

A MIXED-METHODS GEOSPATIAL APPROACH
TO MODEL COMMUNITY VALUES, DEVELOPMENT, & ECOSYSTEM SERVICES
IN SOUTHEAST ATLANTA, GEORGIA, USA

By

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(Under the Direction of Marguerite Madden)

ABSTRACT

This dissertation examines how green spaces and urban development affect Southeast Atlanta's neighborhoods, faced with economic pressures, environmental vulnerability, and development interest. The study models land-use conflict and facilitates sustainable urban planning for at-risk neighborhoods in the South River Forest (SRF) Vision Area using quantitative geospatial analysis and qualitative community insights. Landscape changes and land use suitability are evaluated from the perspectives of local residents, developers, and ecosystem service planners using high-resolution satellite imagery, geospatial data, and a Land Use Conflict Identification Strategy (LUCIS) model. An

annual time series of PlanetScope imagery from 2018 to 2024 showed significant green spaces in regions under development pressure. A survey conducted by the Atlanta Regional Commission (ARC) and meetings of the South River Forest Coalition (SRFC) provided nuanced insights into residents' displacement, development, and environmental justice concerns. The LUCIS model identified stakeholder conflict and alignment for conservation and development. A mixed method approach uses remote sensing, socio-economic data, and community input to create a model that addresses Southeast Atlanta's urban planning needs and advances environmental justice. The findings emphasize the importance of collaborative, data-driven decision-making for equitable urban development, green infrastructure, and cultural and environmental preservation in historically marginalized neighborhoods.

INDEX WORDS: *Environmental Justice, Urban Greening, GIS, Remote Sensing, Southeast Atlanta, Mixed Methods*

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CHAPTER 1

INTRODUCTION

1.1 Summary

Approximately 82% of the world's population lives in cities, a figure projected to increase worldwide by 2.4 billion by the year 2050 (United Nations, 2018). In the U.S. alone, 83% of the people live in urban areas, a steady rise from the 65% estimate in the 1950s (United Nations, 2018). This project investigates the implications of urban greening and development on the residents of neighborhoods in Southeast Atlanta from the perspectives of three driving stakeholders: community, developers and ecosystem services. It emphasizes the importance of equitable access to green spaces and the potential challenges of green gentrification. While some argue there is a need for increasing green spaces within cities, the consequences of adding parks, natural areas, and green infrastructure on the long-time residents of these areas must also be considered.

Green gentrification addresses the negative impacts of green infrastructure developments, such as parks, greenways, and land sustainability projects, on the residents of local neighborhoods (Anguelovski et al., 2019; Gould & Lewis, 2016). Therefore, it is essential to develop methods that monitor urban landscapes and incorporate multiple perspectives, including those of communities, developers, and ecosystem services, into urban planning. This consideration of values from the different stakeholders aims to find nature-based, tangible solutions that create healthy and

economically thriving environments while minimizing the negative consequences of urban greening on local communities.

Integrated geospatial technologies such as remote sensing, photogrammetric techniques, and geographic information systems (GIS) can be used to develop detailed digital geodatabases and perform geospatial analyses to quantify and model changes in urban landscapes. Qualitative methods, including local government reports summarizing in-person surveys and discussions with local community organizations, lead to a stronger understanding of the unintended negative consequences and social vulnerabilities related to urban greening. The integration of quantitative and qualitative methods in a mixed methods approach is, therefore, best for modeling scenarios of future development, neighborhood integrity, and green space preservation in urban environments.

1.2 Introduction

Most African American communities in south Atlanta are especially vulnerable to recent economic pressures, increased attention from developers, and trends in gentrification (Spikes et al., 2024). This includes neighborhoods in Southeast Atlanta with significant urban planning potential but which, until recently, have remained relatively unaffected by the surrounding real estate boom. For urban planners, understanding trends in land use and land cover (LULC) changes, development, and the sentiments of local residents is essential for designing green spaces and development that reflect community values and priorities. To understand the current challenges in Southeast Atlanta, examining the historical and structural inequities faced

by predominantly African American neighborhoods, especially concerning housing and environmental justice, is crucial.

Reports from 2018 and 2019 by Perry and Harshbarger reveal how discriminatory practices like redlining—marking Black-populated areas on maps with red ink to discourage mortgage lending during the late 20th century—resulted in the devaluation of assets in Black neighborhoods and segregationist federal housing policies in the U.S. Consequently, homes in predominantly Black communities are now undervalued by an average of \$48,000 per property, amounting to a national loss of \$156 billion (Perry & Harshbarger, 2018). Meanwhile, a 2022 study by Boyce, published in the Atlanta Journal-Constitution, found that Atlanta ranks as the fifth most overpriced housing market in the U.S., with homes priced at a 55.96% premium over the national average (Boyce, 2022). This surge in housing prices has intensified residential development pressures and accelerated the gentrification of Black neighborhoods.

Overpriced homes and undervalued Black communities raise significant concerns about equitable access to housing. These challenges are further compounded by the disproportionate risks from environmental hazards faced by communities of color, who make up more than half of those living near hazardous waste sites. As urban expansion encroaches upon historically marginalized neighborhoods, environmental justice concerns become even more pressing (Berberian et al., 2022). This research integrates environmental justice by focusing on "green gentrification," evaluating the impacts of urban greening initiatives in these undervalued neighborhoods. It incorporates quantitative geospatial data analysis and qualitative survey methods, including local resident perceptions and government reports, into GIS models such as

the Land-Use Conflict Identification Strategy LUCIS Model. The model aims to balance urban planning with environmental injustice and can help to address issues of inequity in Southeast Atlanta (Carr et al., 2007). Two illustrative examples described below demonstrate the consequences of greening developments in the study area.

In the context of this dissertation, 'mixed methods' refers to an integrative research approach that combines quantitative geospatial analysis with qualitative survey insights (Elwood, 2010). This approach enables a nuanced exploration of green gentrification and urban greening in Southeast Atlanta by encompassing numerical measurements, spatial mappings, and community narratives. Integrating quantitative and qualitative data provides a holistic perspective, allowing for deeper insights into community values, environmental justice, and development impacts that would be difficult to achieve through one methodology alone. Through this approach, the research aims to highlight the multi-dimensional implications of urban greening, ensuring that development aligns with the community's needs and values.

1.2.1. Two Case Study Illustrating Southeast Atlanta Green Space Threats

An example that highlights the multiple perspectives surrounding access to green spaces, city utility uses, and advocates' concerns over land use is an area in Southeast Atlanta known as "The Prison Farm." This area of urban forest decay exemplifies an abandoned city property left for nature to reclaim and is now gaining public exposure over newly proposed development. During the span of this research, from 2018 to 2024, various interest groups have initiated protests in the area by occupying the forest and building barriers and fortresses to express their concerns over proposed development and political policies. For example, City of Atlanta used land in this area towards the

construction of a potential shooting range and emergency training facility for the Atlanta Police Facility has created conflicts among the local community and environmental activists (Akbar, 2023). The movie industry has also expanded its studios into this urban forest area.

This research examines how the public interacts with the landscape (Figure 1.1) and documents current development and green spaces in the disputed area of the former Prison Farm. The study considers three primary stakeholder perspectives: local residents, development, and the environment. It aims to assess the environmental and social implications of the proposed development while exploring sustainable land use strategies that weigh into urban greening, development, and community values within Southeast Atlanta's rapidly changing landscape.



Figure 1.1: Photos of public interaction in community green spaces of Southeast Atlanta.

Left to right: Raised vegetable beds of a community garden, researchers walking along foraging trails, and tables in a community gathering area.

A second illustrative case centers on proposed development in the South River Forest (SRF) vision area, a green space expansion initiative in Southeast Atlanta. Encompassing approximately 1,416 hectares (3,500 acres) of forest, wetlands, and rivers across Fulton County and a part of Southwest DeKalb County, this is one of the

most ambitious green space projects in the Atlanta Metro area. The South River, identified as one of the top 10 “most endangered rivers of 2021” due to inadequate pollution controls, stands as one of the “last remaining green spaces in the [Atlanta Metro] area” (American River, 2021).

In response to the growing concerns over development pressures on this valuable ecological asset, local residents and environmental advocates joined forces to form the South River Forest Coalition (SRFC), a group committed to preserving and protecting public green spaces within the region. The proposed conservation area includes a mix of city-owned, private, commercial, and industrial properties, highlighting the complex nature of landownership and use in the region. Although a small portion of the land within the SRF is in the public domain and includes parks highlighting artistic installations, it has not been considered essential to protect until recently (Figure 1.2).

The SRF example warrants an opportunity to understand community attitudes towards green spaces. This research captured these perspectives by analyzing existing community survey data, attending SRFC meetings, and participating in local events and festivals. These engagements helped identify the most important characteristics of a protected green space that meets community interests. Figure 1.2 features examples of artistic installations within these green spaces, illustrating one aspect of the community's engagement with and attachment to the SRF.

By documenting and analyzing these sentiments, this study explores how various stakeholders—residents, developers, and environmentalists—perceive the proposed developments within the SRF area. These insights provide a foundation for informed

decision-making that prioritizes sustainable development, aligns with community values, and enhances conservation efforts in Southeast Atlanta.



Figure 1.2: Artistic installations in and around the South River Forest parks.

Knowledge gained from these examples of urban greening case studies directly informed the Land Use Conflict Identification Strategy (LUCIS) model, a geospatial model designed to identify areas of conflict and alignment among community, development, and ecosystem service perspectives in Southeast Atlanta (Carr et al., 2007). By integrating data from satellite, aerial, and UAS (Uncrewed Aerial Systems) imagery, ground-based observations, street views, prior surveys, and demographic datasets, the model offers a comprehensive view of urban landscape changes, pinpointing the primary drivers and impacts of these transformations. The LUCIS model provides a dynamic framework where stakeholders can iteratively adjust multiple criteria, yielding a nuanced understanding of land suitability and potential conflicts.

The LUCIS model ultimately serves to prioritize areas with high potential for urban greening and development while preserving essential community values and ecosystem services. By incorporating criteria relevant to key stakeholders, the model

enhances awareness of land-use conflicts and aligns green development with the specific environmental and social goals of Southeast Atlanta's communities.

Geospatial modeling techniques are often used to rank geographic space according to concepts such as suitability for a particular purpose, risk, or vulnerability. The same model can be adapted to reflect the perspectives of parties with different views addressing a common phenomenon. This is accomplished by selecting appropriate map data, identifying criteria, and ranking their importance, whether through the lens of a local community member, a developer, or an urban planner aiming to increase ecosystem services with green spaces. Therefore, The LUCIS model enables a deeper understanding of the linkages and conflicts among local, social, economic development, and ecosystem service perceptions and opinions around green spaces (Carr et al., 2007).

Beyond its foundational application, recent studies have expanded and refined the LUCIS model. Jing et al. (2021) enhanced it by incorporating a multi-objective suitability evaluation approach, which utilized spatial analysis techniques and decision-making tools such as the Analytical Hierarchy Process (AHP) to effectively weigh multiple conflicting land-use objectives. Zhou et al. (2021) extended the LUCIS application to address urban construction space expansion scenarios, specifically integrating detailed ecosystem service valuations into the assessment to accurately measure environmental trade-offs and prioritize conservation efforts alongside development pressures. Additionally, Amidipour (2017) applied the model in a distinct geographical context, employing GIS-based spatial analysis to prioritize land-use

decisions and manage conflicts in Kohgiluyeh and Boyer-Ahmad Province, demonstrating the model's adaptability to diverse regional planning challenges.

Ultimately, the LUCIS model ties factors contributing to developing green spaces with considerations from the community to create a prioritization map showing areas best suited for greening and development, preserving local community values and ecosystem services. The LUCIS framework goes beyond classifying land as suitable or unsuitable, providing stakeholders with a geospatial tool that allows for iterative adjustments to multiple criteria and offers a nuanced perspective on land suitability.

1.3 Study Area

1.3.1 Southeast Atlanta Neighborhoods

Atlanta's neighborhoods share similarities with many across the U.S., where demographics, economic status, education, access to amenities, and levels of civic engagement in urban planning shape community identity. As early as 1984, Ahlbrandt et al. highlighted the connection between neighborhood well-being and the surrounding environment. This relationship has since become a topic of significant discussion. Southeast Atlanta's neighborhoods, however, hold unique historical and cultural value as some of the country's oldest predominantly African American communities, with sites dating back to the late 1870s (Martin, 2007).

With a 51% African American population, Atlanta surpasses New York City, where the African American population stands at 35.5% (U.S. Census, 2010). Recent studies have focused on the impacts of green gentrification in African American

neighborhoods in Southwest Atlanta, highlighting the evolving challenges and opportunities in these areas (Jelks et al., 2021).

The 1,416.4 hectares study area for this research is located approximately 2.5 miles south of downtown Atlanta. It encompasses the South River Forest and Southeast Atlanta's predominantly African American neighborhoods that are bounded by major highways, including I-285 to the east, I-20 to the north, and I-85 to the west (Figure 1.3). Close to the Hartsfield-Jackson Atlanta International Airport, the world's busiest airport, this area largely consists of forested residential neighborhoods that have experienced several demographic shifts.

Initially established as African American communities in the late 1800s, these neighborhoods transitioned to predominantly white working-class areas during the 1930s and 1940s, influenced by their proximity to manufacturing hubs (City of Atlanta, 2021). However, from the 1960s to the 1980s, a trend of white residents moving from city centers to suburban areas reversed this demographic shift, restoring a predominantly African American community. Economic drivers such as extensive trucking services, airport-related industries, and the burgeoning film industry have significantly transformed these neighborhoods and contributed to the pressures of green gentrification impacting Southeast Atlanta (City of Atlanta, 2021).

In examining Southeast Atlanta, this study offers insights into how these economic, social, and environmental forces converge, shaping the area's land-use dynamics. The LUCIS model facilitates analysis of these interactions, supporting urban planners and policymakers as they seek to balance community priorities, sustainable

development, and the preservation of cultural and ecological assets in this historically rich and evolving region.

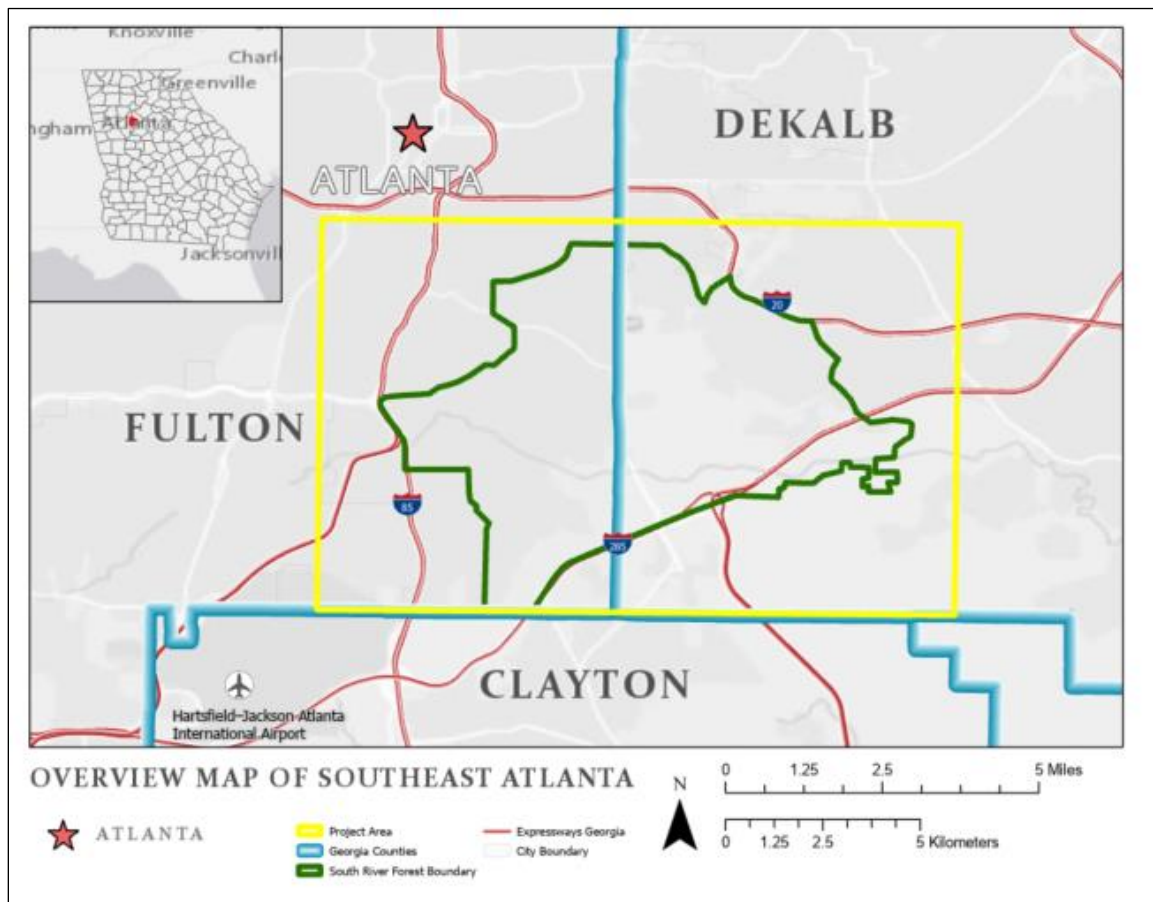


Figure 1.3: Overview map of the study area in Southeast Atlanta.

The study area spans both Fulton and DeKalb counties, covering 7,913 hectares. These conditions are essential to understanding how the area's urban development is shaped. The former Prison Farm and the South River Forest Coalition (SRFC) study areas are discussed below.

1.3.2 Land Use in Southeast Atlanta

Land use in Southeast Atlanta is shaped by three primary categories: industrial, residential, and green spaces. Each of these components plays a distinct role in influencing urban growth patterns in the region. Figure 1.4 illustrates the spatial

arrangement of these land uses, with green corridors like the Atlanta Beltline serving as connectors between various parts of the community (Atlanta Beltline Inc., 2016).

Industrial Land Use:

Southeast Atlanta has a significant industrial and developer presence, driven in large part by the trucking sector and proximity to major transport routes.

Industrial areas provide economic opportunities but also pose environmental challenges, impacting nearby residential neighborhoods and green spaces.

Residential Land Use:

Residential areas in Southeast Atlanta are largely comprised of private homes, reflecting a mix of single-family residences and multifamily community developments. The demographic makeup in these neighborhoods highlights a predominantly African American community with deep historical roots. As economic pressures and gentrification trends increase, these residential areas are faced with the dual challenge of preserving community identity while accommodating inevitable urban development.

Green Spaces:

Green spaces in Southeast Atlanta include parks, recreational areas, and reclaimed properties that have been overgrown with vegetation. These areas offer essential ecosystem services, including flood mitigation, temperature regulation, and recreational benefits for residents. Scattered throughout the industrial and residential zones, green spaces are integral to the quality of life in Southeast Atlanta, providing both environmental and social value.

Understanding the interplay of these land use categories is essential for managing urban growth in Southeast Atlanta. Multivariable models, like the LUCIS model, allow for the assessment of how factors such as land use, demographics, public opinion, and environmental impact interrelate. By applying such models, stakeholders can develop informed strategies that balance development needs with community and ecological considerations.

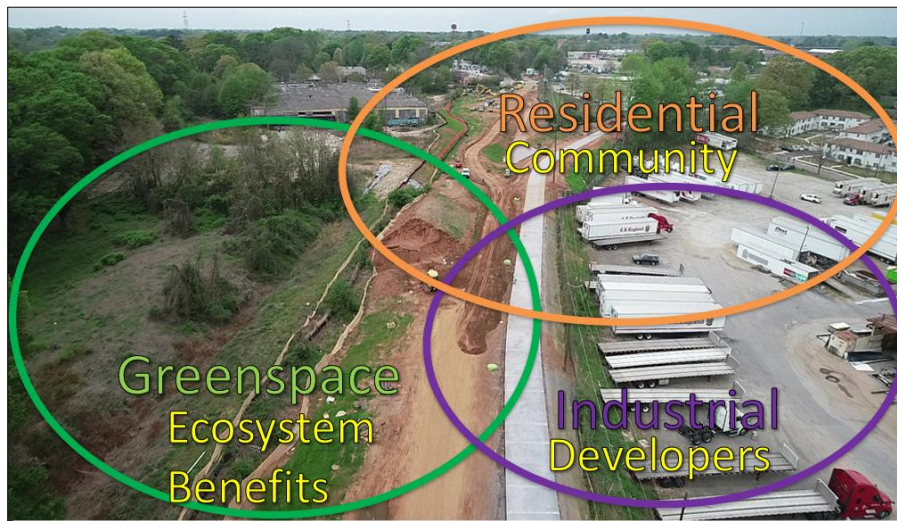


Figure 1.4: Southside Trail looking west toward Allen Avenue in early April 2021.

This photo, courtesy of Astra Group (Urbanize Atlanta, 2022), demonstrates three factors that influence the landscape of urban development in Southeast Atlanta. Residential/community land use is visible in the far upper right corner, industrial/developers to the right, and reclaimed green space/ecosystems to the left.

