safety concerns within Rodney Cook Sr Park were reinforced when assessing the park survey results. Two out of six respondents noted concerns in response to the question “Are there any barriers interfering with your enjoyment of the park?”.

In addition, Rodney Cook Sr Park faces numerous barriers to its usability, including issues with cleanliness and maintenance. Graffiti and litter (Appendix B 18, Appendix B 19), particularly of liquor and beer bottles were readily apparent during all of the observational visits to the park.

They were found throughout and highlighted ongoing maintenance and cleanliness issues. The park also has a lack of essential amenities, such as soap and towels in the bathrooms that were left unusable due to the dirt and debris. This was echoed by one of the survey respondents who noted that improvement by way of "*Making sure there is soap in the restrooms, clean restrooms, empty trash cans out*". The pathways flowing through Rodney Cook Sr Park collected a large amount of debris as well (Appendix B 19) which negatively impacted the park's usability.

Rodney Cook Sr Park also exhibits structural deficiencies such as broken shade structures as well as large holes in the shock absorption play surface area which pose safety hazards for park visitors as well as further detract from the park's aesthetic appeal (Appendix B 20). Although hostile infrastructure within Rodney Cook Sr Park is intended to prevent unhoused individuals from camping or resting on park benches, it can make the areas less inviting and comfortable for others who want to use and relax in the park<sup>51</sup>. Despite the implementation of hostile infrastructure, Rodney Cook Sr Park still had many unhoused individuals camping and sleeping in the park during my visits.

### 5.3.2 Contributions

In Rodney Cook Sr Park there are a few positive aspects relating to its usability which include a variety of amenities for park users, murals, sculptures, and a walking path throughout the entire park. There was a variety of recreational structures such as exercise equipment intended for all ages, toddler play zones, as well as 5-12 playground structures which included swings and merry-go-rounds. The playground structures looked relatively new, aside from the holes found in the shock absorbent surface. Four out of the six survey respondents rated the park's play equipment with a 4/5 (Good) despite the need for some improvements and equipment upgrades. In Rodney Cook Sr Park there are two murals as well as two statues of Rodney Cook Sr and Martin Luther King Jr which are both positive impacts on the park's usability.

Rodney Cook Sr Park's accessibility is enhanced by the presence of several conveniences. The park has a designated Marta stop which offers easy access to the park for those who rely on public transportation. The availability of e-scooters also increases accessibility and provides an eco-friendly way for visitors to come to the park with ease. The continuous sidewalks around the park increase accessibility by providing visitors with a way to walk, jog, or bike to the park. Aside from the accumulation of debris along some of the pathways, they were generally wide, well paved, and ADA-compliant.

### 5.3.3 Green Infrastructure

Rodney Cook Sr Park has an array of noteworthy green infrastructure elements. These features include a large stormwater retention basin and multiple bioretention cells with informative signage detailing the benefits of these components. However, the storm water retention basin may have been malfunctioning or was not working as intended. During observational visits, flooding along some of the pathways was observed, which led to additional debris accumulation along them. It is also worth noting the park lacked green infrastructure to aid in alleviating the urban heat island effect. There is an unusually low number of trees in the park; only two with an additional four shade structures. Unfortunately, I noticed that two of the shade structures were broken during my visits and were not repaired over the course of the study.

### 5.3.4 Quantitative Results

The systematic photo collection and analysis yielded insights into the park's characteristics. The results, illustrated in Figure 15, revealed that a significant portion of the recorded observations (53%) pertained to usability obstacles, with another 9% related to access barriers. These findings highlight the difficulties encountered by park visitors. Nevertheless, noteworthy progress was also noted in the areas of access (12%) and usability (34%), while a smaller fraction (4%) was allocated to cataloging the park's green infrastructure features.

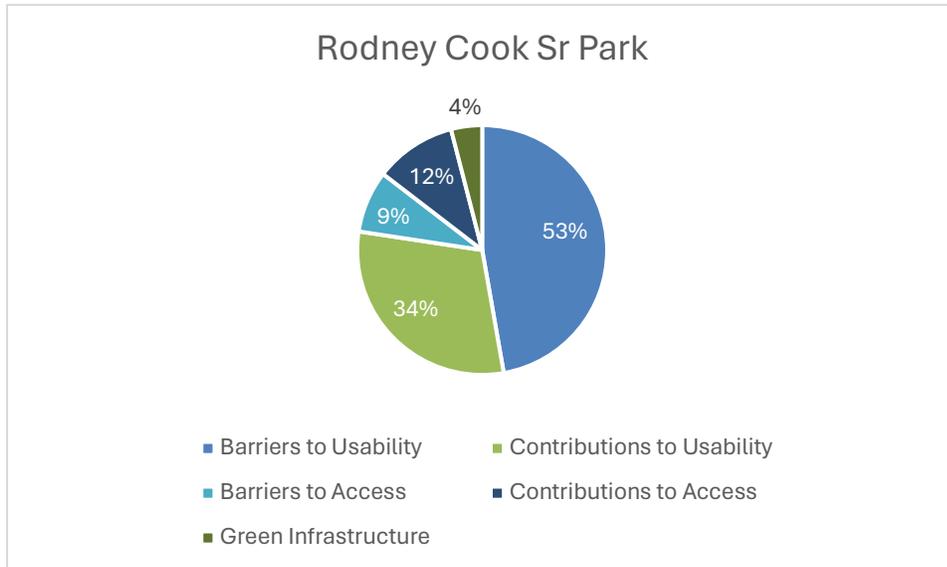


Figure 15 Coded percentages from NVivo for Rodney Cook Sr Park

Based on Figure 16 there are certain areas of the park, particularly on the west side and around the stormwater retention basin, where there are more concentrated barriers to accessibility and usability. These barriers may be due to neglect, infrastructure deficiencies, and issues like limited parking, broken structures, graffiti, and litter accumulation. Additionally, the proximity to stormwater retention basins could worsen certain issues, such as debris buildup and maintenance challenges, which a survey respondent also pointed out by suggesting the need for "*Clean-up of sediment and loose debris where water flows.*" On the other hand, the fact that positive aspects of the park such as functional lighting, designated Marta stops, and recreational facilities are not affected by the same localized challenges as barriers. It is also interesting that both the contributions and barriers are located near the edges of the park. Unlike Springvale Park, visitors to Rodney Cook Sr Park do not have to walk through the park in order to access its amenities. This may be beneficial as there is limited shade to walk under during a hot day, however, it limits the overall interaction that parkgoers have with other features embedded within the park.