1.3.3 South River Forest and Surrounding Community

The Atlanta City Design Project is an ambitious study that addressed the rapidly growing Atlanta Metro population and surrounding communities (SRFC, 2023). The plan was released in 2017 and designated a massive 1,416-hectare (3,500-acre) area within the South River Watershed in Southeast Fulton County and Southwest Dekalb County

as the South River Forest (SRF). SRF is a critical green space in Southeast Atlanta that plays a pivotal role in maintaining the water quality of the South River, which flows into Jackson Lake and connects with the major rivers of the Altamaha Basin, ultimately reaching the Atlantic Ocean (Figures 1.5 and 1.6). Located across Southeast Fulton and Southwest Dekalb counties, the SRF serves as a valuable ecological and community resource. However, as a noncontiguous green space, it remains vulnerable to development pressures, with much of the land surrounding the South River lacking protection from future urban expansion (SRFC, 2023).

The South River Forest Coalition (SRFC) Vision Area (Figure 1.7), a 1,416 hectare (3,600-acre area), identifies essential locations that are key to preserving the SRF's ecological integrity and supporting community goals. These areas include the South River itself, nearby parks, Lake Charlotte, and various public and private properties that could form a connected network of green spaces. The SRFC vision emphasizes the forest's potential to substantially benefit Atlanta's residents, including floodplain restoration, habitat expansion, recreational spaces, and forest preservation. These ecological and community benefits form the foundation of SRFC's land use strategies, which prioritize sustainable development that supports public health, enhances local economies, and provides recreational opportunities.

By focusing on the conservation and enhancement of the SRF, the SRFC aims to preserve a crucial green infrastructure that supports both environmental sustainability and community well-being. This vision reflects a broader commitment to creating a balanced urban landscape that benefits Atlanta's residents while maintaining the ecological health of one of the area's last significant green spaces (SRFC, 2023).

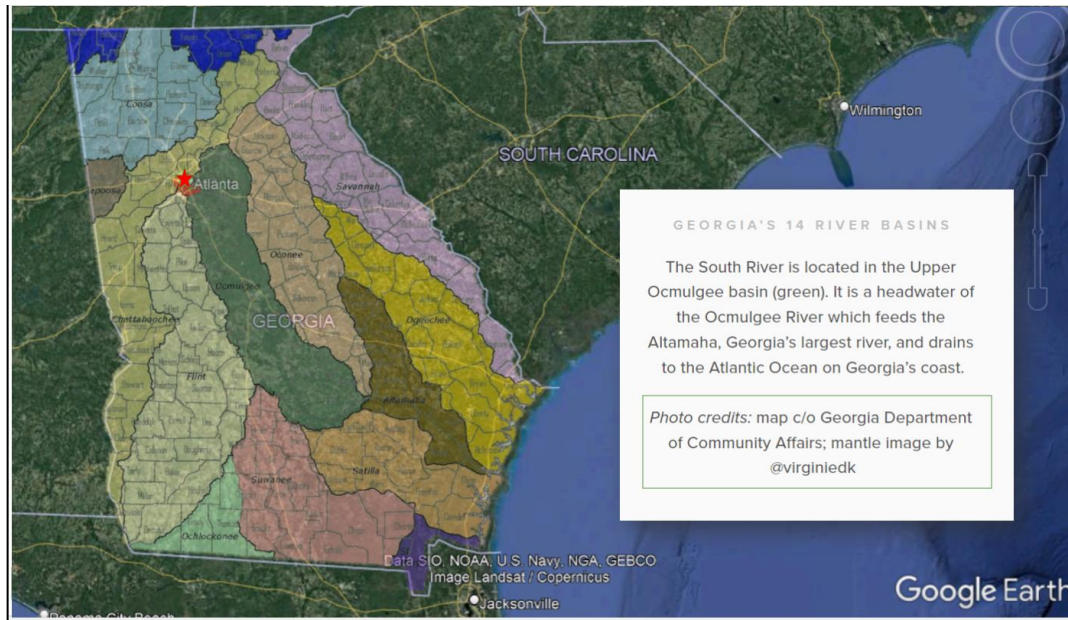


Figure 1.5: Location of Atlanta in proximity to major watershed systems in Georgia.

Hydrologic Unit Code-7 (HUC 7) map displaying the location of Atlanta in proximity to major watershed systems in Georgia. The headwaters of the South River begin at the upper Ocmulgee Basin, then channel through the Altamaha Basin and into the Atlantic Ocean (SRFC, 2023).

The headwaters of the South River are in the Southeast Atlanta metro area that stretches across two counties, Fulton and DeKalb. During the early 19th century, the river provided water to cotton fields. The same land was then converted into residential and business zones. While the original red clay soil is highly productive for agriculture, its fertility has been significantly compromised due to erosion, the heavy influence of industrial development, and residential use, resulting in a largely altered landscape (Wheeler, 2021). This interconnectedness highlights the importance of considering broader regional impacts and management strategies when addressing land use and environmental concerns within the South River Watershed.

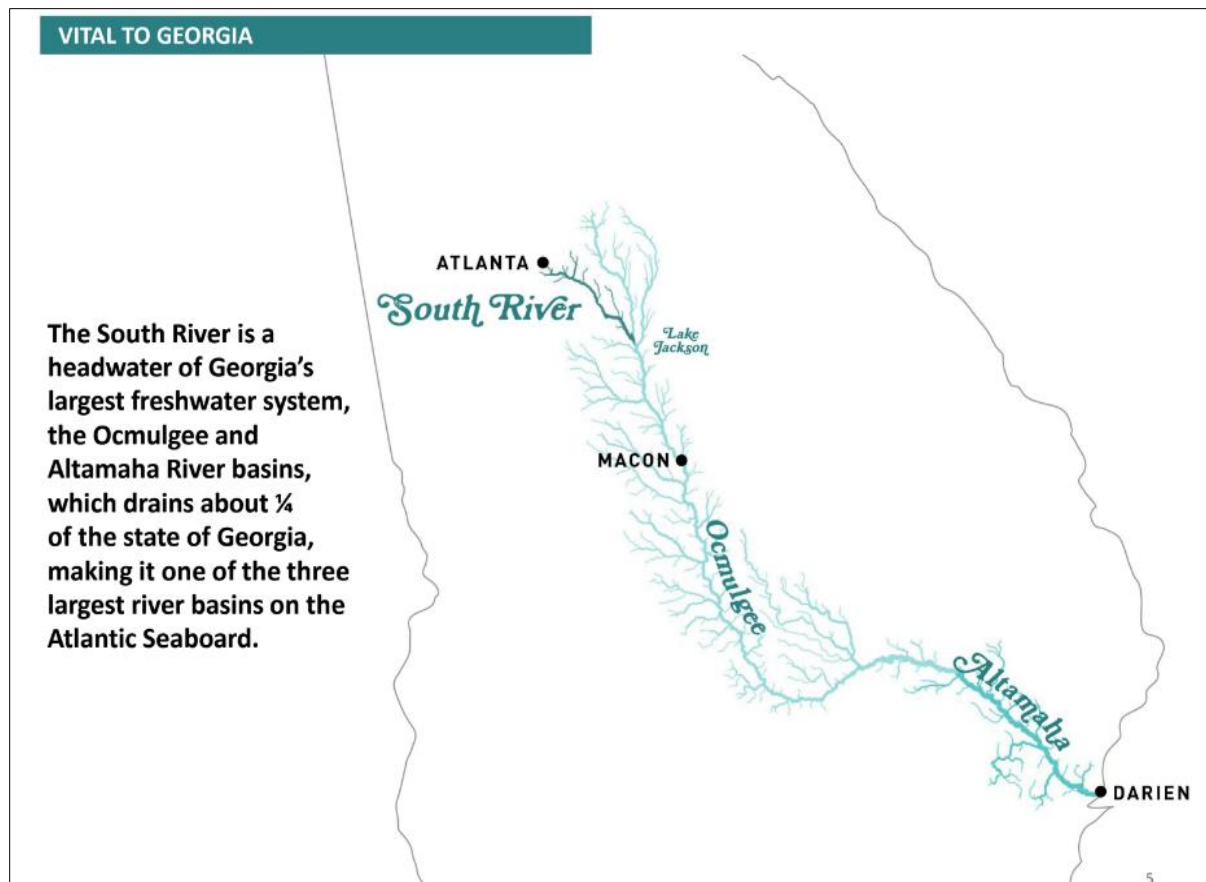


Figure 1.6: Map of the Southeast Atlanta study area.

The Southeast Atlanta study area is located at the headwaters of the South River Watershed and influences water quality of the South River, a major tributary to the Jackson Lake Reservoir that continues to the Atlantic Ocean (SRFC, 2023).

The noncontiguous green space to the south of the South River is much less developed than the other parts of the Atlanta City center. However, these lands are also unprotected from future development (SRFC website, 2023). This study area shares the same boundary proposed by the SRFC and includes key locations within the South River Forest (SRF) that are crucial to realizing its envisioned future. During the 1990s, several Green Planning Opportunities for the SRF were proposed, as mapped in Figure 1.7. Despite these efforts, the SRF area has been a host to several Atlanta dump sites for many years, and the condition of the sites varies greatly. The map created by the

South River Forest Coalition (SRFC) represents the interactions of different stakeholders, such as public and private landowners of developed and undeveloped lands.

Key locations in the SRF include:

- Skyhaven Quarry
- Moreland Bridge Park
- South Moreland Landfills
- Water Treatment Plant Woods & Cemetery
- Old Prison Farm
- Honor Farm
- Intrinchment Creek Park
- Gresham Park
- Sugar Creek Golf Course
- Soapstone Ridge
- Constitution Lakes
- Lake Charlotte
- Hutchens Road Park
- Atlanta Southside Sports Complex
- Browns Mill Food Forest

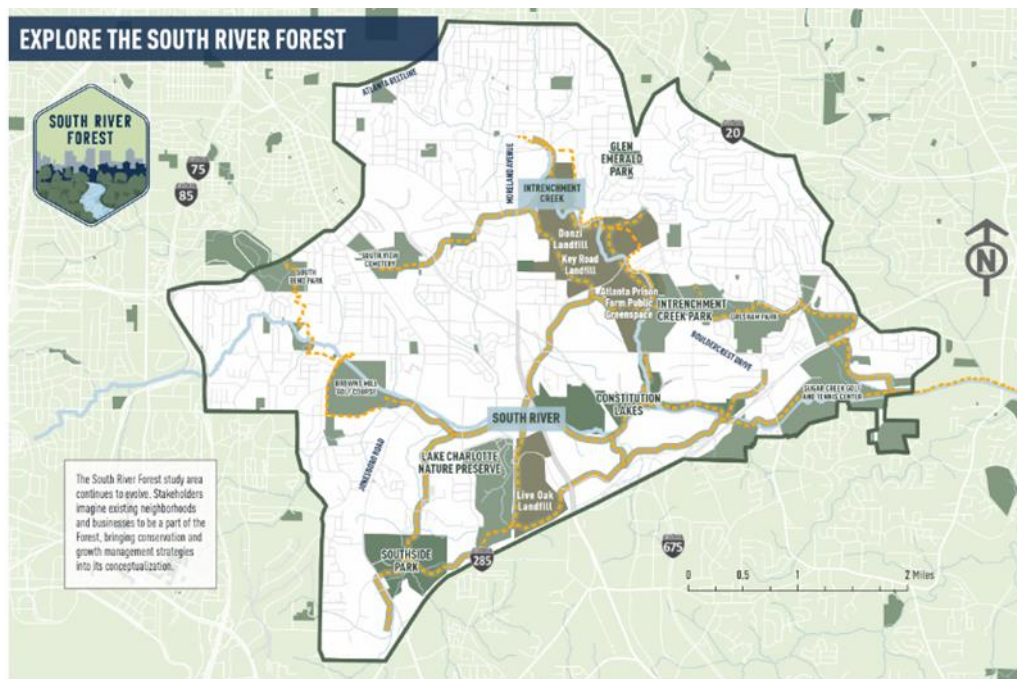


Figure 1.7: Proposed South River Forest Vision Area.

The South River Forest Vision Area is a proposed area made of green space and connected hiking trail planning opportunity zones identified by the South River Forest Coalition. This map displays the zones relative to neighborhoods, transportation routes, and forest areas. Source: SRFC (2023).

The South River Forest (SRF) area includes several historically and ecologically significant sites, such as Skyhaven Quarry, Moreland Bridge Park, Gresham Park, and Sugar Creek Golf Course (Figure 1.7). These locations hold not only environmental value but also cultural and historical significance, adding layers of meaning to land preservation efforts. Atlantans see this place as an opportunity to connect with nature in ways that benefit public health and well-being, physical activity, and economic development. It also offers several environmental benefits, including floodplain restoration, habitat expansion, recreation use, and forest protection. The SRFC considers these benefits when prioritizing land use strategies for conservation and development. Among these, the site of the former Prison Farm stands out for its historical associations and its role as a focal point in the debate over urban development versus environmental conservation.

1.3.4 The Former Prison Farm and Its Controversy

Located within the study area for this research, which also overlaps with the South River Forest Coalition (SRFC) Vision Area, the Prison Farm served as an active correctional facility from 1945 until 1995. Since its closure, the site has largely been left to natural reclamation, allowing forest and vegetation to gradually take over, as seen in the drone-acquired orthomosaic image below (Figure 1.8). The Prison Farm is one of the key focal locations examined in this study, both for its ecological potential and its central role in current land use controversies within the SRFC Vision Area. However, recent proposals by the City of Atlanta to transform parts of this land into a police and emergency responder training facility, controversially named "Cop City," have ignited considerable opposition from environmentalists, community activists, and concerned

residents. This proposed training facility has raised alarms among activists who argue that the planned development will lead to severe environmental degradation, including increased pollution, heightened flooding risks, and substantial forest loss. The proposed police facility has also been met with broader concerns around social justice and environmental impacts, making the land a symbol of the tensions between urban expansion and the preservation of natural spaces. Furthermore, the site holds historical artifacts, such as marble stones from the demolished Carnegie Library in downtown Atlanta, which once rested within the landscape, adding a unique historical layer to the environmental narrative of the Prison Farm (Figure 1.9). These remnants have become symbols for activists and preservationists, who view the land as a place where history and nature intersect, making the forest an area worth protecting (Figure 1.10).

The opposition to the development has been underscored by organized protests, including the establishment of makeshift treehouses by forest advocates who aim to physically block the encroachment. These protestors have occupied the area in an effort to prevent further development, emphasizing their belief in the ecological and cultural value of the forest that they perceive as under threat from what they call "destructive urban development."

Figures 1.8 and 1.9 provide a visual record of the Prison Farm's landscape before any new construction, captured through drone imagery. This imagery, combined with the historical significance of the land, highlights the stakes in the ongoing debate around land use in Southeast Atlanta. The Prison Farm's unique blend of historical importance, natural beauty, and social symbolism make it a focal point in discussions about the region's environmental and urban future.



Figure 1.8: Aerial photos of Prison Farm and man-made lakes in leaf-off conditions.

A) – Drone-acquired orthorectified image mosaic of the Prison Farm and man-made lakes in leaf-off conditions taken in early spring 2022. B) Phantom Pro 4 drone flown by Katie Butler - Founder, GeoLiteracy, LLC.



Figure 1.9: The former Carnegie Library in downtown Atlanta.

The former Carnegie Library in downtown Atlanta was taken around 1910. Although this building no longer exists, fragments from the rock pillars and structure can be found in the urban forest within Southeast Atlanta. Photo credit: <http://historyatlanta.com/carnegie-library-stones/>



Figure 1.10: a) Stone remains of Carnegie Library; b) Defend the forest initiative; c) Abandoned structures of Prison Farm (Photo Credit Amanda Aragón)

A) - Stones that were formerly a part of the Carnegie Library but are now dismantled and moved to various locations across the former Prison Farm site, are referred to as Carnegie Stones. At the moment, they are located next to walking trails. B). "Defend the Forest" participants were seen living in improvised tree houses in various Prison Farm settings. Advocates of the forest to preserve the ecosystem stay in tree houses that can only be reached by climbing up ropes. Once inside, the climbers pull the ropes tight around themselves to create an enclosed space inside the tree fortresses. C) Abandoned structures scattered around the Prison Farm serve as a reminder of the area's history.

1.4 Literature Review

1.4.1 The Dual Impact of Urban Green Spaces - Benefits and Green Gentrification

The rapid population growth and urban expansion across the globe have presented substantial challenges for sustainable development, urban planning, and environmental justice. As early as 1988, Ehrlich and Ehrlich predicted in *National Geographic* that the global population would approach 8 billion by 2020—a forecast that proved accurate, with the population reaching approximately 7.33 billion by that time (Ehrlich & Ehrlich, 1988). This increasing urban concentration, especially within growing cities such as Atlanta, has intensified concerns around resource allocation, environmental resilience, and the diminishing availability of open space for natural vegetation and urban agriculture. The transformation of urban landscapes, often driven by infrastructure development, not only depletes open green areas but also heightens greenhouse gas emissions, exacerbating issues like climate change and urban pollution. In response, urban green spaces have gained recognition for their potential environmental and health benefits, becoming central to sustainable urban planning efforts (Wolch et al., 2014). However, the development of green spaces within densely populated urban areas has also produced unintended consequences (particularly for long-time residents), as seen in Atlanta, Georgia, and comparable cities globally.

While urban green spaces are generally viewed as valuable natural resources that contribute to a vibrant and sustainable city, their benefits are often unevenly distributed. Differences arise between those who travel to these areas to enjoy greenways and those who have traditionally lived in or adjacent to these transformed spaces. The positive and negative impacts of green spaces often correlate with the

income and socioeconomic status of local residents. Environmental gentrification is considered an ecological improvement of urban space that improves sustainability. However, it also leads to the movement of the inhabitants away from the transformed area due to a number of factors, such as speculative development, the increased value of land, homes, and businesses, and the resulting rise in prohibitive taxes.

This phenomenon has been widely recognized in the literature as addressing the consequences of the idea of the “green paradox: intrusions planned to decrease the differences in green space access led to the movement of the very inhabitants the very inhabitants the project was meant to advantage (Wolch et al., 2014). The influence that green space has on the nearby area is determined by who warrants, designs, develops, and funds the project, as well as its envisioned purpose and future developments. Researchers have offered various recommendations, from tangible policy changes to communal participation and a counter-narrative that challenges the typical dialogue around green sustainability.

Certain scholars have labeled the unintended consequences of adding green spaces to urban neighborhoods as eco-gentrification, environmental gentrification, or green gentrification (Checker, 2011). Improvements to parks and other green areas may make a neighborhood more appealing to modern perceptions and, in some cases, correlate with rising property values and taxes. When this occurs, it is critical to differentiate between green gentrification and other outside influences that may have a role in high land/building prices (Checker, 2011). Although green spaces can be a gentrifying influence in some situations, their effects vary depending on the urban setting. Thus, the seemingly creditable goal of increasing access to green space in low-

income neighborhoods can potentially displace the very people it is meant to benefit. As Pearsall and Anguelovski (2016) note, a wide range of interferences activate this same effect, like green space creation, park restoration projects, bike lane infrastructure, smart growth development, and the opening of “healthy” food stores.

Another example of neighborhood variation influenced by environmental clean-up is demonstrated by Gamper-Rabindran and Timmins (2011). They tested housing categorization and variations in neighborhood features in response to dangerous waste site cleanups using limited access to fine to medium-scale geographic data at the Census Block level. They found that clean-up relates to increases in population and housing unit density, upsurges in mean household revenue, and the number of college-educated residents. Additionally, the presence of green spaces and other forms of green infrastructure can drive gentrification by increasing property values, which can lead to increased housing costs and displacement.

One such example in Atlanta, as explained by Okotie-Oyekan in her 2021 article "An Analysis of Green Gentrification in Atlanta Georgia," is that despite the benefits of urban green space, Atlanta's Westside Park is causing gentrification and displacement pressures in Grove Park, a low-income African American community. She examined the conflict between green initiatives in Western and capitalist worldviews and place-keeping policies that support autonomy in marginalized communities (Okotie-Oyekan, 2021).

While urban green spaces generally contribute positively to the well-being of communities, they also have complex socio-economic impacts that can affect different groups in varied ways. These green spaces enhance urban environments by promoting

mental and physical health, providing ecosystem services, and improving overall quality of life. However, access to these spaces and the ability to benefit from them is often unequal. Research by Wolch et al. (2014) reveals that the availability and accessibility of green spaces often correlate with residents' income levels and socio-economic status, with wealthier communities more likely to experience the benefits of such spaces. In many cases, urban greening projects can inadvertently initiate a process known as "green gentrification," whereby improvements such as parks or bike lanes raise property values and attract wealthier residents, ultimately displacing long-time, lower-income residents.

This phenomenon, also referred to as "eco-gentrification" or "environmental gentrification" by Checker (2011), underscores the "green paradox": although green spaces are intended to improve quality of life, they often lead to rising costs of living that drive out the very people they were meant to benefit. This process has been observed in projects like park renovations, the introduction of eco-friendly facilities, and green transit options, which can significantly alter the character of neighborhoods. Pearsall and Anguelovski (2016) note that while these projects aim to address sustainability goals, they often disrupt local communities by escalating property values and rental prices, placing an economic strain on long-term residents.

These cases highlight a tension between green initiatives often aligned with capitalist-driven urban renewal and place-keeping strategies that emphasize community stability and equitable access. In Southeast Atlanta, where neighborhoods face similar vulnerabilities to economic shifts triggered by greening projects, it is essential to

address these socio-economic dynamics to avoid further marginalization of local residents.

1.4.2 Environmental Justice - Principles and Urban Implications

Environmental Justice (EJ) is an issue of international concern. “Environmental justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies” (EPA, 2013).

Environmental Justice is a social movement that supports the decision to strengthen environmental law to ensure equal access to the distribution of social goods connected to ecological freedom and rights to a healthy and safe environment. The authors of EPA (2013) point out that there has been extensive literature on social inequity in locations of hazardous zones in relation to the regions where low-income households and minorities receive less environmental protection than privileged groups. Throughout the text, several references are made to the urban segregation of communities by race and class, groups that are often the most vulnerable and politically misrepresented.

Environmental Justice research has also documented the progression of historical urban development, particularly in the context of modern metropolitan area transformations (Annunziata & Rivas-Alonso, 2018). For example, cities in the U.S. that have transitioned from their industrial roots to now primarily service or knowledge-based economies are often referred to as “post-industrial capitals.” Abandoned industrial buildings are sometimes renovated and occupied by wealthier residents moving into reclaimed industrial zones, leading to a demand for more green spaces (Newman et al., 2016, 2018). This research aims to address issues of urban land use change and

attempts to make cities more sustainable by monitoring green spaces while respecting the values of local residents, developers, and ecosystem services using integrated quantitative techniques and supportive qualitative survey methods.

Urban political scientists, political ecologists, urban planners, and urban geographers have all examined EJ and green gentrification, which is often tied to official policies of governing bodies and municipal authorities. For example, underprivileged residents and marginalized groups may be displaced from areas proximal to emerging green spaces as more affluent groups move in. While some of these changes may be unintentional, others appear to be explicit strategies for attracting commercial and residential investment toward urban renewal and promoting sustainable cities (Dooling, 2009; Quastel, 2009).

The literature on green gentrification also discusses an indirect kind of injustice, which is perceived as disturbing societal condition. Issues of EJ in urban settings might include constructing facilities that contribute to environmental pollution, homes and businesses built on formerly polluted sites, and impacts from residential areas adjacent to airports, busy highways, landfills, and low areas subject to stormwater flooding. Notably, these activities are disproportionately concentrated in neighborhoods with higher minority populations and lower socioeconomic status (Checker, 2011). The persistence of such inequities reflects the notion that both race and socioeconomic status shape the urban environment (Checker, 2011; Loughran, 2014).

In Southeast Atlanta, predominantly African American neighborhoods continue to experience the lingering effects of these discriminatory practices, facing challenges such as undervalued properties, exposure to pollutants, and limited access to high-

quality housing and green spaces. As green spaces and urban parks are developed in Southeast Atlanta under initiatives like the South River Forest (SRF) project, addressing these EJ concerns is imperative. Ensuring that green infrastructure does not inadvertently displace residents or further marginalize communities is essential to achieving equitable urban development.

1.4.3 Mixed-Methods and Geospatial Approaches to Understanding Community Perceptions

To fully understand the complex impacts of green spaces on diverse urban communities, this research utilizes a mixed-methods approach that combines quantitative and qualitative data collection. Elwood (2010) describes mixed methods as an integrative approach that blends statistical analysis with rich contextual information, allowing researchers to not only map the distribution of green spaces but also capture residents' lived experiences and perspectives. Quantitative methods, including geospatial analysis and GIS, are employed to assess land-use changes over time and measure shifts in urban green space access and use (Gong et al., 2016). Qualitative techniques, such as surveys and interviews, complement these methods, which gather residents' insights into how these green spaces influence their lives, neighborhoods, and overall well-being. This integrated approach is particularly relevant in places like Southeast Atlanta, where green spaces impact the physical environment and socio-economic structures.

In this study, community survey data collected by the Atlanta Regional Commission (ARC) for the SRF area serves as a critical source of information on residents' values and perceptions of green spaces. The ARC's 2022 survey found that

while many community members appreciate the benefits of green spaces, there are concerns regarding potential increases in property values and displacement pressures that may accompany green infrastructure projects. However, the survey data may have demographic limitations, as responses often underrepresent minority groups (ARC, 2023).

The ARC survey results, with their extensive dataset, are not only a testament to community engagement but also an invaluable asset for urban planning. They enable planners and policymakers to consider the voices of the community in tangible ways, ensuring that development plans align with the needs and desires of those most directly affected. This approach is in line with the principles of mixed methods research as it combines measurable data with the personal, lived experiences of the community, offering a comprehensive understanding crucial for informed decision-making in urban planning.

Qualitative methodologies, such as surveys conducted in local communities, provide opportunities for residents to voice concerns about proposed changes to their neighborhoods, discuss their needs, and share their vision of the future. Research demonstrates that community surveys effectively gather qualitative data on local perceptions and attitudes. For instance, Wolch et al., (2014) highlighted the role of surveys in capturing diverse community perspectives and knowledge on urban green spaces. Similarly, Anguelovski (2016) used surveys to explore resident experiences and perceptions concerning urban environmental changes, demonstrating how such insights can inform more inclusive and equitable urban planning strategies. The use of pre-existing surveys for gauging community sentiment toward urban green spaces is

particularly beneficial, not only for its cost-effectiveness but also for its potential to unearth the local perspectives that may otherwise remain concealed or unheard for years (Brown & Raymond, 2007).

The ARC survey results provide a large dataset of 1,800 responses reflecting the community's values and interactions with the local green spaces (ARC, 2023). Although these data are a valuable source of information for this study, it is essential to acknowledge the inherent biases of pre-existing surveys, including the one conducted for the South River Forest. These biases may be due to their methodology, respondent selection, and the framing of questions, which can influence the results and interpretations. Specifically, there are limitations in the representativeness of the ARC survey respondents to the community's demographics (ARC, 2023). While 80% of the ARC respondents identified as non-Hispanic white, 80% of the community residents in the South River Forest area are African American (ARC, 2023; U.S. Census Bureau, 2019). In addition, the respondents and residents differ in age and home ownership status (owners vs. renters).

By combining ARC survey insights with geospatial data obtained from remote sensing, this research leverages the Land Use Conflict Identification Strategy (LUCIS) model that Carr et al. (2007) developed. The LUCIS model integrates quantitative geospatial data with qualitative social input to analyze land use conflicts, providing a comprehensive understanding of green space distribution and its implications for Southeast Atlanta communities.

1.4.4 The Southeast Atlanta Context - Greening and Land Use Conflict

The South River Forest area exemplifies Atlanta's greening efforts by fostering urban green spaces that provide vital ecological benefits and enhance the local community's well-being. In meeting the needs of people for both nature and the cherished community values of Dr. Martin Luther King, Jr., the area supports a vision of a more sustainable and inclusive city. Dr. King lived, preached, and, before his reinterment, was buried in this area. During his lifetime, he passionately advocated for principles now recognized as diversity, equity, and inclusion (DEI). These principles not only enrich the community's social fabric but also drive environmentally responsible urban development and greening initiatives, ensuring that the benefits of a greener Atlanta are accessible and equitable for all residents.

1.4.5. Integrating Community Values in Urban Greening: Lessons from the South River Forest

The integration of green infrastructure into urban areas often sparks debates about its socio-economic and environmental impacts. Johnson Gaither et al., (2020) comprehensively analyze these dynamics, using Atlanta's South River Forest (SRF) as a case study to illustrate how divergent stakeholder values shape urban planning trajectories. Their work emphasizes the interplay between ecological conservation, urban development, and community values, particularly in historically marginalized areas such as Southeast Atlanta. This finding aligns with growing concerns about green gentrification, a phenomenon where introducing green spaces leads to rising property

values and displacement of low-income communities (Checker, 2011; Wolch et al., 2014).

Johnson Gaither and Aragón (2024) argue that while urban greening projects offer significant ecological and recreational benefits, they often fail to account for the socio-cultural priorities of historically marginalized communities, particularly those in majority black neighborhoods like those surrounding the South River Forest (SRF). Their study emphasizes that community values cannot be generalized or assumed by planners or environmental groups without meaningful and sustained participatory engagement. In the SRF case, many Black civic leaders supported economic development initiatives, such as park amenity improvements and a proposed land exchange for expanded movie studio space, because they saw them as opportunities to bring jobs, infrastructure, and revitalization to their communities.

This nuanced vision of urban futures where economic opportunity and conservation are not viewed as mutually exclusive challenges dominant environmental narratives and introduces a culturally grounded framework for green space planning. Johnson Gaither and Aragón (2024) stress that displacement and cultural erasure are not merely side effects of urban greening but are often structured into broader urban development paradigms that neglect Black agency and leadership. They advocate for planning models that recognize the right of Black communities to articulate and pursue their own visions for land, development, and environmental stewardship.

These insights align with the objectives of this study, which seek to balance community, ecological, and developer perspectives in urban greening initiatives through tools like the LUCIS model. By combining geospatial analysis with qualitative data, this

research mirrors the methodological approach Johnson Gaither and Aragón (2024) advocated to map areas of conflict and agreement among stakeholders. Such integrative approaches are essential to mitigate the adverse effects of green gentrification and promote inclusive urban planning (Anguelovski, 2016; Carr et al., 2007).

Ultimately, the work of Johnson Gaither and Aragón (2024) provides a valuable lens for understanding the complexities of urban greening in Southeast Atlanta, reinforcing the importance of integrating local values into green space planning and centering Black voices to strengthen the social relevance of urban greening efforts and enhance the long-term sustainability and community support. This perspective informs the research goals of this dissertation, emphasizing the role of mixed method approaches in achieving equitable and sustainable urban development outcomes.

1.4.6 Integrating Geospatial Technologies in Urban Planning

Recent advancements in geospatial technologies provide powerful tools for analyzing and addressing the complexities of green gentrification. Deng et al. (2016a) emphasize the role of geospatial analysis in understanding the socio-environmental impacts of land-use change, while Prakash et al. (2020) highlights the potential of Earth Observation (EO) tools, such as satellite imagery and drones, for monitoring urban sustainability.

This study uses geospatial data, including a time series of PlanetScope imagery, to track land use and land cover (LULC) changes in Southeast Atlanta. These data provide insights into how urban development intersects with ecological and social systems. By combining these quantitative methods with qualitative community input, this

research addresses the multifaceted impacts of urban greening on vulnerable communities.

1.4.7 Integrating Quantitative and Qualitative Methods for Urban Planning

As defined by Elwood (2010), mixed methods research refers to integrating both qualitative and quantitative research methods within a single study, often by 'thinking, doing, and asking in multiple ways.' This approach enhances the depth and breadth of understanding by combining numerical data (quantitative) with detailed, context-rich information (qualitative). Mixed methods offer a holistic view of urban planning, particularly in understanding the impacts of urban green spaces. They help to quantify aspects like the extent and distribution of green spaces (quantitative) while simultaneously capturing residents' subjective experiences and perceptions (qualitative) (Anguelovski, 2016; Wolch et al., 2014).

Quantitative methodologies such as geospatial analysis and GIS modeling provide objective tools for mapping land-use changes and quantifying green space distribution over time (Miller & Shaw, 2001; Gong et al., 2016). However, remote sensing and GIS data alone cannot capture the complex social dimensions of land use. Community surveys complement these approaches, enabling researchers to gather information on local perceptions, attitudes, and values toward land use and green spaces.

This integration of quantitative and qualitative methodologies in tandem offers a more holistic perspective of land use dynamics, capturing the landscape's physical changes and the sentiments of the community living within it (Tashakkori & Teddlie, 2021). Such approaches can inform models like LUCIS, providing them with a robust,

community-informed foundation for resolving potential land-use conflicts and suggesting sustainable urban planning solutions (Carr et al., 2007).

The LUCIS model itself is rooted in ecological principles, particularly those outlined by Eugene Odum in his seminal work "The Strategy of Ecosystem Development" (Odum, 1974). Odum's work, which discusses ecological succession, provides a foundational understanding of how ecosystems develop and change over time, offering valuable insights into managing and resolving conflicts between human activities and natural processes.

Building upon these ecological principles, Margaret Carr and her colleagues at the University of Florida further developed the LUCIS model. Their work expanded Odum's concepts into the realm of land use planning, integrating ecological understanding with geospatial analysis and urban planning principles. This integration allowed for a nuanced examination of land use conflicts and potential resolutions, particularly in urban settings where the interactions between natural and built environments are complex and dynamic.

A 2020 study by Prakash et al. (2020) discusses the importance of *Earth Observations*, such as satellite and drone imagery, for monitoring urban sustainability and assisting city leaders in decision-making over the next decade. The study found that more informed decisions could be made with greater precision and improved data. Additionally, there has been growing recognition that land-use change is a fundamental driver influencing ecosystem services (Dengb et al., 2016; Prakash et al., 2020). Many researchers have investigated how land-use diversity affects ecosystem processes (Abram et al., 2014; Li et al., 2016; Wang et al., 2017). In this study, Earth Observations

in the form of satellite-based images are used to monitor changes in land use, including natural vegetation, urban development, residential neighborhoods, and green spaces.

In Southeast Atlanta, city planners' greening initiatives have resulted in a surge of natural areas, preserves, and green spaces on both public lands and private lots. Recent additions to the region's green landscape include the South River Gardens Nature Preserve and Lake Charlotte. These officially designated green areas were realized through concerted efforts between local communities, policymakers, and environmentalists to promote urban greenery and provide residents with accessible natural spaces (ARC, 2023). Green spaces offer numerous benefits to urban residents, particularly for mental health and well-being. For example, walking in natural areas is considered a restorative activity due to its self-reported calming and beneficial effects. According to interviews conducted by Bornioli et al. (2018), perceptions of sustained attentiveness are cultivated by walking because it encourages introspection and feelings of revitalization. The study's participants perceived walking as "relaxing" and "stimulating." One participant stated that his midday stroll helped him feel peaceful and improved his overall psychological response.

Incorporating the LUCIS model in this research offers a sophisticated framework for analyzing land use changes in Southeast Atlanta's urban green spaces. By overlaying geospatial data with input from community surveys, the model helps identify areas where community interests, urban development, and ecological conservation may align or conflict. This approach is crucial in developing strategies that balance ecological integrity with urban development and community needs. Table 1.1, adapted from McQuarrie's (2023) master thesis, presents different land use scenarios with their

corresponding LUCIS codes, indicating varying levels of preference or suitability from the perspectives of community, developers, and ecosystems. This adaptation draws from a table in Carr et al., (2007) adapted from “The Strategy of Ecosystem Development” by Odum (1969). The table demonstrates how the model synthesizes diverse data inputs to highlight areas of agreement and conflict, guiding decision-making in urban areas.

Table 1.1: A Table developed by Master Thesis student McQuarrie (2023) demonstrates a comparison of Odum’s Work in “The Strategy of Ecological Development”.

Odum’s Classifications	Odum’s Classifications Definitions	LUCIS Classification	Private/Public Ownership
Productive	Succession is continually retarded by human controls to maintain high levels of productivity	Agriculture: Lands that produce food, fuel, and fiber	Mostly private lands
Protective	Natural areas, where succession is allowed or encouraged to proceed into the mature and thus stable, if not highly productive stages	Conservation: Environmentally significant lands	Public ownership for conservation purposes and private lands where future development is constrained by easement or deed restriction
Compromise	Some combination of the first two stages exists		
Urban/Industrial	Biologically non-vital areas	Urban: Lands that support relatively intense human activity like residential commercial and industrial uses	Privately and publicly owned lands for reasons other than conservation

Therefore, combining geospatial methodologies with community surveys provides a robust and multifaceted approach to studying land use changes. This combined approach facilitates a comprehensive understanding of urban green spaces'

physical, social, and cultural dimensions, which is essential for informed urban planning and policymaking.

1.5 Objectives

This research examines the impacts of green space creation and development on local communities within Southeast Atlanta, focusing on urban parks and conservation areas, such as the South River Forest (SRF). Using a mixed-methods approach that integrates geospatial and qualitative analyses, this study aims to quantify landscape changes and capture local community values and perspectives. High-resolution satellite imagery and local survey data support the development of a geospatial model to inform sustainable land use planning in key Southeast Atlanta neighborhoods, especially those within Fulton and DeKalb Counties. The study investigates areas like community gardens and the SRF to offer insights that can guide future urban planning efforts.

By employing the Land Use Conflict Identification Strategy (LUCIS) model, this study addresses multiple stakeholder perspectives of local residents, developers, and planners focused on the conservation of green spaces—on neighborhood character, development, and ecosystem services in Southeast Atlanta’s green spaces. The research includes the following three objectives,

Objective 1: Quantitative Remote Sensing of Land Use/Land Cover (LULC) Changes

The first objective involves implementing a remote sensing approach to assess LULC changes within the Southeast Atlanta study area, particularly in neighborhoods affected by urban development and green space expansions. This objective quantifies the physical and ecological characteristics of LULC changes while analyzing their

impacts on local residents. Through the platform ArcGIS Pro, this study sources high-resolution image data at 3.7m-spatial resolution from PlanetScope satellites to assess annual LULC changes from 2018 to 2024, and systematically classify land cover into distinct categories, including Water, Forest, Bare Earth, Impervious/Developed, and Buildings.

A key methodological aspect in this research is using ArcGIS Pro's Change Detection Wizard, which allows for a structured pixel-by-pixel comparison between classified land cover datasets during this period. The analysis first employs an unsupervised classification approach using the Iso Cluster algorithm, followed by a reclassification process to refine classification accuracy. The study then employs a categorical change matrix to quantify land cover changes, identifying key trends such as urban expansion, vegetation loss, and shifts in land use stability.

Objective 2: Qualitative Assessment of Community Perspectives

The second objective captures local perspectives on development and green space expansion in Southeast Atlanta. Community perspectives are crucial as they may not align with developers' or planners' objectives for urban aesthetics, services, and ecosystem benefits. This research utilizes data from the 2023 Atlanta Regional Commission (ARC) survey, which reflects resident opinions on outdoor recreation, neighborhood character, and development concerns. Analyzing ARC survey responses reveals the community's views on the potential drawbacks of green space creation, such as increased taxes and possible displacement risks.

Engagement with the South River Forest Coalition (SRFC) through monthly meetings further enriches the understanding of community values and motivations,

especially among those who actively advocate for the preservation of this significant forested area. By combining insights from the ARC surveys, SRFC discussions and voices of Black civic leaders, this research captures a comprehensive view of local sentiments, ensuring that community values are well-represented in the subsequent geospatial models.

Objective 3: Multi-Criteria Geospatial Modeling with LUCIS

The third objective builds on the insights from Objectives 1 and 2 to develop a multi-criteria geospatial model to analyze land use conflicts within Southeast Atlanta, particularly in the SRF area. Due to competing priorities among community, development, and conservation interests, the LUCIS model, developed by Carr et al., (2007), maps stakeholder values, including those of residents, developers, and planners focused on maximizing ecosystem services. This model assesses landscapes through physical, economic, social, and ecological parameters, enabling a balanced approach to urban planning.

The LUCIS model integrates geospatial data with stakeholder feedback to define criteria for physical terrain, LULC, urban characteristics, and community concerns. Each stakeholder group's criteria are weighted based on preferences derived from ARC survey data and additional community input. The model's suitability maps visually represent areas in Southeast Atlanta where stakeholder perspectives align or conflict. These maps highlight zones of high, medium, and low suitability for various perspectives, offering a comprehensive view of socio-economic and environmental factors shaping urban green space planning in the area.

1.5.1 Significance of Integrated Approaches in Southeast Atlanta

This research provides a multifaceted understanding of green space and development impacts on Southeast Atlanta's communities by combining quantitative remote sensing, community-based qualitative assessments, and multi-criteria geospatial modeling. The LUCIS model framework enables visualization of potential conflicts or synergies among residents, developers, and environmental advocates. This study not only highlights where these groups' interests align or diverge but also equips policymakers with actionable insights for fostering sustainable urban environments that respect both ecological integrity and community needs. Through this model, stakeholders can explore a range of solutions for balanced urban growth that promotes environmental justice, supports community well-being, and aligns with Southeast Atlanta's long-term planning goals.

1.6 Chapter Structure

The following chapters explain the methods used to address the entirety of this project, combining remote sensing with local community insights to evaluate the impacts of greening and urban development in Southeast Atlanta. Chapter 2 examines annual changes in LULC to assess trends in urbanization and increased green space on residential neighborhoods within the study area, and Chapter 3 focuses on evaluating community and residential stakeholder perspectives for input to the Land Use Conflict Identification Strategy (LUCIS) model. Chapter 4 creates and implements a robust geospatial urban planning framework in the form of the LUCIS model to identify areas of conflict and synergy from the three stakeholder perspectives. Chapter 5 presents a

synthesis and discussion of the integrated findings, reflecting on the implications for urban planning, environmental justice, and future research. A list of abbreviations is provided in Appendix A. Appendix B contains the full land use classification breakdown. Appendix C includes supplemental maps and model outputs supporting the analysis.

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CHAPTER 2

REMOTE SENSING AND LAND COVER ANALYSIS OF SOUTHEAST ATLANTA'S
GREEN SPACES

Aragón, A.D. and Madden, M. To be submitted to a peer-reviewed journal.