## Rodney Cook Sr.

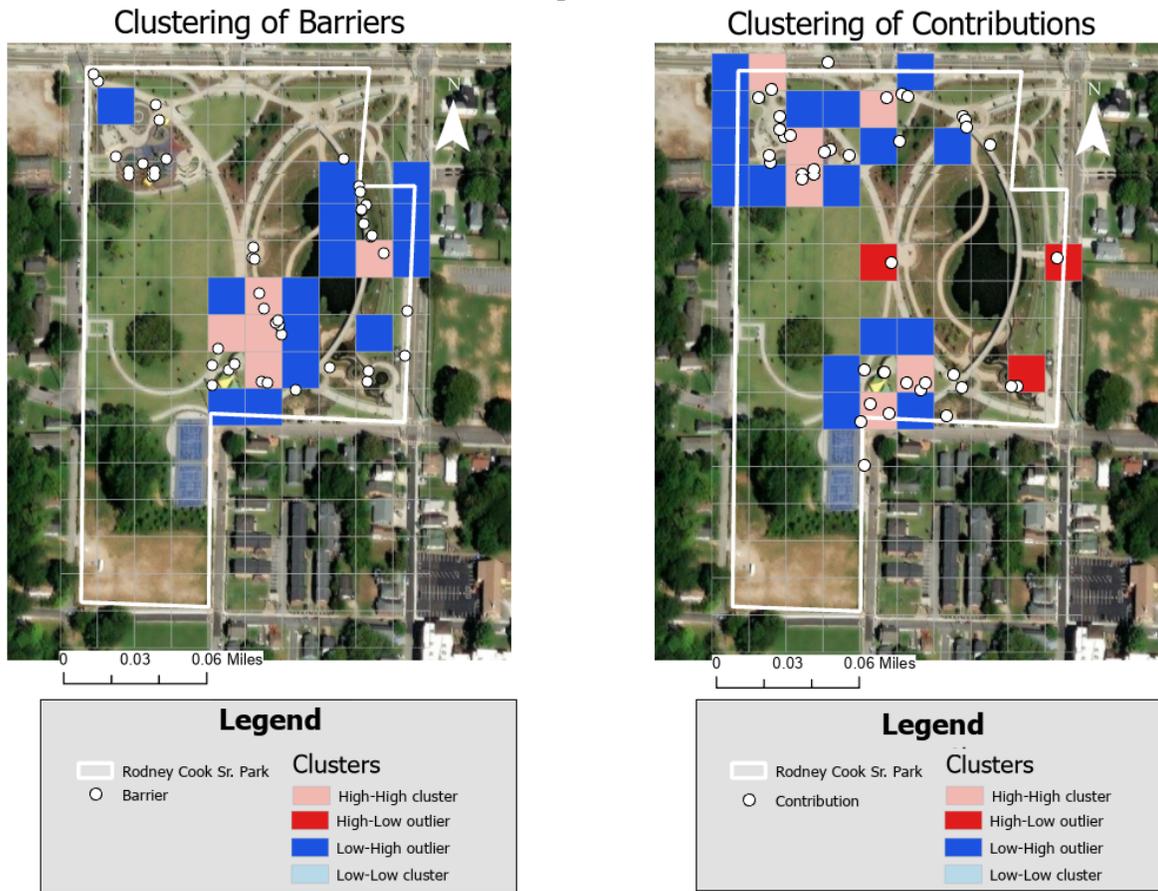
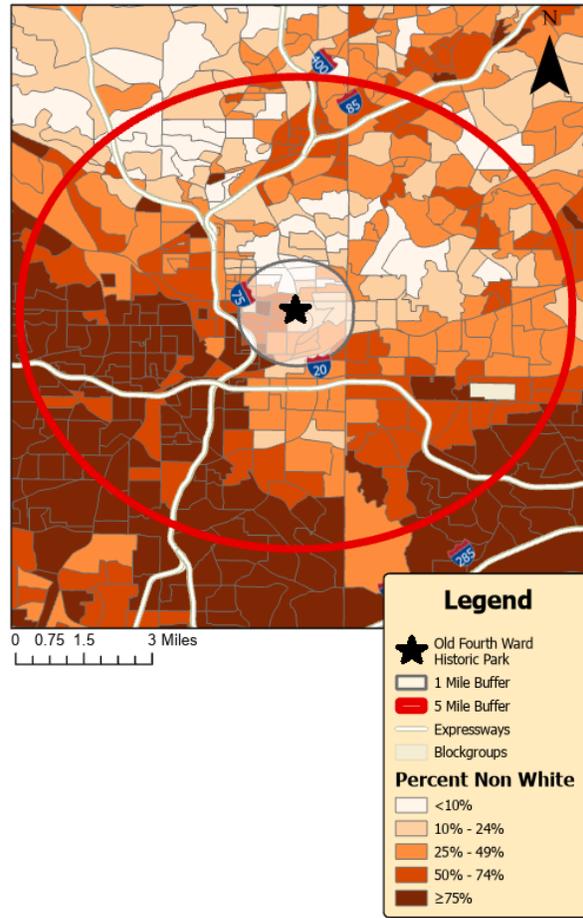
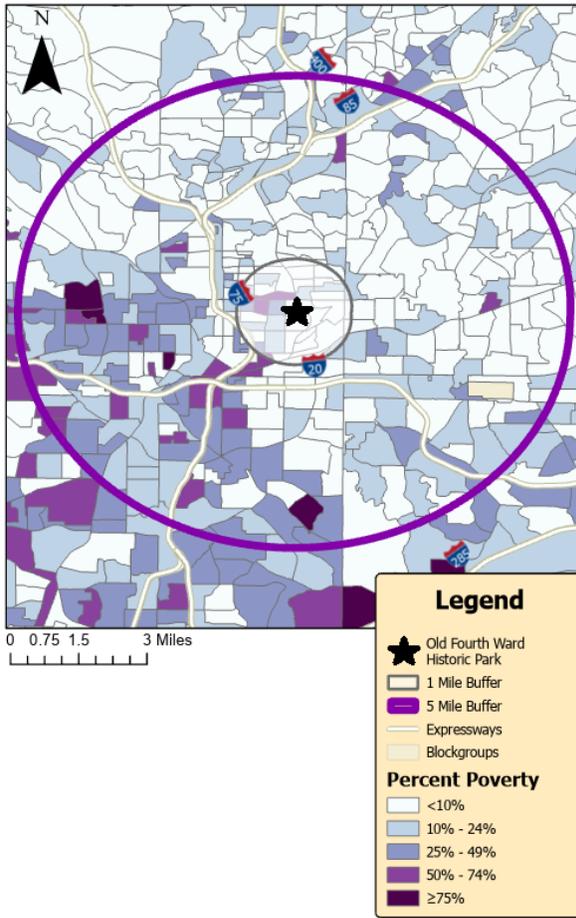


Figure 16 Spatial variance of barrier and contribution clusters for Rodney Cook Sr Park

### 5.4 Old Fourth Ward Park

Old Fourth Ward Park is a 17-acre park strategically designed for stormwater management within Atlanta's urban landscape. It occupies a pivotal role in environmental sustainability and community well-being. Old Fourth Ward is a very vibrant park that routinely had a high number of visitors during my observations. The park is situated in a low socioeconomic disadvantaged area (Figure 17). In the one-mile buffer around the park, the population is 49% nonwhite population, the majority of whom are not experiencing poverty (79%). In the five-mile buffer around the park, the nonwhite population drops to 36% and the population in poverty increases to 14%. Findings indicate that the park exhibits a notable surplus of contributions to both access and usability compared to barriers.