Abstract

Land-use change has significantly reshaped city landscapes globally, presenting opportunities and challenges for communities in sustainable and ecologically driven urban development. This chapter explores the spatial and temporal changes in vegetation and urban land use/land cover (LULC) in Southeast Atlanta. Using multi-temporal remote sensing data, we examine the spatial and temporal dynamics of urban expansion, vegetation loss, and the effects of greening initiatives annually from 2018 to 2024. High-resolution PlanetScope data with a 3.7-meter pixel size and four spectral bands were analyzed using Esri ArcGIS Pro. Unsupervised classification techniques and change detection were performed to quantify landscape transformations and enable a robust analysis of urban development and ecological changes in the study area. This method provides a data-driven understanding of the environmental impacts of the encroachment of urban development into previously vegetated areas and underscores the pressures faced by urban ecosystems and residential neighborhoods (Anguelovski et al., 2019; Baptista & Mendes, 2021). This phenomenon is evident in rapidly expanding metropolitan areas like Southeast Atlanta, where urban development intersects with critical ecological areas. Understanding and managing these land-use changes are essential for maintaining ecosystem services, promoting environmental resilience, and maintaining neighborhood integrity in urban settings (García-López & Ruiz, 2018; Newman & Kenworthy, 1999). Findings reveal a measurable decline in forested green space (−7.4%) and a corresponding increase in impervious surfaces (+5.6%) across the study period, with the highest rates of change occurring near major transportation corridors and in the vicinity of proposed development zones like the

Prison Farm and Lake Charlotte. These results provide a spatial foundation for later modeling in geospatial modeling and underscore the ongoing pressures facing ecologically and socially vulnerable landscapes in Southeast Atlanta.

2.1 Introduction

2.1.1. Remote Sensing of Neighborhood Changes and Green Spaces

The rapid expansion of urban areas has raised concerns about the balance between development and environmental preservation. This study analyzes the spatial and temporal changes in vegetation and urban land use/land cover (LULC) in Southeast Atlanta, Georgia—a metropolitan region in the Southeastern United States, located approximately 150 miles inland from the Atlantic Coast and serving as the capital and most populous city in the state. The research focuses on understanding the evolving dynamics of green spaces and built environments within this rapidly developing urban landscape. Checker (2011) explains the paradoxical way that "green" initiatives, which are intended to make cities more livable, can cause displacement of residents in lower-income areas. At the same time, the historical injustices that amplify the risks in African American communities living in close proximity to recently constructed green corridors are highlighted by the social vulnerability framework put forth by Cutter et al. (2003). For instance, Pearsall and Anguelovski (2016) documented how New York City's greening strategies inadvertently contributed to socioeconomic inequities, where the most vulnerable communities experienced heightened displacement risk. Comparable results are observed in other cities, including São Paulo, where urban greening initiatives focused on ecological restoration have resulted in heightened housing prices in

communities that can no longer afford to reside in the neighborhoods, thereby exacerbating social inequalities (Baptista & Mendes, 2021). Anguelovski et al. (2019) provide additional examples from Barcelona, explaining that neighborhoods historically marked by socioeconomic marginalization face intensified pressures from green gentrification, further deepening inequity and exclusion.

Southeast Atlanta has experienced significant land-use transitions characterized by increased urbanization and strategic greening initiatives designed to enhance environmental quality. However, these initiatives have raised concerns regarding their unintended consequences, notably green gentrification, where environmental improvements contribute to rising property values and displacement pressures on long-term, lower-income residents (Dooling, 2009; Pearsall & Anguelovski, 2016).

Addressing these dynamics necessitates comprehensive research that amalgamates ecological evaluations with qualitative methodologies and social vulnerability assessments to guarantee equitable and sustainable urban planning results (Denzin & Lincoln, 2011; Cutter et al., 2003). Integrating remote sensing results with evidence of social vulnerability and environmental justice, these findings from prior studies emphasize how land-use decisions disproportionately affect historically marginalized communities (Annunziata & Rivas-Alonso, 2018; Anguelovski, 2016). Similarly, areas of Atlanta are experiencing significant vegetation loss due to development projects, such as the controversial police training facility, locally known as "Cop City". Direct concerns for community health and ecological sustainability are coupled with efforts for justice and equitable access to environmental rights (Gant, 2022).

This research aims to use remote sensing techniques to monitor changes over time in urban development, neighborhoods, and green space distribution in Southeast Atlanta, leveraging a time series of high-resolution PlanetScope satellite imagery. By capturing annual LULC data for seven years from 2018 to 2023, the study provides a comprehensive view of how urban sprawl, targeted greening efforts, and environmental pressures have shaped the urban landscape. By exploring these intersections between urban development and ecological change, the study contributes essential knowledge to ongoing discussions on sustainable urban ecosystems and community development strategies around social vulnerability (Gibbs & Kruger, 2007; Hedrick, 2011).

Due to the detailed and dynamic nature of urban land cover changes in this rapidly evolving landscape, existing national-scale land cover datasets such as the National Land Cover Database (NLCD), derived from Landsat imagery, were insufficient due to their coarse spatial resolution (30 meters) and limited temporal detail (provided by the U.S. Geological Survey every 2 years). Instead, PlanetScope satellite imagery, characterized by its high spatial resolution of approximately 3.7 meters and frequent revisit times of near-daily global coverage, was utilized to capture more precise and timely assessments of urban land use and land cover (LULC) transformations. The high-resolution orthomosaic base maps derived from PlanetScope imagery (Planet Labs Inc., 2025) allowed for detailed identification and quantification of urban features, vegetation cover, and impervious surfaces, making it particularly advantageous for monitoring urban dynamics at the neighborhood scale.

2.1.2 Study Area

The study area for this analysis covers approximately 1,416.4 hectares (3,500 acres) within Southeast Atlanta, spanning portions of Fulton and DeKalb Counties, Georgia, USA (Figure 2.1). This region, situated approximately 4 kilometers (2.5 miles) southeast of downtown Atlanta, is defined by major transportation corridors, including Interstate 20 (I-20) to the north, Interstate 285 (I-285) to the east, Interstate 85 (I-85) to the west, and Moreland Avenue as a significant north-south connector (Atlanta Regional Commission, 2022). The South River originates within this urban landscape, flows southeastward to connect with major rivers flowing to the Atlantic Ocean, and forms a critical ecological corridor that significantly influences Atlanta's land cover patterns (South River Watershed Alliance, 2021).

Southeast Atlanta has experienced rapid population growth and urban expansion, reflecting broader trends across the metropolitan Atlanta area. Its population increased by approximately 15% between 2010 and 2020, making it one of the fastest-growing urban regions in the United States (U.S. Census Bureau, 2019). The climate is humid subtropical, characterized by hot summers and mild winters, with an annual average rainfall of approximately 1,250 millimeters (49 inches), influencing vegetation growth and urban heat dynamics (NOAA, 2022).

This area is ecologically and socially significant due to its diverse residential neighborhoods, industrial zones, and essential green spaces, including Inntrenchment Creek Park, Glen Emerald Park, Constitution Lakes, Lake Charlotte Nature Preserve, Urban Food Forest at Browns Mill, Gresham Park, and the historically important Atlanta Prison Farm site (Atlanta BeltLine, Inc., 2022; City of Atlanta, 2024). These green areas

serve essential ecological functions, including habitat provision and recreation, and mitigating urban environmental issues such as flooding and heat island effects (Baggett, 2019).

Figure 2.1 provides a detailed visualization of the study area, highlighting key landmarks, parks, landfills, and transportation infrastructure.

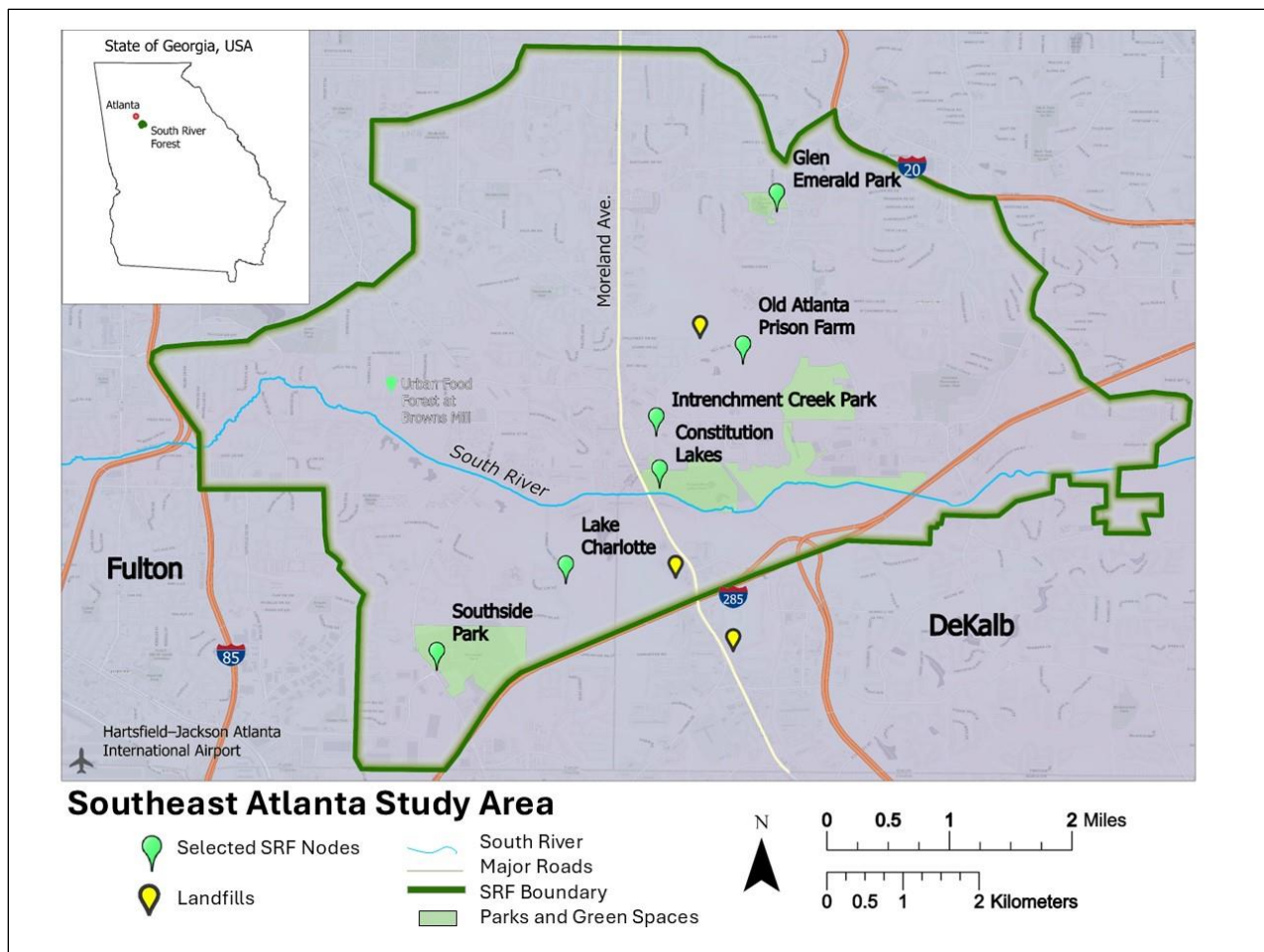


Figure 2.1: Visualization of Southeast Atlanta study area.

Visualization of Southeast Atlanta study area with major roads, rivers, green spaces, landfills, and urban developments. This map includes the boundary of the South River Forest Vision Area and critical South River Forest (SRF) nodes as landmarks to help identify locations of land use and land change.

2.2 Methods

2.2.1 Satellite Imagery Acquisition and Land Cover Classification Using PlanetScope

PlanetScope imagery, offering a 3.7-meter resolution with a near-daily revisit potential through a constellation of over 100 small satellites. Quarterly, monthly, biweekly or weekly basemaps were utilized to document vegetation and urban developments within the Southeast Atlanta study area (see Figure 2.1). An orthomosaic of cloud-free images, acquired during peak summer months, captured maximum vegetation greenness and provided the necessary data to analyze trends in green space loss, growth, and urban encroachment (Figure 2.2).

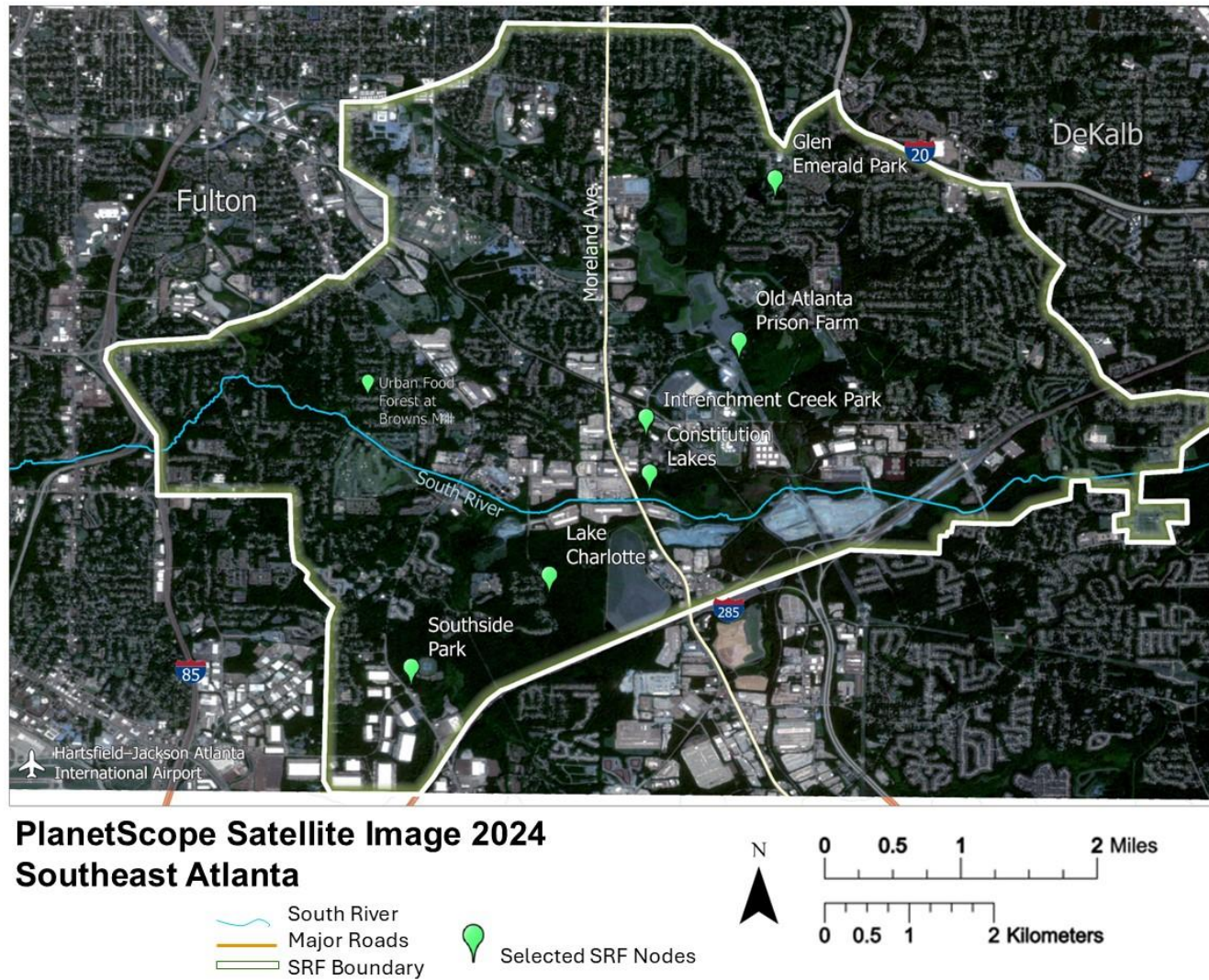


Figure 2.2: 2024 PlanetScope Satellite Image of Southeast Atlanta Study Area.

2.2.2 Vegetation and Urban Land Use/Land Cover (LULC) Inventory

This study utilizes a time series of annual high-resolution PlanetScope satellite imagery to document changes in vegetation and built environments. A LULC classification is first deployed to identify and map land use over a 7-year period, followed by change detection to assess the temporal differences in land use. The images allow us to analyze how urban sprawl, and greening efforts have affected the landscape, particularly the changes between green spaces and developed land. The methodology encompassed three primary components: (1) land use and land cover classification, (2) accuracy assessment, and (3) change detection analysis.

Annual PlanetScope 3.7-m orthomosaic basemaps from 2018 to 2024 were used to analyze land cover changes, with high-resolution images selected from the late summer months of August and September to ensure consistency in vegetation conditions. Cloud-free basemaps were obtained from the Planet Explorer website on Planet.com showcasing maximum greenness and facilitating detailed analysis of vegetation dynamics and urban landscape alterations in Southeast Atlanta (Table 2.1).

Table 2.1 PlanetScope months and years.

Year	Acquisition Date	Spectral Bands
2018	August 15 th	Blue, Green, Red, Near-Infrared (NIR)
2019	August 15 th	Blue, Green, Red, Near-Infrared (NIR)
2020	August 18 th	Blue, Green, Red, Near-Infrared (NIR)
2021	August 14 th	Blue, Green, Red, Near-Infrared (NIR)
2022	September 1 st	Blue, Green, Red, Near-Infrared (NIR)
2023	August 13 th	Blue, Green, Red, Near-Infrared (NIR)
2024	August 23 rd	Blue, Green, Red, Near-Infrared (NIR)

A two-step classification approach was applied to map and refine the land cover classifications. Initially, an unsupervised classification was conducted in ArcGIS Pro

using the Iterative Self-Organizing Data Analysis Technique (ISODATA) algorithm (Ball & Hall, 1965), which produced 30 spectral clusters based on statistically distinct spectral signatures. These clusters were then manually reclassified into five key LULC types with corresponding numeric codes: Water (1), Green Space (2), Bare Soil (3), Impervious/Developed (4), and Buildings (5). Image chips shown in Figure 2.2 illustrate the signatures of these LULC categories. Figure 2.3 illustrates spatial pattern examples from image chips from a 2024 PlanetScope orthoimage mosaic used in this study.

PlanetScope Image Chips		
1		Water Rivers, lakes, ponds, or other water bodies.
2		Green Space Natural vegetation, including trees, shrubs, and grass areas.
3		Bare Earth Areas without vegetation, such as exposed soil, sand, or construction sites.
4		Impervious/Developed Urban surfaces, roads, and paved areas that prevent water infiltration into the soil.
5		Buildings Large constructed structures such as commercial buildings.

Figure 2.3: PlanetScope image chips of Southeast Atlanta (2024), showing spatial patterns used for land cover classification.

One of the challenges encountered was the misclassification of roads and parking lots, which shared spectral similarities with dark, clear water bodies. A road

layer sourced from the City of Atlanta GIS database was integrated into the classification workflow to enhance classification accuracy (City of Atlanta Department of City Planning, 2024). A 12-meter buffer was applied to this vector roads layer to capture the road width. The road buffer was then converted into a 3.7-meter raster to apply a road mask to the classified LULC and ensure correct classification of impervious surfaces and enhance the representation of urban land cover (Figure 2.4)

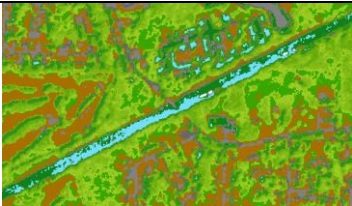
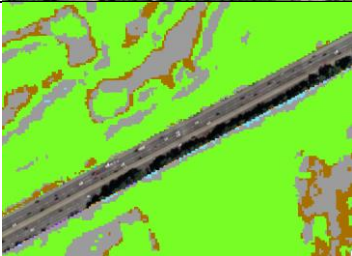
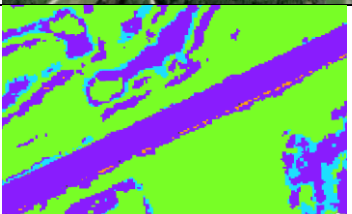
Masked Roads Correction	
	Initial Classification Issue: Some road segments were misclassified as water due to spectral similarities.
	Applying Road Masking: A 12-m road buffer was applied, and a mask was created to isolate road networks and ensure proper classification.
	Road Removal and Reclassification: Roads were removed using the 12-m buffer to eliminate misclassified areas.
	Refinement: An updated reclassified 3.7-m rasterized road layer mask was applied.
	Reclassification Process: The masked areas (in purple) were joined using the “ mosaic to new raster ” Arc CIG Pro tool, resulting in reclassified roads to correctly distinguish from water features.

Figure 2.4: Road misclassification correction.

2.2.3 Change Detection Analysis

Categorical change detection was performed using ArcGIS Pro's Change Detection Wizard. The analysis focused on year-to-year comparisons to identify trends in urban expansion, vegetation decline or growth, and land stability. The initial change detection focuses on the overall land cover changes between 2018 and 2024, providing insights into change across the entire six-year study time frame. Subsequently, year-to-year change detection was performed for each consecutive year. This sequential analysis helps capture short-term variations and the progression of land cover changes over time that might be related to economic or policy changes. The categorical change detection method compared pixel-by-pixel transitions between predefined land cover categories using the preset class codes (1-5), enabling the identification of significant transformations such as urban expansion and vegetation loss/gain, as well as areas of stable LULC.