Map created by Ansleigh Bright. Data retrieved from IPUMS NHGIS.

Figure 17 Sociodemographics of Old Fourth Ward Park

Barriers to Access	Barriers to Usability	Contributions to Access	Contributions to Usability	Green Infrastructure
Limited Parking, only Street parking	Excessive noise in some areas of park caused by traffic and construction work	Marta stop	Parks were often monitored by patrolling police and occasionally with park security walking around inside the park	Storm water retention basin that can handle 500 year flood
For three months of observational period construction fence was surrounding portions of the park	Hostile infrastructure on all benches	E-Scooters	Functioning, clean, regularly maintained bathrooms	Solar panel light posts
	Graffiti present on temporary construction work fence at surrounding apartments, some	E-Bikes	Splash pad	Water wall with sculptural elements

	benches have graffiti as well			
	Not much of the park is shaded, no heat relief	Luxury apartments surrounding park	Skate park	Use pine straw as mulch to manage invasive species in the park
	Large holes in shock absorbent rubber play surface	Coffee shops and restaurants around the park	Toddlers play structure, as well as older kids play structure	Rain gauge
	Graffiti present in skatepark bathrooms	Signs in Spanish and English	Dog park	
	Safety railing on multiple stairways is not secured, extremely wobbly not ADA-compliant	Multiple points of entry all with bike racks	Many dog waste stations	
	All play structures have been faded a lot by UV	External path (Atl Beltline) goes through park area	Frequent Park events	
	Drug use	Sidewalks surrounding the park	New grass and trees	
			Lots of landscaping features, trees inside planters, boulders placed along paths, pathway has a pattern	
			Sculpture	
			Two faux waterfalls from storm water retention basin	
			Free library with lots of books	
			Educational signage	
			Many lights throughout park, lights on the ground as well as solar powered light posts	
			Observation points over the pond	
			Open field	
			Artificial fountain in the pond	
			City department frequently removes debris after a storm	

			Patrolled by Old Fourth Ward neighborhood patrol	
			Amphitheatre at storm water retention basin	
			Operating water fountains	

Table 9 Barriers and contributions observed in Old Fourth Ward Park

#### 5.4.1 Barriers

Old Fourth Ward Park had few barriers to park usability and accessibility. It was clear that the park designers deliberately made the park as accessible as possible. However, barriers to access within Old Fourth Ward Park include somewhat limited parking availability, likely attributed to the constraints of the downtown Atlanta area in which it is situated and where parking spaces are inherently scarce. Old Fourth Ward Park also had barriers to usability that manifested through noise pollution stemming from ongoing construction and traffic nearby. During the observation period, sections of the park were initially lined by construction fencing which contained graffiti, although subsequent visits showed the issue was addressed before peak summer usage. Barriers to usability included some non- ADA-compliant safety railings, graffiti in park facilities (Appendix B 21), and UV-faded play structures (Appendix B 22), which are indicative of maintenance inadequacies. Other observed barriers to usability included large holes in the shock-absorbent rubber play surfaces (Appendix B 23), lack of shade due to scattered trees, and evidence of drug use. The use of drugs was also noted by a survey respondent who stated, *“Enforce no smoking policy, especially when it comes to illegal and offensive obnoxious smells.”* Another barrier present within Old Fourth Ward was the inclusion of hostile infrastructure on all park benches. As previously mentioned hostile infrastructure is designed to prevent unhoused individuals from camping or resting on park benches, however, it can make the areas less inviting and usable for anyone wanting to sit and relax in the park<sup>51</sup>.

#### 5.4.2 Contributions

Old fourth ward experiences far more contributions to access and usability than barriers. Contributions to access include a designated Marta Stop, many E-Scooters and E-Bikes, and parts of the Atlanta BeltLine flowing through the park. All of these increase the overall access to the park by offering different methods for getting to the park for those not living within walking distance or for those without a car. Old Fourth Ward also exhibits significant contributions to usability which include amenities like a dog park, splash pad, observational decks overlooking the pond, various play equipment, and an amphitheater. Play equipment present in Old Fourth Ward included a jungle gym, a swing set, a merry-go-round, a toddler play area, as well as a 5-12 play structure. While the play equipment was older in age and faded by the sun three survey respondents rated the play equipment between 4 and 5 (good – very good) out of the 5-item Likert scale.

The artificial fountain and the two water walls connected to the stormwater retention basin not only increased the park’s aesthetic value but also worked to drown out the noise pollution highlighting the park’s thoughtful design. Old Fourth Ward Park’s thoughtful design positively impacts the park’s usability which was echoed by the survey respondents. Six of the eight survey respondents said they enjoyed the park’s walking paths which have been designed to encircle the stormwater retention basin, water wall, and fountain. Old Fourth Ward also had operational water fountains, well-maintained bathrooms, and debris-free pathways indicating efforts to keep the park

clean. Six out of eight survey responses agreed with the statement "This park is normally clean." While visiting the park robust park surveillance measures were observed, which included lights and patrol officers. The security was further exemplified by seven out of the eight survey respondents who agreed they felt safe in this park.

### 5.4.3 Green Infrastructure

Old Fourth Ward boasts an abundance of green infrastructure, including a 500-year flood stormwater retention basin situated at its center (Appendix B 24) which was adorned with an adjacent water wall (Appendix B 25). The stormwater retention basin and stormwater drain work in the park to divert the water away from areas commonly used by visitors positively contributing to the park’s usability. During observational flooding onto pathways that surround the basin or in the surrounding fields was not observed. Unlike some of the other parks in this study, the well-functioning retention pond kept the debris from accumulating on or around them. Additionally, the park featured solar panel-powered lights (Appendix B 26) and used pine straw to control invasive species. While the park has scattered trees throughout, many are concentrated near the play area. There is a large structure with benches at the play area. Also of note, during the summer months, visitors can enjoy the splash pad which provides further relief from the urban heat island effect.

### 5.4.4 Quantitative Results

Upon analyzing the codes derived from the photographs of the park it was determined that 30% of the codes were associated with barriers to usability and 3% were barriers to access(Figure 18). A significant portion of the images (57%) were coded as contributions to usability, while 19% were coded as contributions that eased access. Furthermore, 3% of photos captured were coded as green infrastructure within the park.

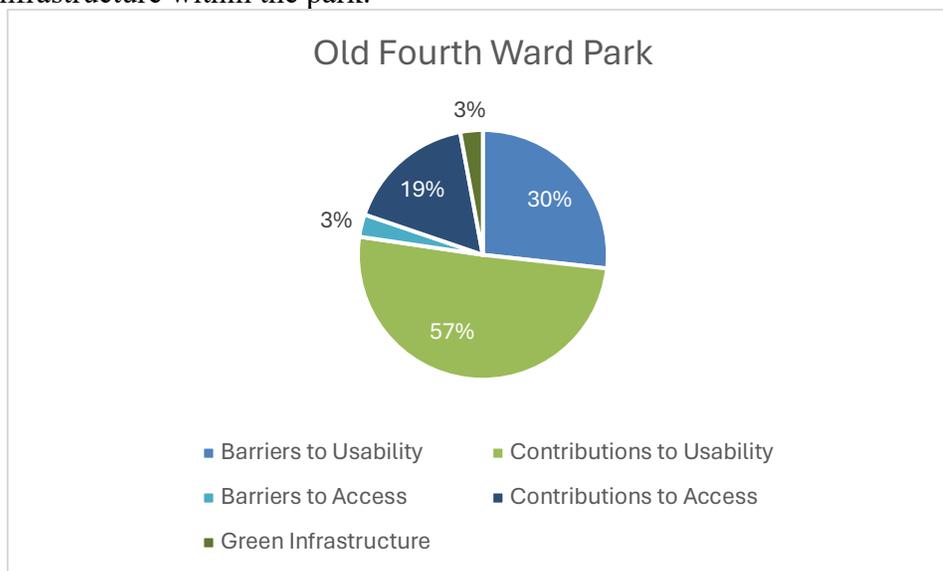


Figure 18 Coded percentages from NVivo for Old Fourth Ward Park

The clustering of barriers and contributions happens towards the south end of the park (Figure 19). This spatial pattern suggests a nuanced relationship between barriers and contributions, wherein areas with heightened recreational offerings also tend to experience challenges to accessibility or usability. This increased clustering of barriers could be due to various

factors, including higher foot traffic and usage intensity in amenity-rich zones, which can also lead to increased wear and tear, maintenance demands, and potential safety concerns. It is also worth mentioning that even though the significant cluster of contributions and barriers are concentrated in the south, there are both barriers and contributions scattered throughout. Users are therefore encouraged to walk through the park to utilize its amenities.

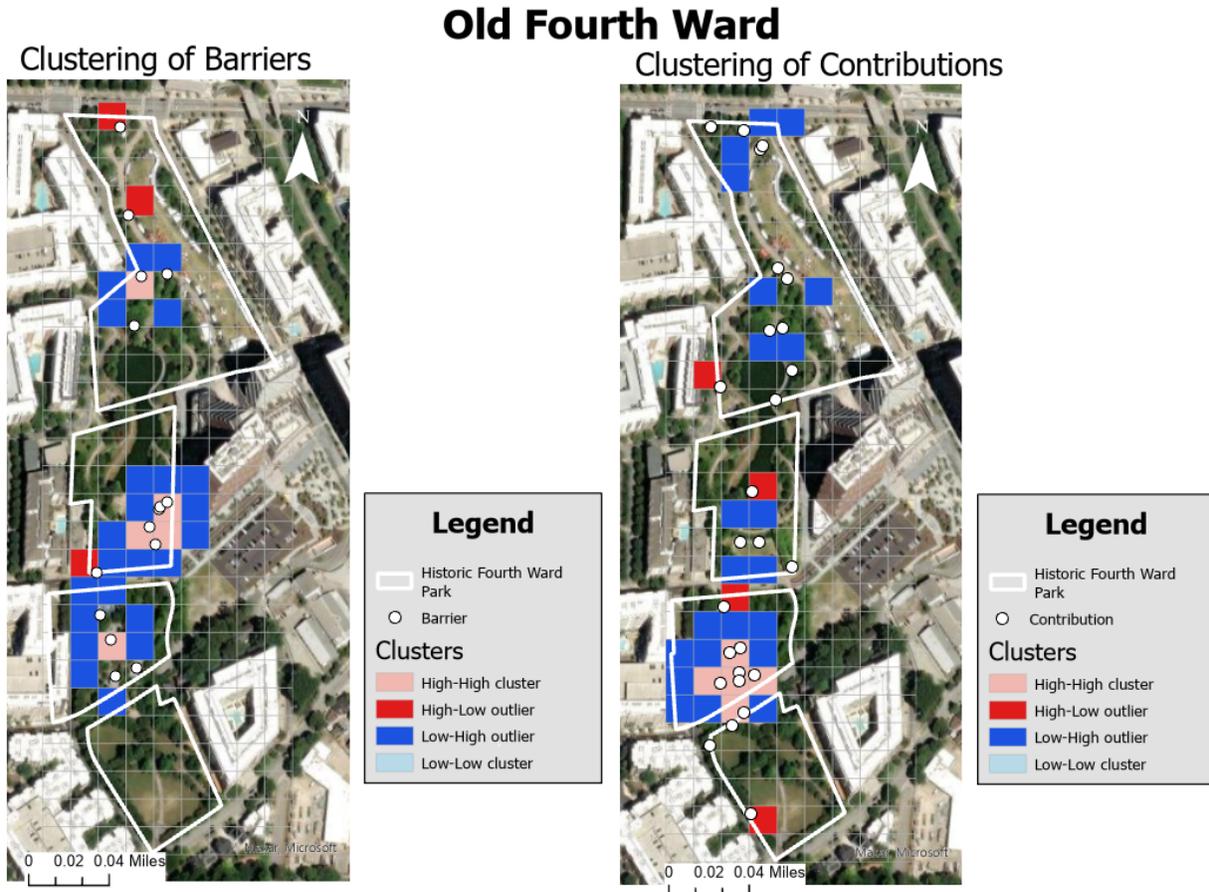


Figure 19 Spatial distribution of barrier and contributions clusters within Old Fourth Ward

## 6. Discussion and Conclusion

### 6.1 The Relationship between usability, accessibility, and use

Each of the parks had various means of access whether through large parking lots, E-scooters, or Marta Stops. However, the study highlights significant challenges to usability which were particularly evident in Grove Park and Rodney Cook Sr Park which were both in socioeconomically disadvantaged areas. During observational visits, there was a noticeably low number of visitors at both these park locations, despite the many means of accessing it. Therefore, there is some support for the hypothesis that parks located within highly socioeconomically disadvantaged block groups have equitable access but face more physical and social barriers to usability, which directly impede their use.