For example, the Change Detection Wizard is accessed within the Imagery tab in ArcGIS Pro to begin the change detection process. The classified land cover raster 2018 is selected as the Before Image, while the raster for 2024 is set as the After Image. Both datasets must have the same spatial resolution and classification schema to ensure consistency in the analysis. This is then performed for the following consecutive years:

- 2018 to 2019;
- 2019 to 2020;
- 2020 to 2021;
- 2021 to 2022;
- 2022 to 2023; and
- 2023 to 2024.

The tool generated a change matrix, quantifying the area of each land cover transition between different classification categories and allowing for an in-depth interpretation of long-term trends in land-use change.

To simplify the interpretation of pixel-level land cover transitions and highlight broader patterns of landscape transformation, all classified change combinations were grouped into four general categories: Stable Natural, Natural to Developed, Developed to Natural, and Stable Developed (Table 2.2). These categories were developed by analyzing pairwise transitions between land cover classes from one year to the next. Transitions such as green space to green space (2-2) or water to green space (1-2) were grouped as Stable Natural, representing areas that maintained or reinforced their ecological function. Changes from water or green space into impervious surfaces, bare earth, or buildings (e.g., 1-4, 2-3) were classified as Natural to Developed, indicating vegetated or undeveloped land conversion into urban uses. Conversely, areas that transitioned from developed classes back to natural ones (e.g., 3-2, 4-1) were grouped from Developed to Natural, capturing ecological recovery or reclamation instances. Finally, transitions among developed categories (e.g., bare earth to impervious, buildings to buildings) were categorized as Stable Developed, representing land areas that remained within urban/developed use but may have undergone surface-level changes such as construction or resurfacing. This grouping framework allowed for a more generalized and interpretable analysis of landscape changes across the study period.

Table 2.2: Generalized Land Use Land Cover Change Categories

Change Type Transitions	
Stable Natural	Water → Green Space (1-2), Green Space → Water (2-1), Water → Water (1-1), Green Space → Green Space (2-2)
Natural to Developed	Water → Bare Earth (1-3), Water → Impervious (1-4), Water → Building (1-5), Green Space → Bare Earth (2-3), Green Space → Impervious (2-4), Green Space → Building
Developed to Natural	Bare Earth → Water (3-1), Bare Earth → Green Space (3-2), Impervious → Water (4-1), Impervious → Green Space (4-2), Buildings → Water (5-1), Buildings → Green Space (5-2)
Stable Developed	Buildings → Bare Earth (5-3), Bare Earth → Impervious (3-4), Impervious → Bare Earth (4-3), Impervious → Buildings (4-5), Buildings → Impervious (5-4), Bare Earth → Bare Earth (3-3), Impervious → Impervious (4-4), Building → Building (5-5), Bare Earth → Building (3-5)

2.3 Results

2.3.1 Land Use Classification Annual Trends

This section presents the land use and land cover (LULC) classification results and change detection analysis conducted for the Southeast Atlanta study area from 2018 to 2024. Using high-resolution PlanetScope imagery and a consistent classification approach, the analysis quantifies spatial and temporal trends across five major land cover categories: water, green space, bare earth, impervious/developed surfaces, and buildings. The findings are supported by annual classified maps, a land change matrix, and summary tables that reveal key urban growth patterns, vegetation loss, construction activity, and land-use transitions, as well as stable LULC. Together, these results provide a comprehensive understanding of the evolving landscape.

Figure 2.5 (Maps A–G) illustrates the annual classification results, offering both spatial context and temporal comparisons essential for interpreting the patterns and trends discussed in this chapter. As seen in this sequence of LULC maps and

summarized in Table 2.3 and Figure 2.6, impervious and developed surfaces steadily increased over the first five years, growing from 26.46% in 2018 to 32.43% by 2022, driven by new roads, paved areas, and industrial development. However, a decrease was observed in 2023 (26.34%), followed by a slight rise to 28.95% in 2024, indicating substantial land conversion, particularly around significant infrastructure corridors such as I-285 and in zones of commercial-industrial growth.

Bare earth, often a transitional or disturbed land type, expanded—from 3.11% in 2018 to 11.28% in 2024, suggesting widespread site clearing and early-stage development across Southeast Atlanta. Annual classification revealed that the most substantial spikes in bare earth occurred between 2020 and 2022, which coincided with increased construction near I-285 and possibly with staging areas for infrastructure projects and industrial expansion. In particular, expansions of landfill sites along the eastern edge of Interstate 285 and south of Moreland Avenue were notably visible by 2021, reflecting how dynamic land transformation patterns are best captured through yearly analysis.

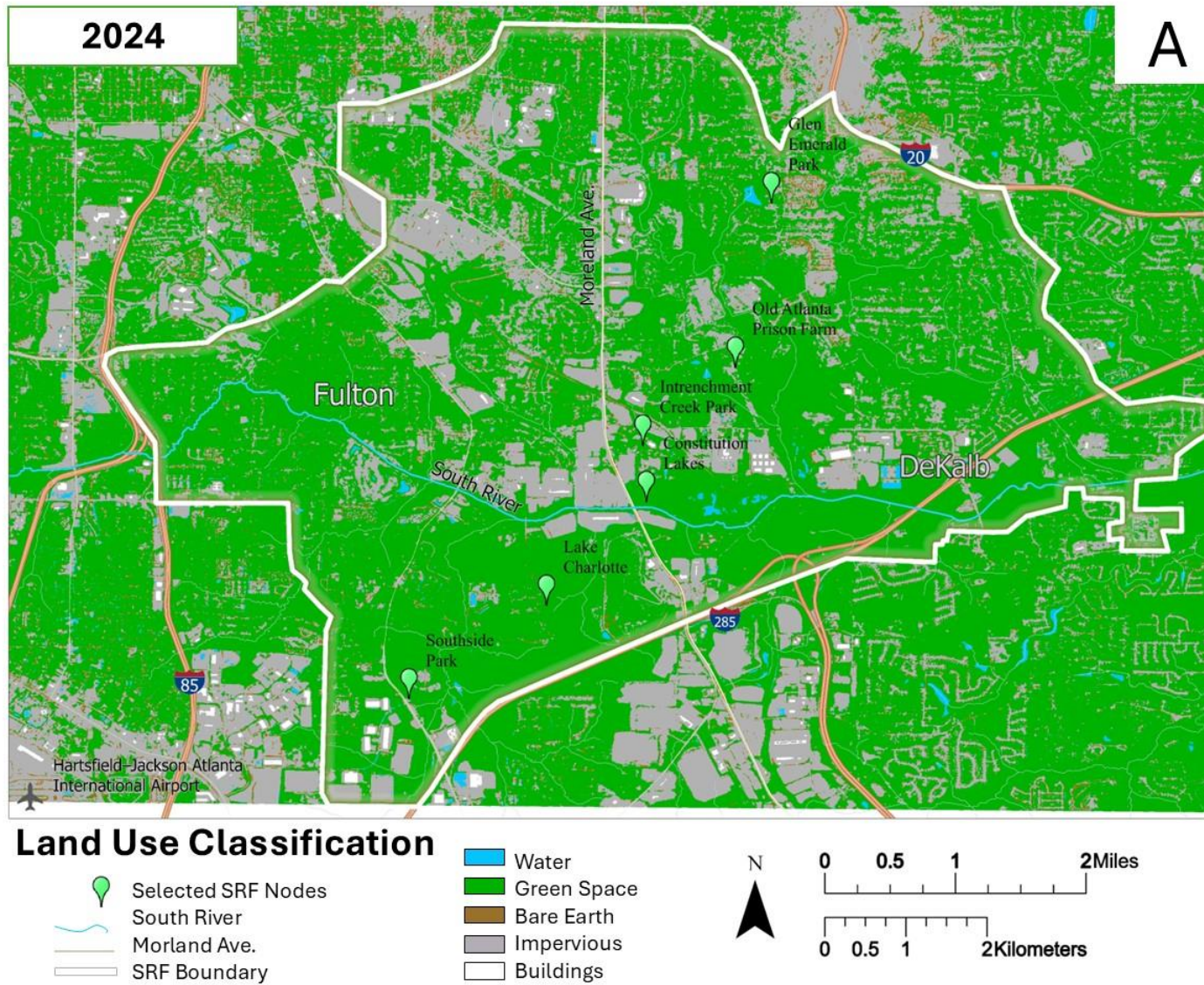
Building coverage also rose during the 7-year study period, growing from 0.49% in 2018 to 2.02% by 2024. A year-by-year assessment revealed that the most accelerated increase in impervious surfaces occurred between 2021 and 2023, particularly within construction zones adjacent to Hartsfield-Jackson Airport and in the vicinity of Shadowbox Studios (formerly Blackhall Studios) in DeKalb County. The studio's facility saw a major footprint expansion in 2022, which corresponds with the observed rise in building class pixels for that year (Business Wire, 2022). These new

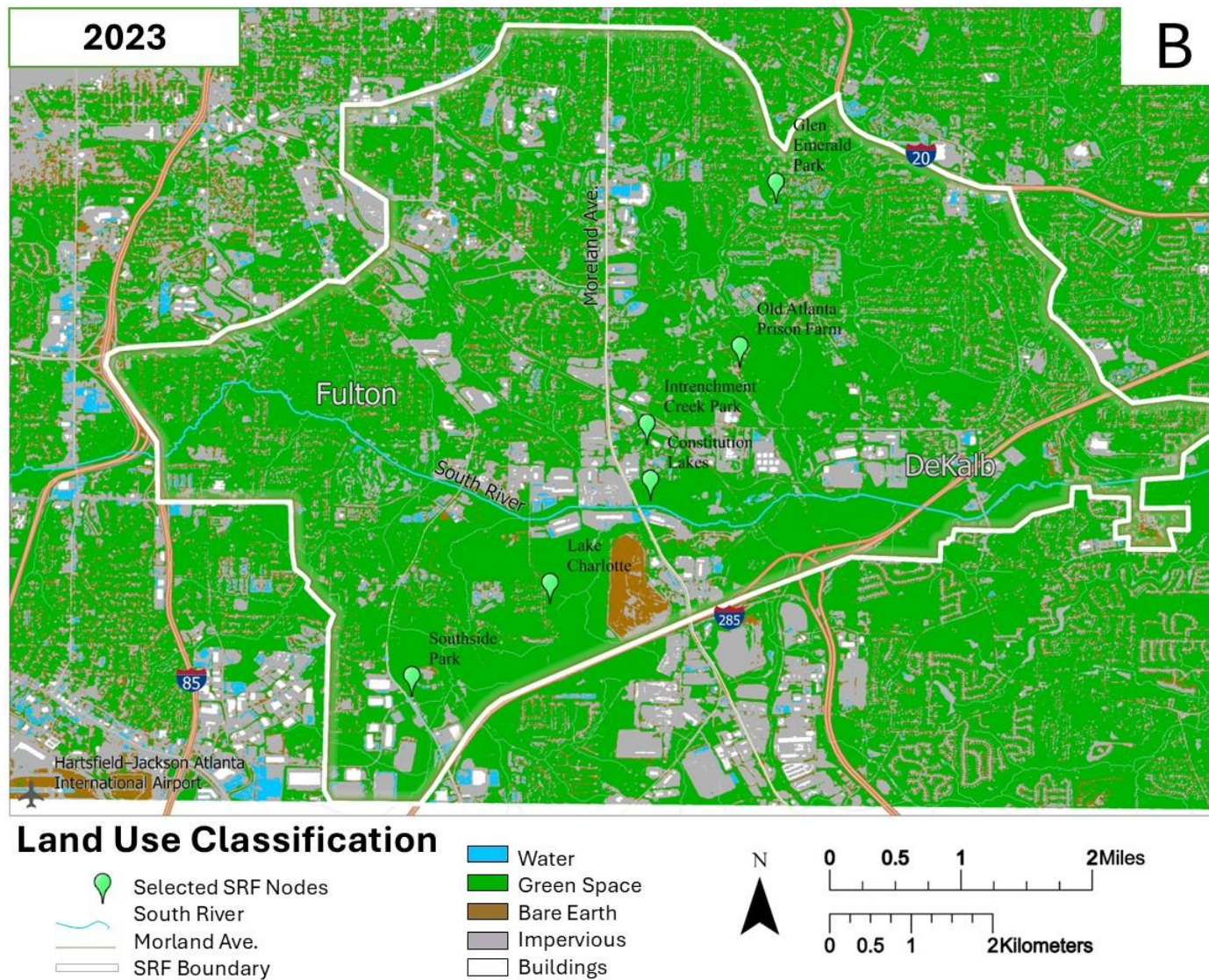
structures contribute to the fragmentation of green spaces and signal a transition toward more permanent, high-density development across the landscape.

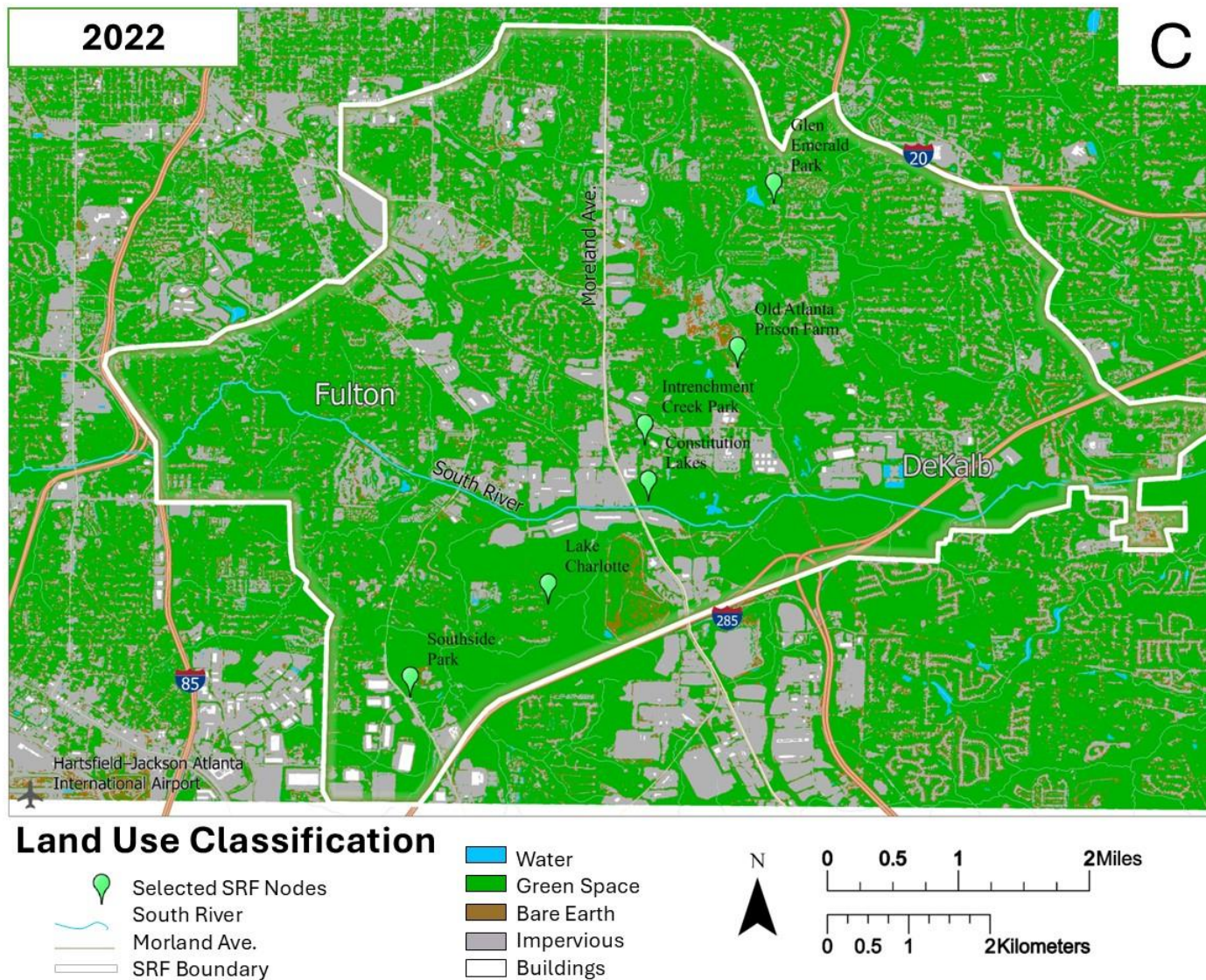
Water bodies remained relatively stable in percentage, accounting for less than 1.5% of the land throughout the study period. The minimal change in this category suggests that hydrological conditions and surface water extents in the study area have not experienced major transformations. Green space, classified primarily as forested or vegetated areas, declined steadily from 2018 to 2024, dropping from 66.5% to 59.1% of total land cover—a loss of over 7.4%. While some reductions occurred incrementally each year, the sharpest single-year decline was observed between 2021 and 2022, corresponding with rapid development and tree clearing in areas like Lake Charlotte, the western edge of Intrenchment Creek Park, and parcels surrounding the former Prison Farm. These zones fall within or adjacent to the South River Forest (SRF) Vision Area, a focal region of this study. While certain core green patches within SRF—such as Gresham Park and Soapstone Ridge—remained relatively intact, the edges experienced significant erosion, particularly where infrastructure expansion encroached on unprotected woodlands. This annual change mapping provided essential insight into these nuanced shifts, revealing how year-to-year transformations, even when subtle, compound into considerable landscape alteration over time.

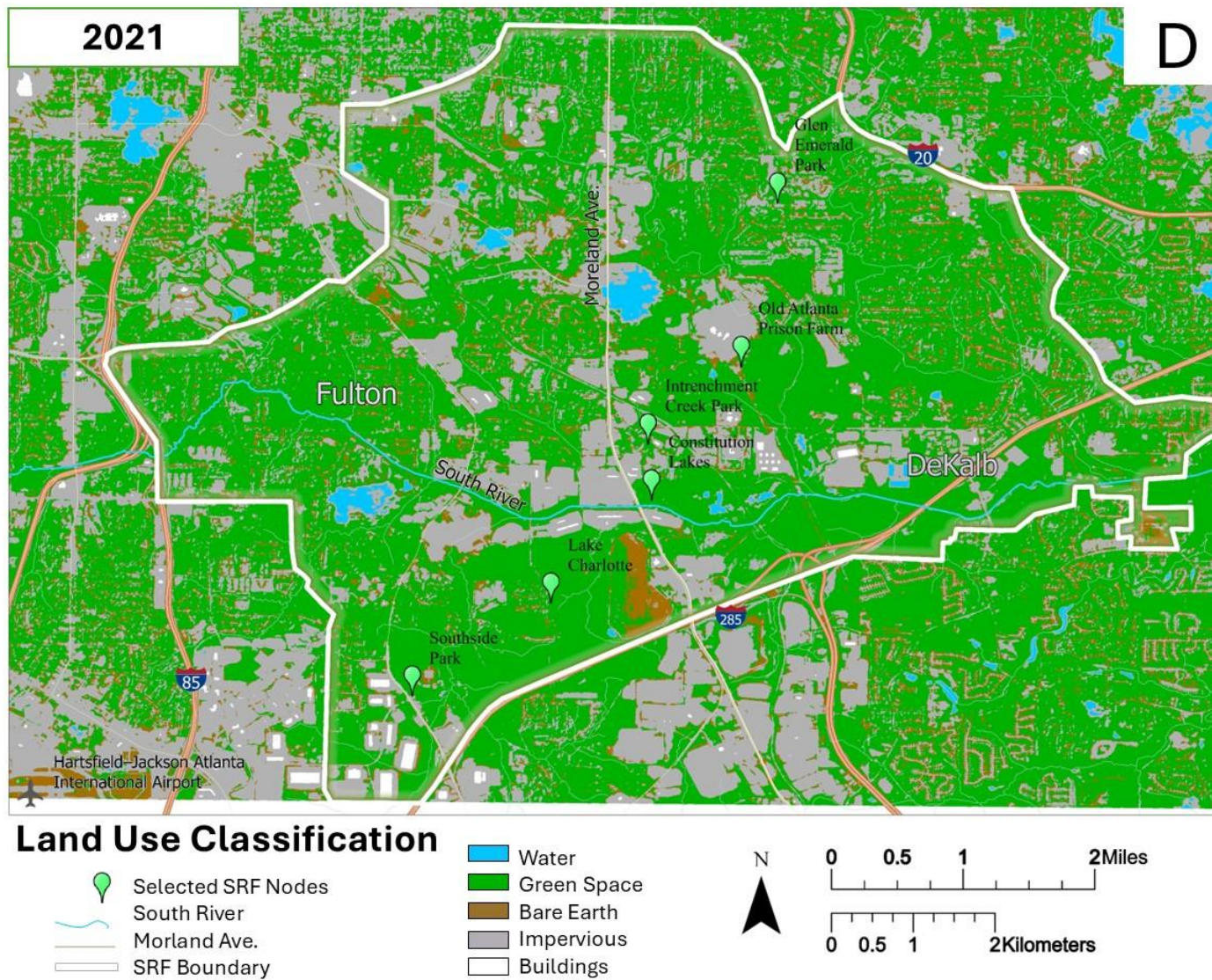
Overall, the annually mapped LULC results indicate intensifying development pressure and significant land cover transformation across Southeast Atlanta. The expansion of impervious surfaces, construction zones, and newly built structures has occurred largely at the expense of natural vegetation and existing green spaces. Forested areas—particularly those classified as green space within the South River