Grove Park experienced issues like deterioration of amenities, litter accumulation, neglect of facilities management as well as safety concerns impeding the overall usability of the park which negatively impacted its use. Observations in Grove Park highlighted concerns about safety, dissatisfaction with amenities, and overall neglect of facilities management, which likely deterred

community members from utilizing the park as it was initially intended. Safety and maintenance concerns were further evidenced by responses in the survey as well as the little attendance by visitors to the park. Anecdotes from the survey underscore areas needing improvement such as desires for updated park equipment to ensure safety, as well as concerns about the lack of shade, cleanliness, and amenities. These sentiments align with observations made during the study, where deficiencies in amenities, maintenance, and cleanliness were noted.

The original design of Grove Park was clearly aimed at building community bonds and encouraging socialization among community members. Perhaps at one time it was the focal point of the neighborhood. Community gardens are generally meant to bring people together while actively engaged in a common activity. Similarly, the free library was meant to encourage sharing of likes and interests through literature. It is not clear when these features began to degrade in quality as the state of the community garden was poor at the start of my study and remained in the same degraded state throughout. What is clear is that the usability of the park has declined in recent years and that has had a major impact on park use. The apparent closure of the Recreational Center may also have played a role as children and adults using the Recreational Center could have easily accessed these amenities. One promising observation was the relatively small but noticeable improvement to the park's play structure and parking lot. This could signal that the City of Atlanta is working to restore at least some of the park's original features that will hopefully increase usability. Until then, the readily accessible park appears to remain in a state of underutilization due to the many barriers to usability.

Similarly, Rodney Cook Sr Park also faces many challenges to the park's usability such as graffiti, litter accumulation, debris-filled pathways, abandoned homes, as well as evidence of alcohol use. These barriers directly impeded the use of parks by community members. More importantly, survey responses expressed concerns about personal safety, dissatisfaction with amenities, and overall park cleanliness. The barriers observed likely contributed to the low number of visitors observed during the observational period. Despite these challenges, there was positive user feedback regarding specific amenities and features which indicates that efforts to address barriers could contribute to overall user satisfaction.

It is worth mentioning that Rodney Cook Sr Park was modeled after Old Fourth Ward, the most vibrant and attractive park that I surveyed. The similarities between the two are somewhat clear. Both are relatively accessible, offer unique amenities that cater to the surrounding population, and incorporate water features that double as storm water management strategies. There is clear evidence around Rodney Cook Sr park of active gentrification. New houses are being built in place of the older abandoned homes and the park user demographics, despite being predominately black and high disadvantage, are seemingly more diverse. It is not hard to imagine that a similar gentrification process took place around Old Fourth Ward when it was first conceptualized so it may just be a matter of time before improvements to the usability barriers uncovered at Rodney Cook Sr Park are warranted to support the gentrifying population. Until then, it would seem that although the park can be easily accessed, the usability remains a strong barrier to overall park use.

Springvale Park was unique in that it was arguably the most community-centric park. It exhibited few barriers to usability which primarily stemmed from maintenance issues. Despite observed maintenance barriers, there were typically multiple families present in the park during my observations. Springvale Park boasts many positive aspects like a shaded area, diverse recreational amenities, and incorporation of natural features contributing to its overall appeal and usability. Being situated in one of Atlanta's first suburbs there was clearly an eye toward providing

the residents with some natural green space to escape the concrete jungle of city life. While slightly smaller than the other parks, it felt the most natural. The original landscape of the area was clearly preserved, especially in the southern portion of the park that had meandering hiking trails in an otherwise natural ravine. Access was somewhat limited, which prevented people from outside the immediate area from easily accessing it. Overall, the limited access but higher usability contributed to its community feel and likely garnered a higher vested interest from the surrounding community, contributing to the limited number of barriers to usability and overall higher use.

Old Fourth Ward Park presented a surplus of contributions to both access and usability, outweighing the challenges such as limited parking and noise pollution. The park's amenities, well-maintained infrastructure, and safety measures contributed to its overall appeal and functionality. Evidence that the presence of diverse amenities and effective maintenance practices contributing to positive park usability was confirmed by the park user survey. Parks with fewer barriers and more contributions, Springvale Park and Old Fourth Ward Park, experience higher levels of park usage and satisfaction among visitors which was confirmed by the park user survey. Positive survey responses and a high number of coded photos showcase the abundance of contributions in Old Fourth Ward Park as well as the higher user satisfaction.

In general, the results suggest that parks situated in socioeconomically disadvantaged areas may face equitable access but encounter numerous physical and social barriers to usability which impedes the effective use of parks. There seem to be two processes at play and both have to do with how a park evolves over time. First, the provision of a park in a community that changes over time may lead to less interest as new community members move in or as the original park's users move out. The apparent closing of the Recreation Center in Gover Park, along with turnover in the surrounding houses may have contributed to the slow decline in use of the community garden, which further contributed to declines in usability. Second, the installation of a park within a community that is already established may result in less interest in maintaining the features. This may be the case with Rodney Cook Sr Park the relatively new park in an area that is disadvantaged and actively undergoing a demographic and economic shift may contribute to less interest in using it by either demographic group. Without the use, there won't be any calls to keep it maintained which will eventually lead to a decline in the amenities and the accumulation of trash, debris, and other illicit activities (graffiti and drug use). Thus, this area is left with a highly accessible park but an increasing number of barriers to usability. These findings are consistent with broader principles of environmental justice that emphasize the need to address not only access discrepancies but also urban park quality. To ensure inclusive recreational opportunities for all community members, it's essential to integrate environmental justice frameworks into park planning. Targeted interventions, such as improving maintenance practices and enhancing infrastructure emphasized in this study, are crucial steps in advancing environmental justice goals within urban parks.

### *6.2 The role of green infrastructure*

There is also support for the second hypothesis which posited that the implementation of green infrastructure within urban green spaces increases the usability as well as the accessibility of parks. Green infrastructure elements such as shaded areas, trees, stormwater retention basins, and bioretention cells contribute positively to the overall park experience and have the potential to provide relief from the effects of the urban heat island<sup>2</sup>. These improvements create a more pleasant environment for park users, thereby increasing the likelihood of increase park use as well as enjoyment. Findings in this study suggested that green infrastructure can enhance the usability

in parks. There were positive survey responses as well as a high number of elements within the photos that contributed positively to usability for both Springvale Park and Old Fourth Ward. The implementation of green infrastructure elements as seen in Springvale Park and Old Fourth Ward Park contributed positively to park usability by keeping park amenities free of flooding and shading areas to offer respite from the sun. The presence of green infrastructure like shaded areas with seating as seen in Springvale Park and Old Fourth Ward Park encourages users to stay longer increasing the park's usability which was observed in the frequent visits to the parks.

One of the key features of the green infrastructure of Old Fourth Ward Park is its stormwater management system, including a two-acre pond designed to capture and filter stormwater runoff from the surrounding areas. This system not only serves the purpose of preventing flooding of nearby neighborhoods but also creates an attractive amenity within the park. The addition of green infrastructure elements expanded the range of recreational activities available to its users. Visitors can now enjoy walking or biking along the park's trails, picnic in shaded areas, or relax by the water. By incorporating green infrastructure elements such as native plantings, tree canopy, and naturalized wetlands, Old Fourth Ward Park has enhanced the environmental quality within an urban landscape. The park's role as a green oasis in the city can be seen as it attracts a large number of visitors seeking respite from urban stresses.

However, the effectiveness of green infrastructure to increase usability does depend on various factors such as design and maintenance as evident in Rodney Cook Sr Park. In Rodney Cook Sr Park, the inclusion of green infrastructure features such as a stormwater retention basin and bioretention cells is intended to positively contribute to the park's environmental sustainability by improving stormwater management and water quality as well as positively impact park usability. Rodney Cook Sr Park has a large stormwater retention basin in the center of the park meant to showcase its sustainable design and prevent flooding of the local area. Along the paths encircling the basin are educational signs providing opportunities for visitors to learn about water conservation and environmental stewardship while fostering awareness and appreciation for ecological processes present in the park increasing park satisfaction. However, due to inadequacies in park management, debris-filled pathways can be observed which were further evidenced by survey responses expressing the need to clean up debris after rainfall. Conversely, Grove Park had very limited green infrastructure elements which could result in limited relief from the urban heat island effect and reduce overall park usability as noted by a survey respondent who said "*The barriers I have with the park is the lack of shade, so during hot days I will choose another park.*" This statement highlights the direct impact of green infrastructure on park use, particularly in the context of mitigating the urban heat island effect and enhancing park use.

This study reveals that while green infrastructure elements can improve a park's usability, the overall impact on park use is more constrained by maintenance practices. The findings of this study highlight the importance of equitable maintenance practices and importance of community engagement to ensure that all communities regardless of socioeconomic makeup can enjoy the benefits of green infrastructure provided in parks. This study also emphasizes the utilization of green infrastructure elements to improve park usability by making the park more functional, attractive, and accessible to its users.

### *6.3 Significance*

This study uses both quantitative and qualitative methodologies to explore strategies for promoting equitable park usability. It reveals that parks in socioeconomically disadvantaged areas often face more physical and social barriers to usability such as litter accumulation, deteriorating

amenities, abandoned buildings, neglect of amenities, and evidence of alcohol use. This contributes to less use of the park overall. The objective of the research is to encourage inclusive and resilient urban communities by assessing the impact of green infrastructure on park usability and highlighting disparities in park access and usability across different communities in Atlanta. The study also identifies spatial patterns in the distribution of barriers and contributions within parks which indicate the need for targeted approaches in park management. The research provides insights into the challenges and opportunities associated with urban park accessibility and usability, with implications for creating inclusive and resilient urban environments.

This study was intended to supplement, not supplant, the many individual voices and grassroots efforts that have been calling out and working to solve the many inequities and injustices in urban green spaces.

## **7. Limitations and Future Work**

### *7.1 Limitations*

Conclusions from this study are derived from observations and survey responses gathered during a specific period. However, it is possible that these findings may not reflect long-term patterns in park usage. Additionally, the study's results are based on a limited sample size, which was a deliberate decision to allow for an in-depth mixed methods comparative case study analysis of the factors influencing park usage within the chosen sample. The findings from this study cannot be generalized to a broader area outside of Atlanta, Georgia.

### *7.2 Future Work*

The results of this research emphasize the importance of implementing target management practice by the City of Atlanta to improve park usage. It would be beneficial to conduct a similar analysis over a longer period of time, examining the temporal effect on patterns of barriers impacting park usability and accessibility and how those patterns impact park use. For example, observing how use changes at the Rodney Cook Sr. park in relation to the gentrification could provide some interesting insight into the cycle of park usability and accessibility. It could also reveal the role that the local community has in keeping the park maintained. More vested interest in the park may result in more calls to the city to keep it maintained, therefore increasing its use. This same process could also be observed at Gove Park. Additionally, expanding the sample size to include different parks in different cities could allow for a more generalization of findings. Moving forward, I plan to reach out to the City of Atlanta Parks and Recreation office to address targeted areas of concern within the selected parks while also collaborating with stakeholders to ensure optimal outcomes for the communities of Grove Park, Old Fourth Ward, Vine City, and Inman Park.

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**Appendix A Master Table Results Across all Methodologies**

<b>Data Collection Methods</b>				
<b>Results</b>	<b>Parks</b>	<b>Observation Instrument</b>	<b>Park User Survey</b>	<b>NVivo</b>
<b>Barriers to Access</b>	<b>Grove Park</b>	Play area was blocked off. No Sidewalks around park. No Marta Stop. Limited parking at community Garden.	"Everything about this park needs improvement. it is completely inaccessible"	Out of 207 files 33 were identified as barriers to access. 15 photos were coded as blocked off. 10 photos were broken signs. 7 photos were abandoned buildings. 1 photo was coded as limited parking.
	<b>Old Fourth Ward Park</b>	Limited parking. Construction fence was surrounding portions of park for a few months.		Out of 153 files. 5 were coded as barriers to access. 2 were coded as limited parking. 3 were coded as broken sign.
	<b>Spring Vale Park</b>	Limited parking. Construction on apartments adjacent to park.		Out of 86 files 4 files were coded as barriers to access. 3 were coded as limited parking. 1 was coded as damaged sidewalk.
	<b>Rodney Cook Sr Park</b>	Limited parking. Abandoned Buildings nearby. Liquor store directly adjacent to park.		Out of 179 files 16 were coded as barriers to access. 4 were coded as limited parking. 10 were coded as abandoned buildings. 2 were coded as broken signs.