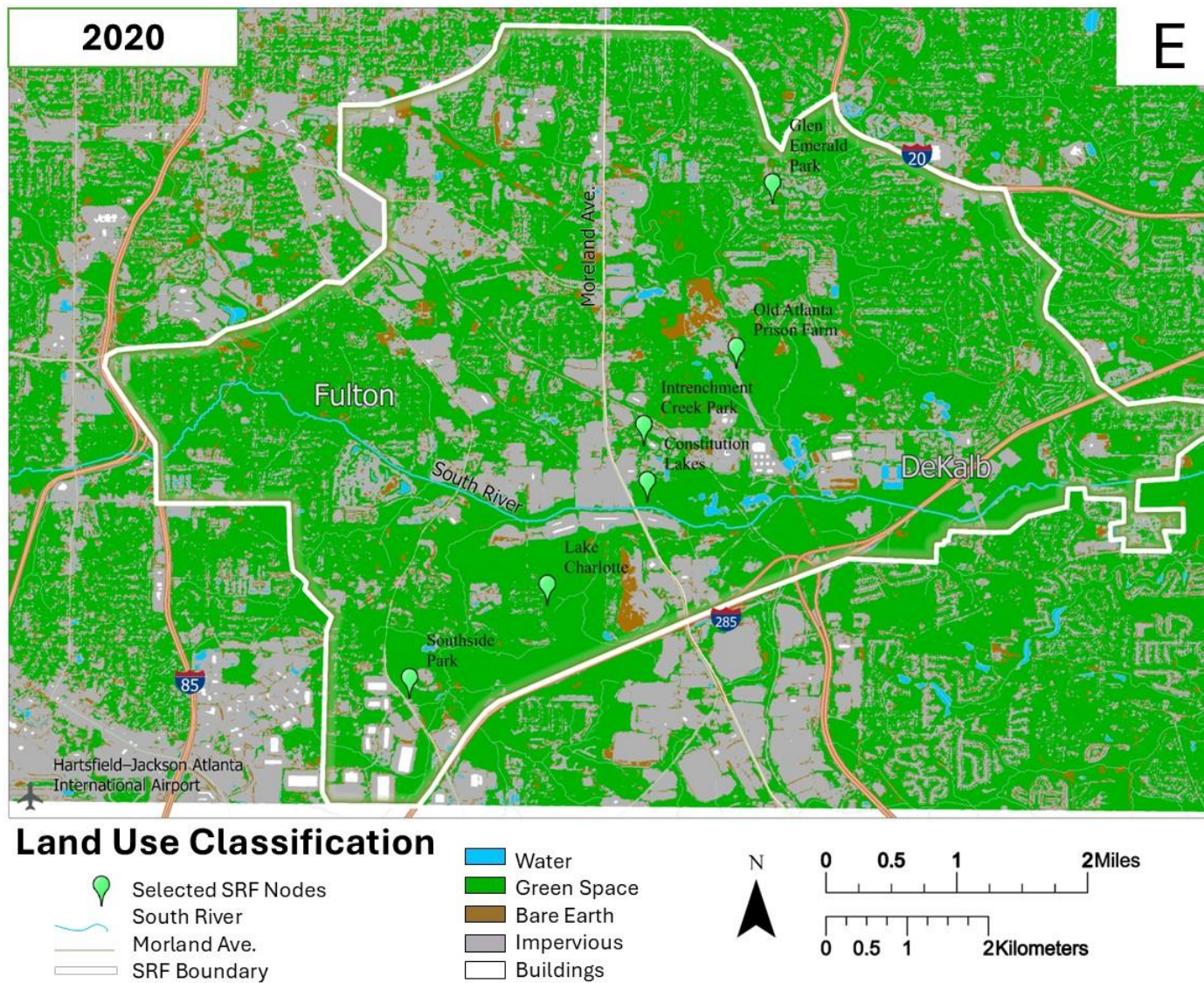
Forest (SRF) Vision Area—declined by over 7% between 2018 and 2024, with noticeable fragmentation along the edges of Lake Charlotte, Intrenchment Creek Park, and the former Prison Farm. While some green space cores remain intact, the cumulative loss of vegetated land has serious implications for habitat continuity, stormwater regulation, and community access to nature. These findings underscore the value of annual change detection for revealing both steady declines and sudden landscape shifts, emphasizing the urgent need for proactive urban planning and conservation strategies to mitigate these changes' ecological and social impacts. impacts.

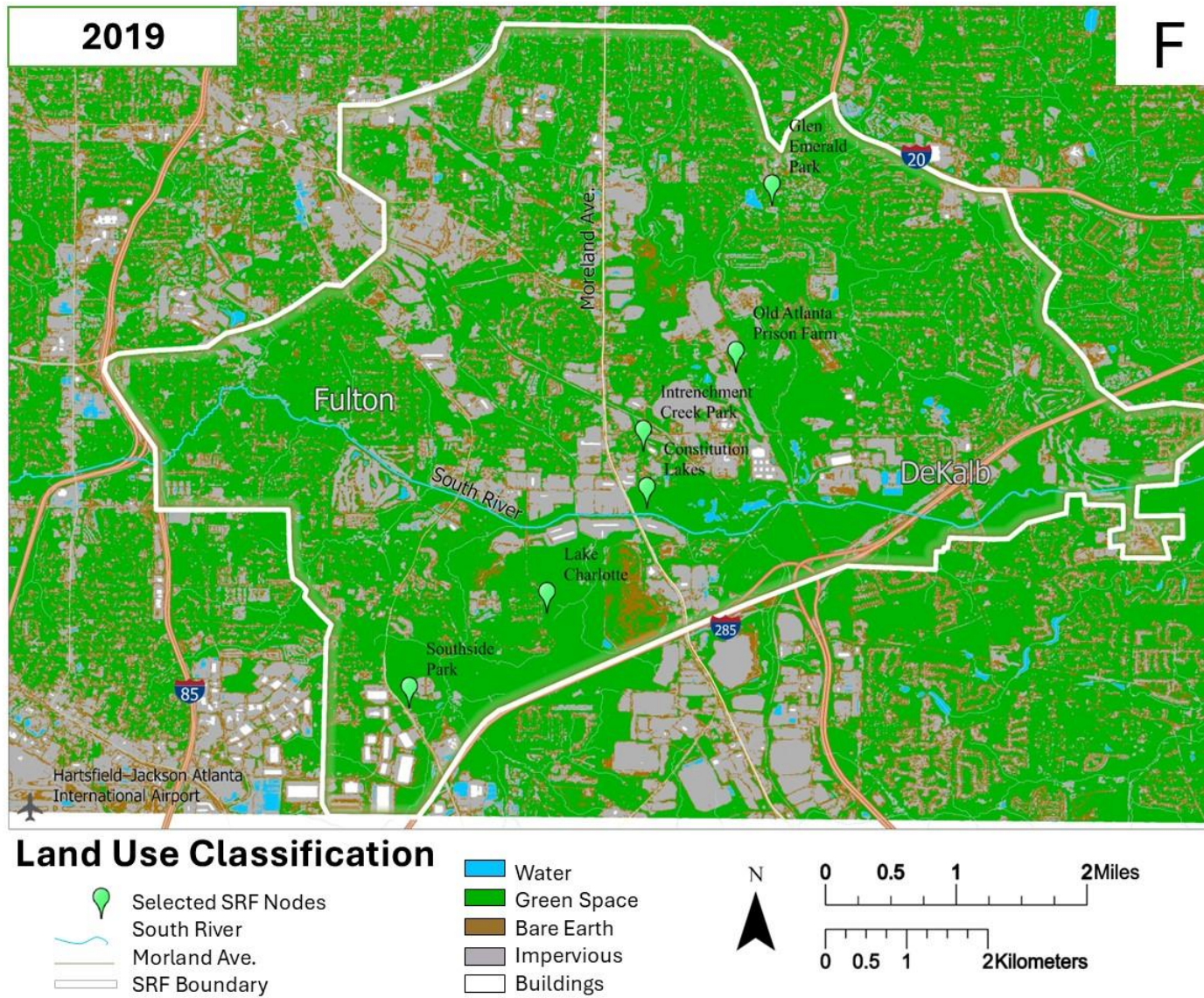












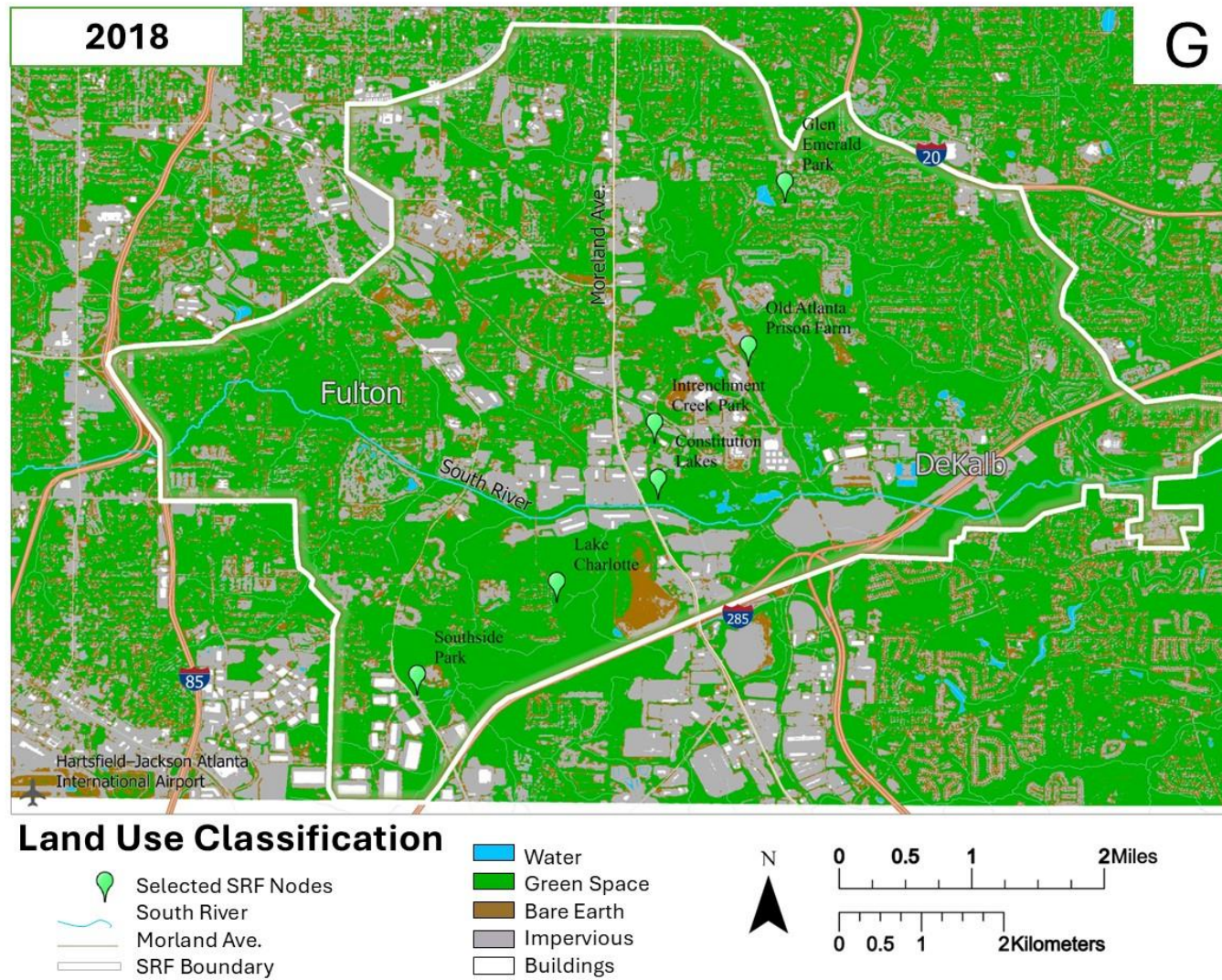


Figure 2.5: Figures A), B), C), D), E), F), and G) depict annual maps of five major LULC classifications from 2018 – 2024.

Table 2.3: Land Use Land Cover Annual Summary of Areal Coverage

Year	Water		Green Space		Bare Earth		Impervious/Developed		Buildings	
	Area (Km ²)	Percent	Area (Km ²)	Percent	Area (Km ²)	Percent	Area (Km ²)	Percent	Area (Km ²)	Percent
2018	116.00	0.83	9189.26	65.96	432.76	3.11	3685.61	26.46	67.65	0.49
2019	193.73	1.39	8388.64	60.21	972.27	6.98	3753.36	26.94	183.29	1.32
2020	87.94	0.63	8718.74	62.58	916.10	6.58	3674.34	26.37	94.17	0.68
2021	172.47	1.24	7968.36	57.20	1074.12	7.71	4203.49	30.17	72.85	0.52
2022	92.83	0.67	8146.14	58.47	667.61	4.79	4518.09	32.43	66.62	0.48
2023	99.11	0.71	7771.45	55.78	1871.75	13.44	3669.41	26.34	79.58	0.57
2024	84.65	0.43	11297.04	57.89	2202.03	11.28	5650.08	28.95	281.21	1.44

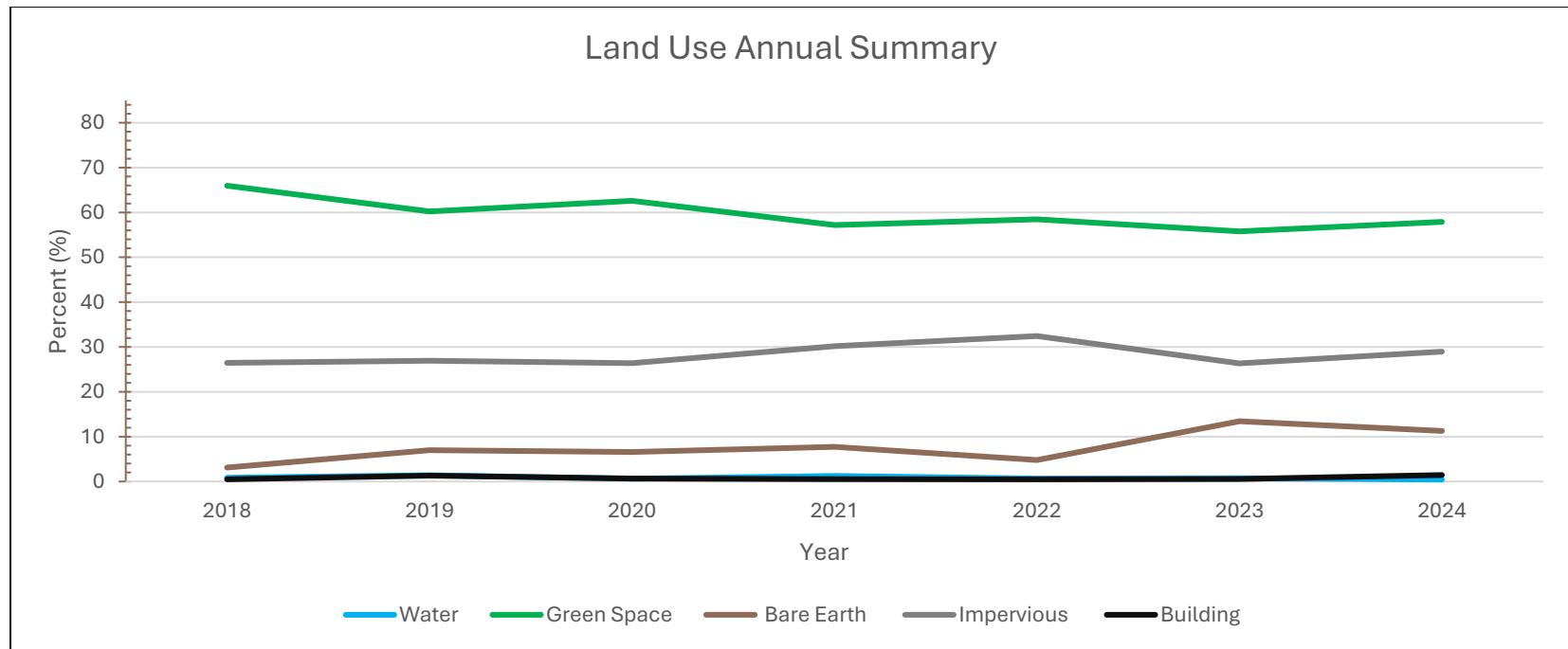


Figure 2.6: Percent Land Use Annual Summary for all years from 2018 to 2024.

2.3.2 Notable Land Use Change Detections

Figure 2.7 (Maps A – G) illustrates land-use changes between 2018 and 2024, classified into four distinct change matrix categories: stable natural, natural to developed, developed to natural, and stable developed.

The LULC change analysis performed using Esri's Change Detection Wizard within Southeast Atlanta reveals that although the study area remained predominantly natural over the study period, significant land transitions also were observed. Although the study area remained predominantly natural over the study period, in overall changes from 2018 to 2024 listed in Table 2.4A, stable natural land—including green space and water—accounted for approximately 7,222.48 km² (52.56%) of the area, while stable developed land—including impervious surfaces and buildings—covered 3,676.25 km² (26.75%). The remaining landscape included natural to developed transitions totaling an increase of 2,075.76 km² (15.11%) and developed to natural increase of only 641.63 km² (4.67%). Examining changes between 2023 and 2024, these proportions shifted modestly: stable natural land slightly declined to 7,129.16 km² (51.88%), while stable developed areas increased to 4,378.13 km² (31.86%), reflecting the most recent and steady urban growth pressures. Transitions from natural to developed land remained substantial, with values ranging annually between 6.76% and 15.11%, indicating continued expansion of impervious surfaces, especially near infrastructure corridors and high-growth nodes like the area surrounding the Hartsfield-Jackson Airport and along I-285.

Maps of yearly changes in generalized LULC categories between 2018 and 2024 visualize when and where urban expansion and green space loss and growth took place

within the study area (Figure 2.7, A-G). In almost all of the change maps, stable natural areas, depicted in green, dominate the map, indicating extensive regions within Southeast Atlanta where natural vegetative cover has persisted or even expanded. This is particularly noticeable around the South River corridor, within residential areas and locations like Lake Charlotte and Constitution Lakes. These areas serve as ecological strongholds, sustaining green spaces amid ongoing urban pressures.

Areas shifting from natural to developed, marked yellow, are most prominently visible in pockets adjacent to significant transportation corridors such as Interstate 285 and the northern areas close to Interstate 20. Larger yellow blocks along the southern corridor in the early years of 2018-2019, and then again in 2023-2024 correspond to landfill sites, where previously vegetated areas have been converted into waste management zones or cleared for industrial purposes (Figures 2.7B and 2.7G). In 2019 to 2020, one of these landfill areas converted from developed to natural (colored purple) when grass grew in the landfill area (Figure 2.7C). The scale and visibility of these changes underscore the significant environmental footprint of landfill expansion within the study area and reflect urban expansion. Notably, substantial deforestation and urban expansion are also observed in the "Cop City" area near the former Prison Farm in 2019-2020 and 2020-2021 (Figures 2.7C and 2.7D) and near Intramural Creek area in 2022 to 2023 (Figure 2.7F), reflecting intense developmental pressures and land-use conflicts in close proximity to local neighborhoods.

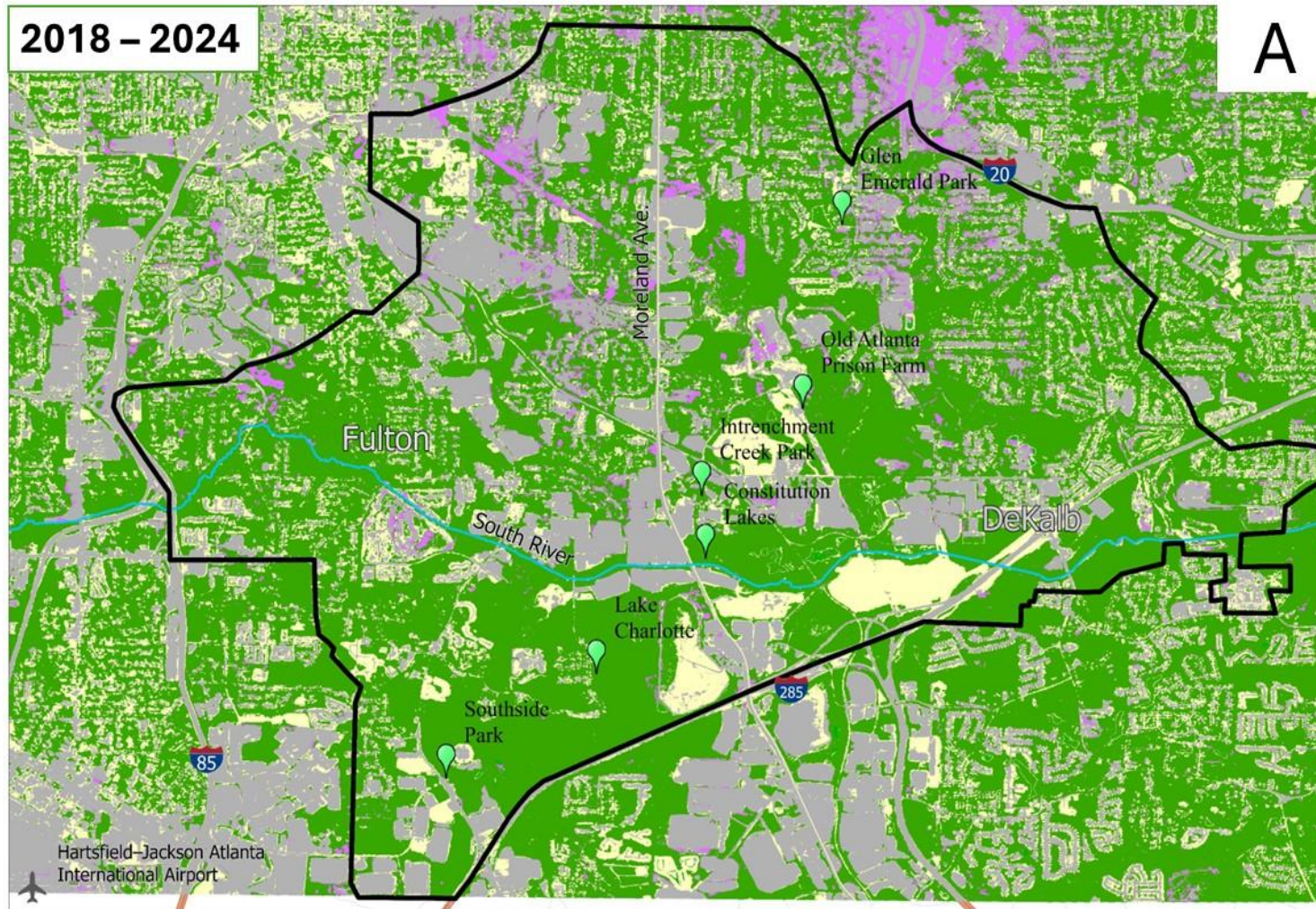
Conversely, highlighted in purple, developed to natural changes are relatively scarce and scattered, suggesting limited occurrences of urban retreat or reclamation by

natural vegetation. Such instances may indicate intentional restoration projects or abandonment of previously developed lands.