<b>Barriers to Usability</b>	<b>Grove Park</b>	Litter present. Evidence of alcohol use. Homeless persons inside the park. Broken Park furniture. Broken and dirty water fountain. Abandoned community garden. No stair/trail maintenance lots of debris from storms. Closed rec center. Free library was broken. 1 mural destroyed.	"Park equipment should be updated to ensure safe use." "The barriers I have with the park is the lack of shade, so during hot days I will choose another park." 3 out of 5 survey responses said they have concerns about their personal safety. 4 Survey responses rated the Park's play equipment as poor. 2 Survey Responses disagreed to the statement " This Park is normally clean"	Out of 207 files 99 files were coded as barriers to usability. 17 were coded as broken park furniture. 33 were coded as litter. 25 were coded as alcohol use. 9 were coded as unmaintained trails. 15 were coded as unmaintained facilities.
	<b>Old Fourth Ward Park</b>	Excessive noise in southern portion of park due to nearby traffic and construction. Trees very scattered throughout park. Large holes in shock absorbent play surfaces. Safety railing wobbling on 3 staircases. All Play structures have been faded severely by UV.	"Enforce no smoking policy, especially when it comes to illegal and offensive obnoxious smells."	Out of 153 files 46 were coded as barriers to usability. 5 were coded as alcohol use. 10 were coded as litter. 5 were coded as hostile infrastructure. 5 were coded as unmaintained trails or stairs. 4 were coded as limited shade. 2 were coded as broken lights. 8 were coded as graffiti. 7 were coded as broken park structure.
	<b>Spring Vale Park</b>	Non- Ada compliant pathways. Noise pollution from construction. Stairs leading down to park are uneven, have no railing, and have debris.	"Park clean-up of excessive leaves".	Out of 86 files 9 files were coded as barriers to usability. 1 was coded as graffiti. 6 were coded as unmaintained trails or stairs. 2 were coded as lighting.

	<b>Rodney Cook Sr Park</b>	<p>2 broken shade structures. Graffiti present. Large holes in play area. Dirty bathroom, no soap or paper towels. Occasionally completely closed. Removed mirrors. Homeless persons present in park. Unmaintained trails with lots of debris present. All benches contain hostile infrastructure. Very few trees.</p>	<p>"Things commonly used by visitors should be attended to more." "Making sure there is soap in the restrooms, clean restrooms, empty trash cans out." "Clean-up of sediment and loose debris where water flows"</p> <p>2 out of 6 Respondents reported concerns about their personal safety when asked Are there any barriers interfering with your enjoyment of the park.</p>	<p>Out of 179 files 94 were coded as barriers to usability. 15 files were coded as broken park furniture. 5 were coded as hostile infrastructure. 32 were coded as litter. 15 were coded as alcohol. 5 were coded as limited shade. 7 were coded as graffiti. 3 were coded as unmaintained facilities. 12 were coded as unmaintained trails or stairs.</p>
<b>Contributions to Usability</b>	<b>Grove Park</b>	<p>Trails. Tennis court. Murals. 3 sheltered picnic areas. Creek flowing through the park. Baseball field. Open field. 5-12 play area set with swings.</p>	<p>" I wish the park had artwork bathrooms." " A flower garden would be nice." 1 out of 5 survey responses recorded they enjoy the paths.</p>	<p>Of 207 files 41 were coded as contributions to usability. 4 files were coded as art. 3 were coded as covered shelters. 5 were coded as garden. 1 was coded as free library. 1 was coded as open field. 1 was coded as bike path. 5 were coded as benches. 5 were coded as playground. 6 were coded as picnic tables. 4 were coded as trashcans. 8 were coded as playground. 1 was coded as tennis court.</p>

	<p><b>Old Fourth Ward Park</b></p>	<p>Parks frequently monitored. Functioning, clean, maintained bathrooms. Splash pad. Skate Park. Toddlers play structure as well as 5-12 play structure. Dog park. Dog waste stations. Frequent Park events. Many landscaping features trees inside planters, new grass and tree planting. Boulders places along paths. Sculpture. Faux waterfalls. Big pond. Free library. Observation points over the pond. Many lights throughout the park. Open field. Artificial fountain in pond. Debris free pathways and stairs. Amphitheater. Operating water fountains.</p>	<p>6 of 8 Survey takers said they enjoy the parks walking paths. 7 out of 8 Survey responses agreed they feel safe in this park. 6 out of 8 Survey responses Agreed to the statement "This park is normally clean." 3 Survey responses rated the play equipment as "5-Very good" . 1 response rated the play equipment as "4-Good" 3 Responses rated the play equipment as "3-Acceptable".</p>	<p>Of 153 files 87 files were coded as contributions to usability. 9 of which were coded as art. 4 were coded as bathrooms. 15 were coded as benches. 1 was coded as dog park. 2 were coded as open field. 1 was coded as drinking fountain. 3 were coded as skatepark. 4 were coded as splashpads. 1 was coded for tables. 5 were coded as trashcans. 4 were coded as dog waste stations. 12 were coded as playground. 3 were coded as surveillance. 23 were coded as lawn maintenance.</p>
	<p><b>Spring Vale Park</b></p>	<p>Neighborhood watch. Much of the park area is shaded by trees. Sandbox. Lots of toys at the play area. Fairy wooden sculpture. Large wooden tree sculpture. Bocce Ball court. Ravine trail. Sandbox. 5-12 play structure. Litter free park. Large pond with artificial fountain. Bike racks. Outdoor connect 4.</p>	<p>The 2 survey takers for this park recorded they had no barriers impeding their use of this park. 2 Survey responded rated the park equipment as "4-Good".</p>	<p>Out of 86 files 48 files were coded as contributions to usability. 17 were coded as playground. 2 were coded as art. 3 were coded as open field. 2 were coded as dog waste stations. 9 were marked as proper signage. 3 were coded as benches. 12 were coded as landscaping. 3 were coded as surveillance.</p>
	<p><b>Rodney Cook Sr Park</b></p>	<p>Two sculptures. Mural on bathrooms and at basketball court. Occasional food trucks. 1 picnic shelter. Open field. Basketball court. Play areas for toddlers as well as ages 5-12. Surveillance cameras from ATL police. Walking paths over and around storm water pond.</p>	<p>4 out of 6 survey responses rated the park's play equipment as "4-Good"</p>	<p>Out of 179 files 60 were coded as contributions to usability. 4 were coded as art. 2 were coded as basketball court. 4 were coded as bathrooms. 9 were coded as benches. 2 were coded as bike racks. 2 were coded as covered shelter with tables. 1 was coded as open field. 1 was coded as splash pad. 15 were coded as playground. 6 were coded as proper signage. 3 were coded as lawn maintenance. 5 were coded as trashcans. 12 were coded as educational signs.</p>