Rapid urban growth, indicated in areas transitioning from stable vegetation to developed land (appearing as grey patches in the LULC classification maps), is particularly evident in regions north of Hartsfield-Jackson Atlanta International Airport. These areas exhibit significant transitions from natural vegetative cover to impervious surfaces and built environments, particularly between 2020 and 2023, a period marked by commercial expansion linked to the trucking and logistics industries. Figure 2.7 highlights these changes year by year, especially in tracts bordering major transportation corridors and industrial zones. Additionally, the film industry's expansion, particularly through the growth of Shadowbox Studios (formerly Blackhall Studios), has substantially transformed adjacent natural and vegetated areas into infrastructure-dominated spaces with production facilities, road networks, and parking areas. This transformation is most evident in 2022 and 2023, when the studio's footprint expanded rapidly, as captured in the corresponding maps in Figure 2.7. Shadowbox Studios now encompasses approximately 850,000 square feet of production space, including nine fully soundproofed and air-conditioned stages, making it a major contributor to local landscape change and economic growth (Business Wire, 2022; Shadowbox Studios, 2024).

Figures 2.8 and 2.9 summarize the percentage changes of the generalized LULC categories from 2018 to 2024. The most pronounced increase is seen in bare earth, which grew dramatically from 3.1% to 15.8%, reflecting widespread site clearing and transitional development across Southeast Atlanta. Impervious surfaces also expanded

from 11.0% to 14.2%, and building coverage rose from 0.49% to 1.44%, underscoring intensified urbanization and new construction activity during the study period. In contrast, forest cover declined from 66.5% to 59.1%, marking a significant 7.4% loss of vegetated land and green space. Water bodies remained relatively stable, with only a minor change from 1.4% to 1.3%. These trends, when visualized in the summary graphs, clearly illustrate how development is reshaping the landscape, replacing natural cover with built infrastructure—and reinforce the importance of annual change detection in capturing both gradual declines and year-to-year pulses of landscape transformation relevant to LUCIS conflict analysis.

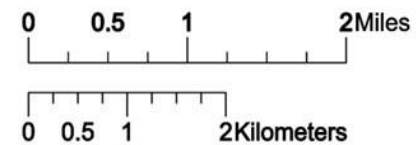


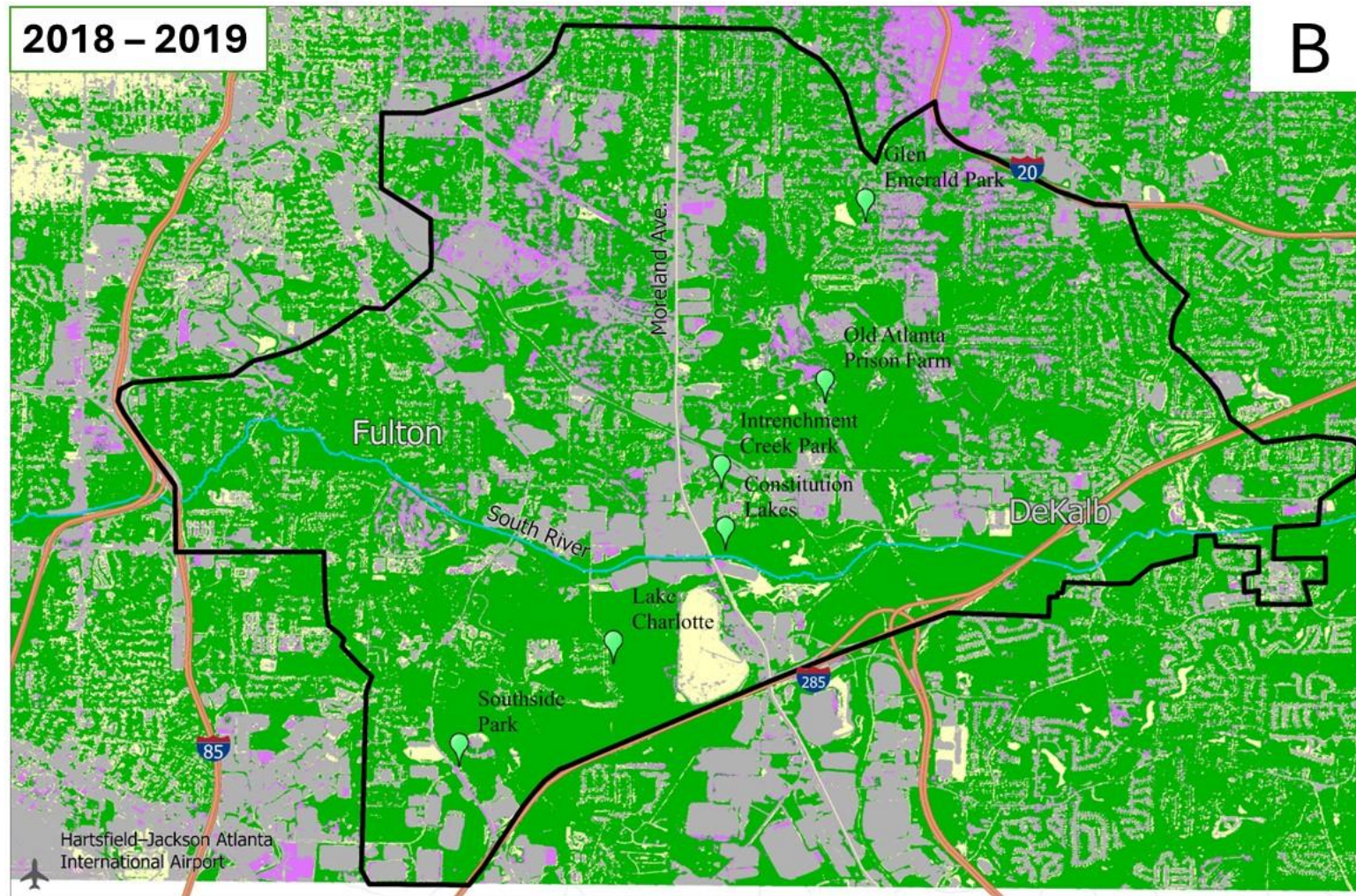
Land Use Changes

- Selected SRF Nodes
- South River
- Major Roads
- SRF Boundary

Change Matrix Categories

- Stable Natural
- Natural to Developed
- Developed to Natural
- Stable Developed



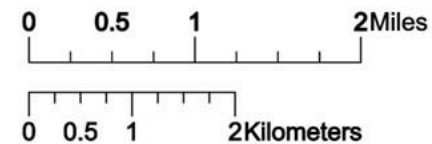


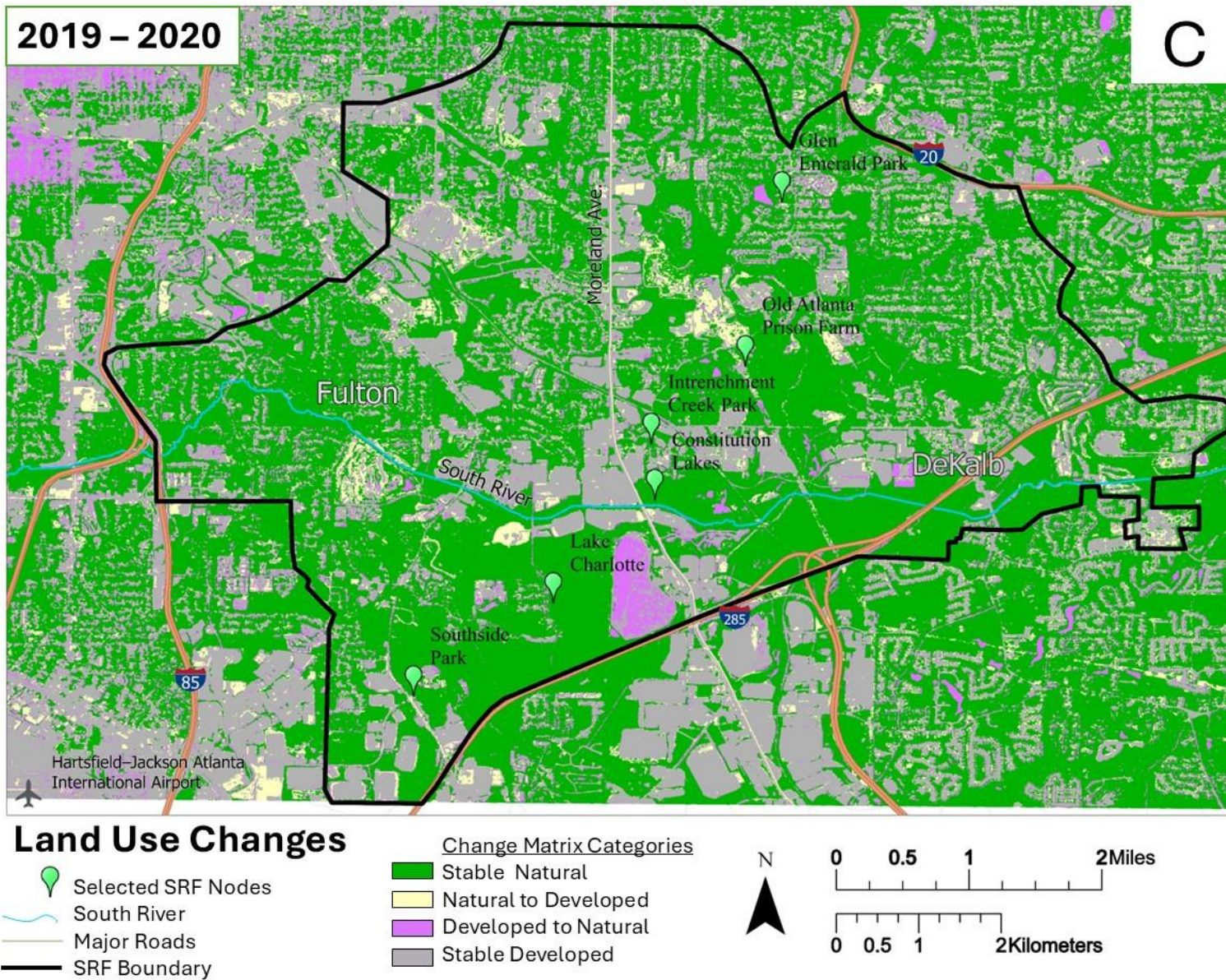
Land Use Changes

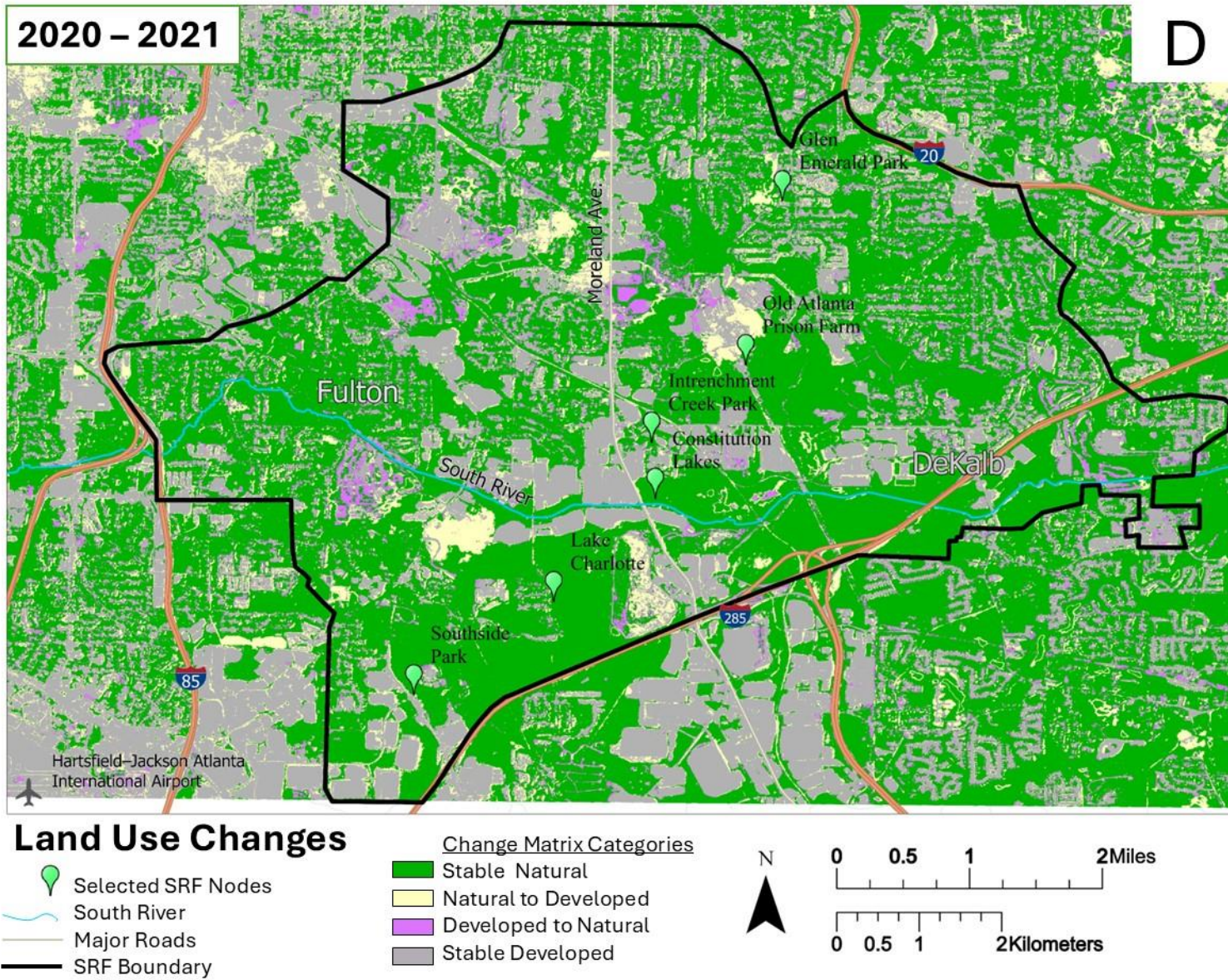
- Selected SRF Nodes
- South River
- Major Roads
- SRF Boundary

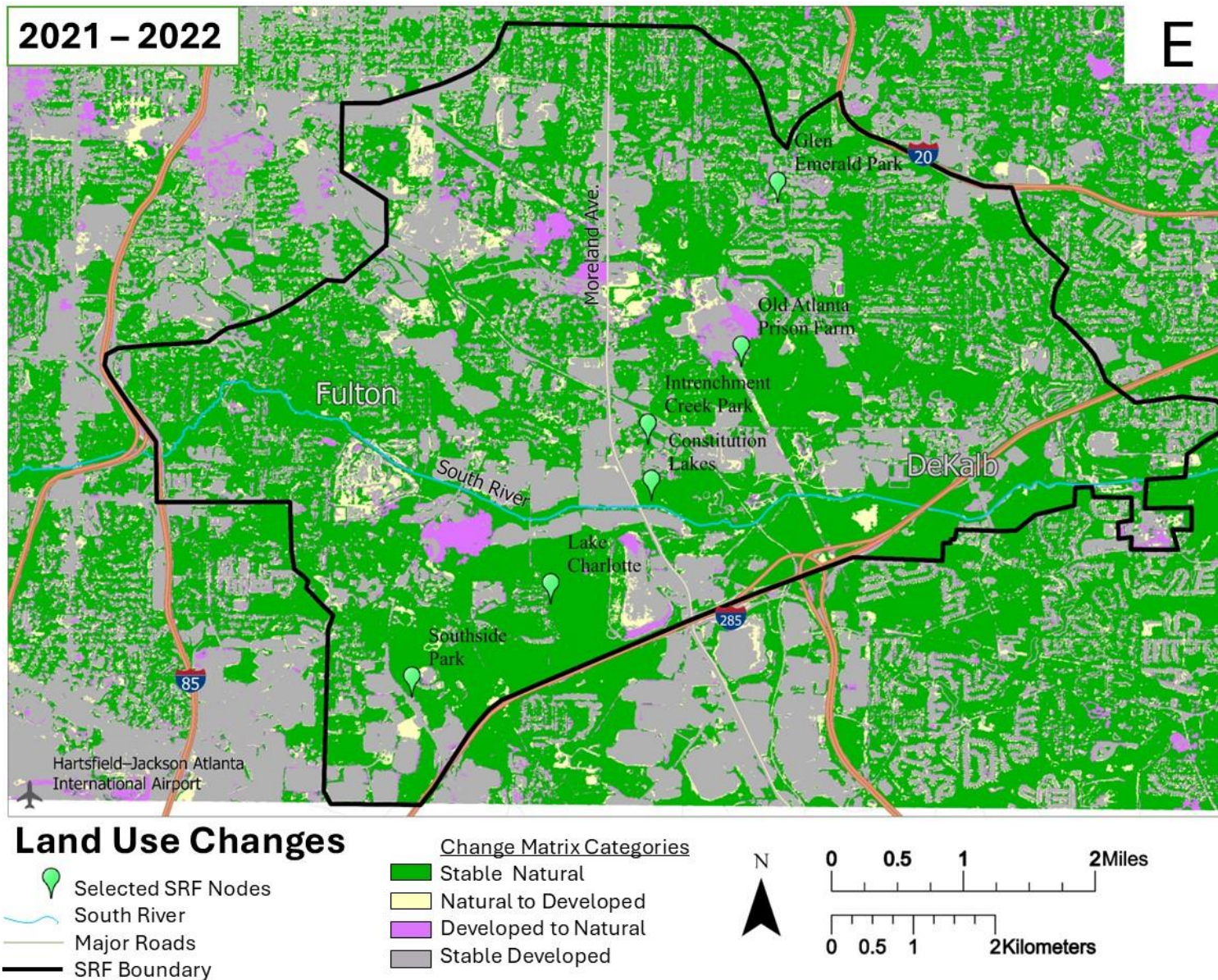
Change Matrix Categories

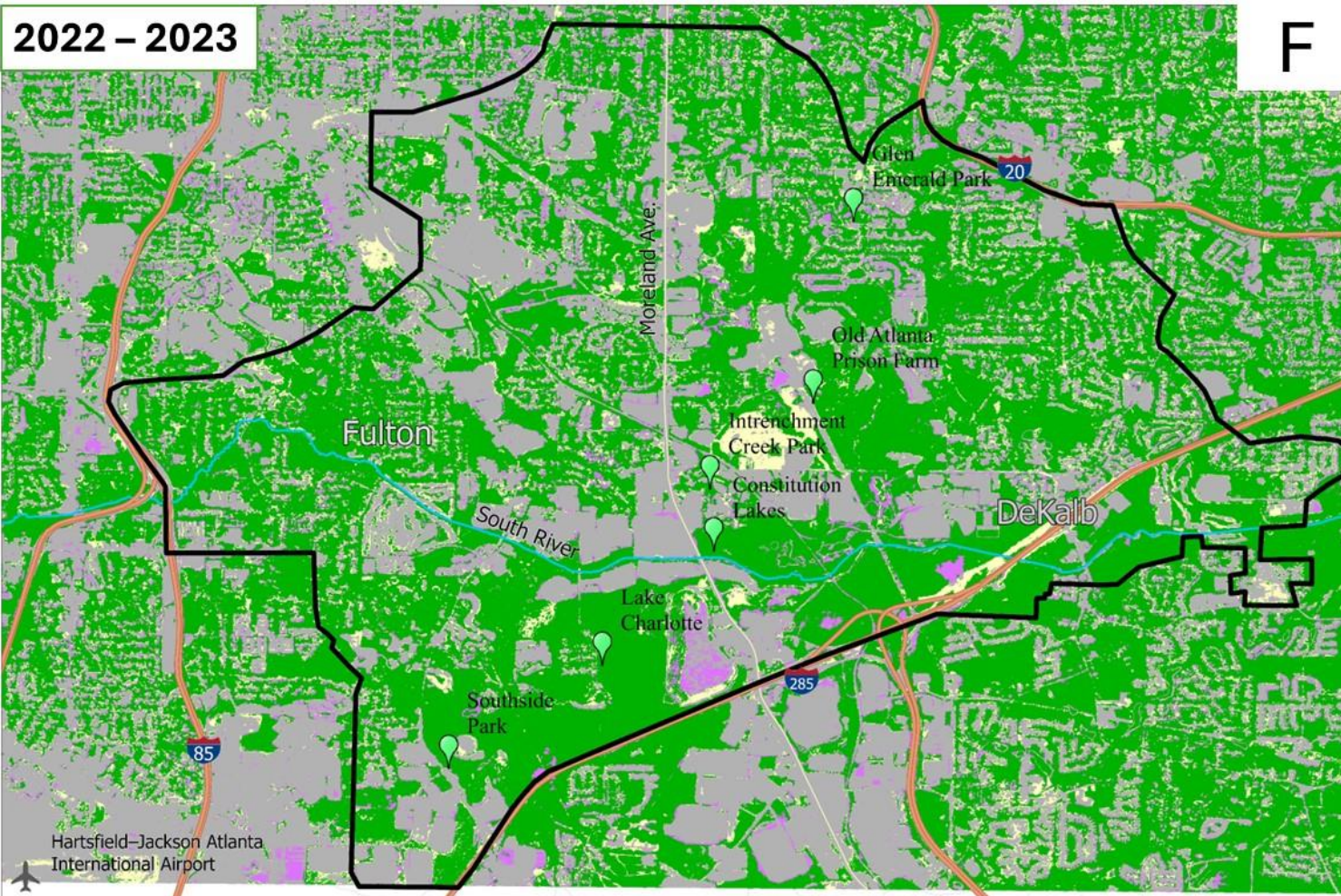
- Stable Natural
- Natural to Developed
- Developed to Natural
- Stable Developed