<b>Contributions to Access</b>	<b>Grove Park</b>	YMCA Nearby and New school next to park. Neighborhood food pantry next to park.	3 out 5 Survey responses walked to this park. The other 2 got to the park by car	Of 207 files 29 were coded as contributions to access. 18 were coded as signs. 1 was coded as parking. 7 were coded as community resources near the park. 1 coded as e-scooters. 1 was coded as bike rack.
	<b>Old Fourth Ward Park</b>	E-Scooters and E-Bikes, Signs in Spanish and English. Designated Marta stops. Multiple points of entry all with bike racks. External path leading to ATL Beltline. Sidewalks surrounding park. Luxury apartments surround park.	5 out of 8 Survey takers walked to this park. 2 took the Marta and 1 got to the park by car.	Out of 153 files 29 files were coded as contributions to access. 1 was coded as bus stop. 9 were coded as bike racks. 6 were coded as scooters. 8 were coded as trails. 5 were coded as park signs.
	<b>Spring Vale Park</b>	Neighborhood signs, Community signs- Keep Springvale beautiful. Caterpillar club sign. E-Scooters. Historical homes and sites border the park.	1 Survey taker biked to this park the other came by car	Out of 86 files 24 were coded as contributions to access. 11 were coded as park signs. 3 were coded as community resources near park. 2 were coded as bike racks. 5 were coded as scooters. 3 were coded as trails. 2 were coded as parking spaces.
	<b>Rodney Cook Sr Park</b>	Lighting throughout the park is operating. Designated Marta stops. Sidewalks border entire park. Signs in Spanish and English.	3 Survey takers walked to this park 3 Survey takers drove	Out of 179 files 21 were coded as contribution to access. 1 was coded as a bus stop. 2 were coded as bike racks. 3 were coded as parking spaces. 12 were coded as scooters. 3 were coded as park signs.
<b>Green Infrastructure</b>	<b>Grove Park</b>	Trash trap. Riparian buffers.	"Better water drainage after heavy rains, and I wish it had a few more trees"	of 207 files 5 were coded as green infrastructure.

	<b>Old Fourth Ward Park</b>	Storm water retention basin. Solar panel light posts. Water wall with sculptural elements. Pine straw usage to prevent invasive species. Rain gauge.		Of 153 files 22 files were coded as green infrastructure
	<b>Spring Vale Park</b>	Riparian buffers		Of 86 files 5 were coded as green infrastructure.
	<b>Rodney Cook Sr Park</b>	Bioretention cells. Two-acre storm water pond. Educational signage from ATL watershed.	"More shaded options would be really helpful"	Of 179 files 8 were coded as green infrastructure.

*Appendix A Table 1 Master Table: Results Across different Methodologies*

## **Appendix- B Park Figures**



*Appendix B 1 Broken picnic table in Grove Park.*



*Appendix B 2 Deteriorating stairs leading to the picnic area in Grove Park*



*Appendix B 3 Liquor bottle next to park bench at Grove Park*



*Appendix B 4 Play areas at Grove Park completely blocked off*



*Appendix B 5 Outdated park fliers in community box in Grove Park*



*Appendix B 6 Dirty inoperable water fountain at Grove Park*



*Appendix B 7 Unmaintained stairs*



*Appendix B 8 Broken mural at Grove Park*



*Appendix B 9 Abandoned Community Garden*



*Appendix B 10 Broken Free Library at Grove Park*



*Appendix B 11 Abandoned planters and discarded free library at Grove Park*



*Appendix B 12 Broken bench in its new location at Grove Park*



*Appendix B 13 Wood with nails sticking out left behind by workers at Grove Park*



*Appendix B 14 Pathway in Springvale Park*



*Appendix B 15 Stairway in Springvale Park*



*Appendix B 16 Toys located in Springvale Park*



*Appendix B 17 Abandoned building in Rodney Cook Sr Park*



*Appendix B 18 Debris filled pathway at Rodney Cook Sr Park*



*Appendix B 19 Excessive Litter and Debris in Rodney Cook Sr Park*



*Appendix B 20 Large holes in shock absorbent play ground at Rodney Cook Sr Park*



*Appendix B 21 Graffiti in OFW*



*Appendix B 22 UV faded play structure at OFW*



*Appendix B 23 Large holes in play surface at OFW*



*Appendix B 24 Stormwater retention basin in OFW*



*Appendix B 25 Waterwall in OFW*



*Appendix B 26 Solar panel lights*

**Appendix C Park User Survey**



AUBURN UNIVERSITY

By Selecting "I agree" you consent to your responses being recorded and used for research purposes. You are also confirming you are at least 18 years of age.

- I agree
- I do not agree

What Park are you evaluating?

- Grove Park
- Rodney Cook  
Sr Park
- Springvale  
Park
- Old Fourth Ward Park

What is your gender?

- Male
- Female
- Non-binary
- Prefer not to say

What is your age?

- 18-20
- 21-30
- 31-40

- 41-50
- 51-60
- 61 and over

What is your race?

- American Indian/ Native American/ Alaskan Native
- Asian/ Asian American
- Black African/ African American
- Latino(a)/ Hispanic
- Native Hawaiian/ Pacific Islander
- White/ Caucasian
- Other:

Are you a Fulton County Resident?

- No
- Yes

Please provide your zip code

How far did you travel to get to the park?

- 0 to 1/4 Mile
- 1/4 mile to 1/2 mile
- 1/2 mile to 3/4 mile
- 3/4 mile to 1 mile
- More than 1 mile
- More than 5 miles

How did you get to the park?

- Walk
- Bike
- Car
- Marta
- Other

How often do you use this park?

- Daily
- Weekly
- Monthly
- Occasionally
- Rarely

Why do you visit this park? (select all that apply)

- Bring children
- Biking
- Event
- Sightseeing
- Skating
- Time with family/friends
- Exercise
- Fishing
- Play spots
- Relax
- Volunteer
- Walk dog
- Walking

Are there any barriers interfering with your enjoyment of the park?

- No barriers preventing enjoyment of park/recreation facilities
- Concern about traveling to/from the park/recreation facilities
- Excessive costs/fees
- Amenities do not match my interests
- Unaware of amenities
- Concern about my personal safety at parks/recreation facilities
- Lack of quality facilities near my home
- Lack of time

Have you ever participated in an event or organized program in this park?

- Never
- Rarely
- Sometime
- Often
- Always

If so which one(s) (if not applicable enter N/A)

When you visit the park do you or your children use the play equipment and/or courts?

- Never
- Rarely
- Sometime
- s
- Often
- Always

Please rate the condition of the play equipment or courts.

- 1-Very poor
- 2- Poor
- 3-Acceptable
- 4-Good
- 5-Very good

This park is normally clean.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

I feel safe in this park.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

Parks & Recreation staff are on site when you are here.

- Strongly Disagree
- Disagree
- Neither agree nor disagree
- Agree
- Strongly agree

What amenities in this park appeal to you? (Select all that apply)

- Available parks staff
- Bathrooms
- Benches/ Table
- Children's play equipment
- Children's splash pad

- Cleaning/litter removal
- Dog park
- Drinking fountain
- Gardens and Flowers/  
Community Garden
- Accessible for all abilities
- Lighting
- Paths
- Public art
- Recreation/
- Sports programming
- Security
- Signage
- Skate park
- Sports courts/ fields
- Lawn maintenance
- Track
- Tree planting
- Shade Structure
- Water feature
- Tree Canopy
- Other

Please note any ideas for improvement to parks features, design, services, or programming.

Please provide your email to receive your incentive.