Land Use Changes

-  Selected SRF Nodes
-  South River
-  Major Roads
-  SRF Boundary

Change Matrix Categories

-  Stable Natural
-  Natural to Developed
-  Developed to Natural
-  Stable Developed



0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

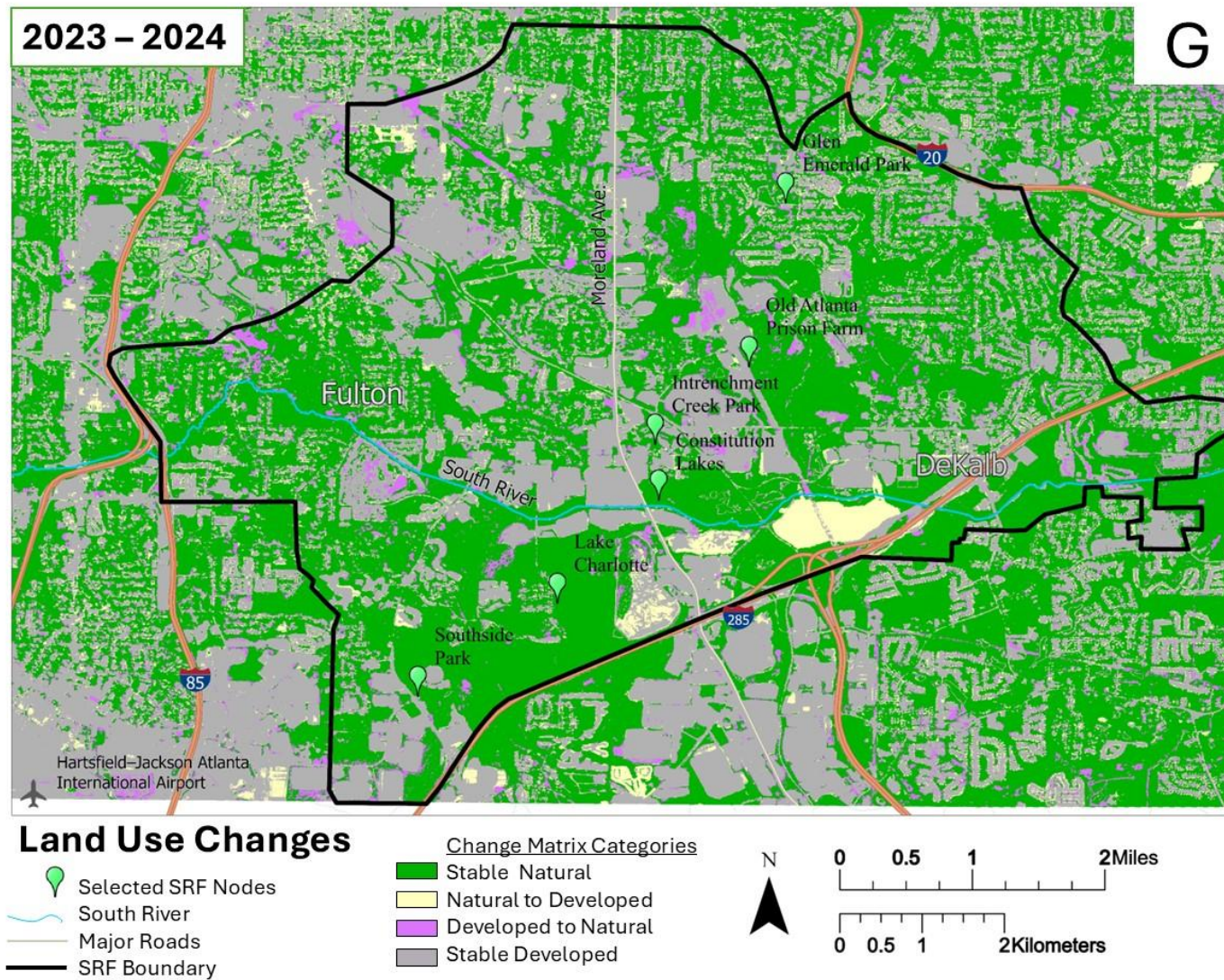


Figure 2.7: Figures A), B), C), D), E), F), and G) depict annual LULC changes from 2018 to 2024.

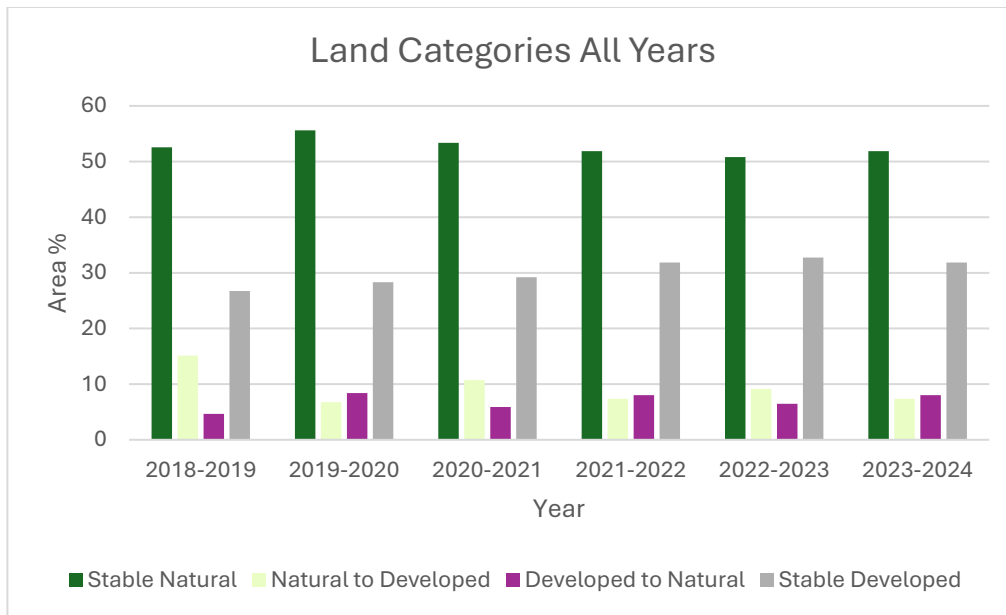


Figure 2.8: Percent generalized land categories for all years from 2018 to 2024.

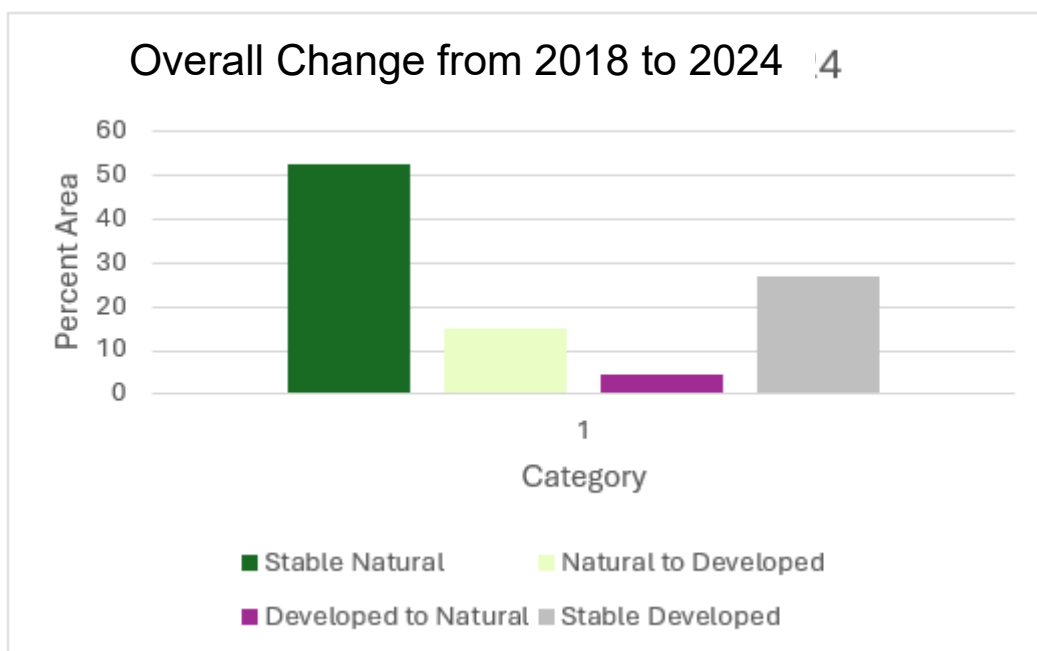


Figure 2.9: Percent overall change of generalized land categories from 2018 to 2024.

Table 2.5: Tables A), B), C), D), E), F), and G), Overall LULC Areal Change 2018 to 2024

Overall Land Change 2018 to 2024		
Category	Area (km ²)	Percent
Stable Natural	7222.48	52.56
Natural to Developed	2075.76	15.11
Developed to Natural	641.63	4.67
Stable Developed	3676.25	26.75

A.

Land Change 2018 to 2019		
Category	Area (km ²)	Percent
Stable Natural	7222.48	52.56
Natural to Developed	1478.39	15.11
Developed to Natural	755.51	4.67
Stable Developed	3568.04	26.75

B.

Land Change 2019 to 2020		
Category	Area (km ²)	Percent
Stable Natural	7652.3	55.61
Natural to Developed	929.046	6.76
Developed to Natural	1153.56	8.39
Stable Developed	3892.87	28.33

C.

Land Change 2020 to 2021		
Category	Area (km ²)	Percent
Stable Natural	7331.21	53.35
Natural to Developed	1474.7	10.73
Developed to Natural	809.26	5.89
Stable Developed	4012.6	29.2

D.

Land Change 2021 to 2022		
Category	Area (km ²)	Percent
Stable Natural	7129.16	51.88
Natural to Developed	1011.32	7.36
Developed to Natural	1102.18	8.02
Stable Developed	4378.13	31.86

E.

Land Change 2022 to 2023		
Category	Area (km ²)	Percent
Stable Natural	6981.19	50.8
Natural to Developed	1257.15	9.15
Developed to Natural	888.95	6.47
Stable Developed	4500.5	32.75

F.

Land Change 2023 to 2024		
Category	Area (km ²)	Percent
Stable Natural	7129.16	51.88
Natural to Developed	1011.32	7.36
Developed to Natural	1102.18	8.02
Stable Developed	4378.13	31.86

G

2.3.3 Manual Land Classification Using PlanetScope Imagery (2024)

To enhance spatial understanding of land use patterns in the South River Forest (SRF) study area, this study employed a manual land classification method using high-resolution **PlanetScope imagery from early 2024**. This approach was conducted in **ArcGIS Pro** and focused on visually interpreting land cover features based on texture, geometry, and contextual clues that offered a complementary technique to automated supervised and unsupervised classifications performed elsewhere in the study.

The classification was performed by digitizing polygon boundaries over the most recent, cloud-free Planet imagery at a working scale of approximately 1:2,000. Land cover types were assigned to six major categories (Figure 2.10):

Residential (orange)

Green Space (bright green)

Industrial (dark purple)

Commercial (magenta)

Bare Earth (light gray)

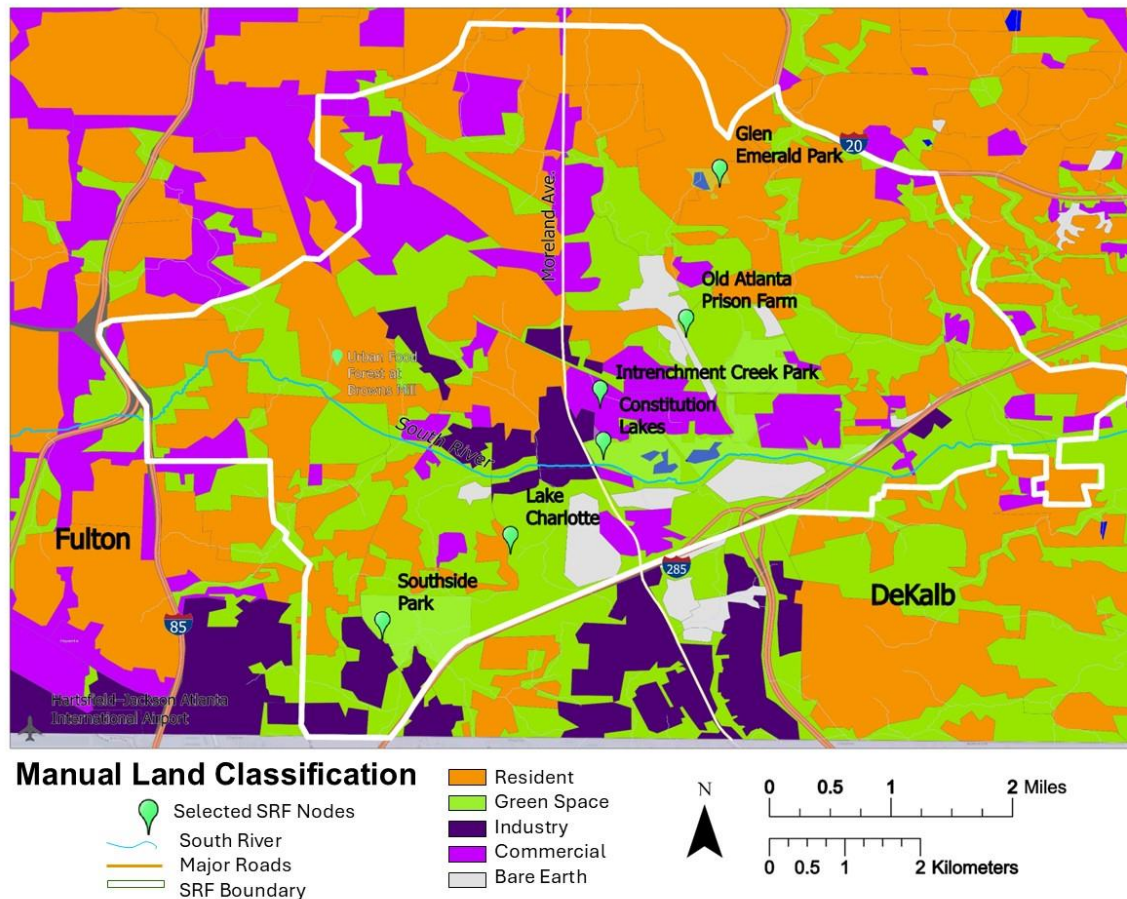


Figure 2.10: Manual Interpretation map digitized from 2024 PlantScope Image.

These classes reflect the dominant land uses across the SRF boundary and align with criteria layers later used in the LUCIS model for land use conflict and suitability modeling. In contrast to automated methods, this manual approach allowed for precise visual differentiation between land use types based on real-world understanding of built form, use, and context. Key features such as trailheads, public parks, and industrial facilities were labeled, and nodes of interest were incorporated to support further analysis.

A major strength of this manual classification approach lies in its ability to **accurately identify residential areas**, which often present difficulties in pixel-based

unsupervised classifications such as ISO Cluster or K-means. In urban fringe and transition zones like those found in Southeast Atlanta, residential areas frequently overlap spectrally with commercial, vegetated, or bare-earth areas due to variable roofing materials, canopy coverage, and development density. As a result, unsupervised methods tend to group mixed land uses into broad, indistinct classes that lead to overgeneralization or misclassification.

Manually digitization, by contrast, allows the interpreter to recognize housing blocks, lot spacing, and street networks, all of which provide reliable indicators of residential, green space, and developed land use. This human-centered approach yields a more spatially and thematically accurate classification, especially in mixed-use corridors where land values, development pressure, and greenspace are in active contention. The ability to clearly define residential areas is especially important for this study, as these locations are often the focal point of land use conflict between community priorities, developer interests, and ecological conservation goals explored in Chapter 4.

This manually interpreted dataset provides not only a highly accurate base map for spatial modeling but also contributes to a fine-resolution lens through which land use tension, displacement risk, and urban greening impacts can be more meaningfully assessed.

2.3.4 Residential Proximity Buffers: Modeling Community Green Values and Gentrification Pressure

To strengthen the representation of the community and development dynamics in the LUCIS model, two new spatial layers were created using buffer-based analysis

around manually classified residential areas (Figure 2.11). These layers were designed to reflect both community-valued greenspace access and potential gentrification pressure, depending on the stakeholder perspective.

The first layer modeled walkable access to green space from residential neighborhoods. Buffers of 500 ft, 1000 ft, and 1500 ft were generated from the perimeter of manually classified residential zones, approximating 5-, 10-, and 15-minute walking distances. These buffers were then clipped to the greenspace layer derived from manual land cover interpretation, creating a new tiered layer of greenspace-accessible zones. This proximity-to-parks layer was incorporated into the Community Perspective in the LUCIS model, where it was positively weighted to reflect strong community support for walkable, accessible green infrastructure that promotes recreation, safety, and well-being.

The second layer applied a -500-foot internal buffer within residential areas, creating a ring of residential land that is increasingly adjacent to expanding or redevelopment zones. This inward-facing buffer was interpreted as a spatial proxy for gentrification risk. These are locations where new or enhanced ecosystem services interface with long-standing residential areas and where land value pressure may begin to build inward. This layer was included in the Developer Perspective to highlight zones of potential real estate interest, increased market turnover, or land speculation, especially in historically marginalized neighborhoods with emerging environmental investments.

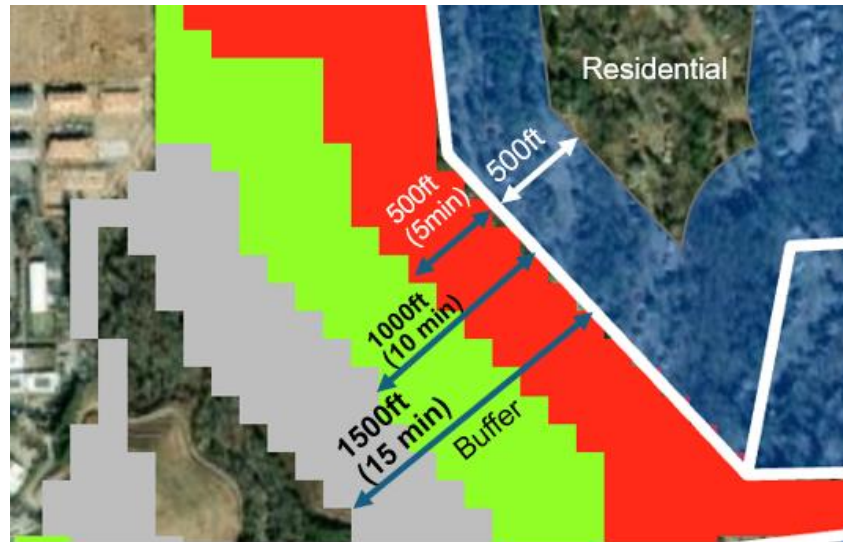


Figure 2.11: Image clip of residential buffer layers showing walkable green space access (Community) and inward-facing gentrification potential (Developer).

Together, these two layers operationalize both community-valued green access and developer-driven gentrification dynamics, providing a balanced spatial input structure for modeling stakeholder conflict in the South River Forest region.

2.4 Accuracy Assessment

An accuracy assessment for the land use/land cover (LULC) classification was conducted using high-resolution imagery from Google Earth Pro to derive reference data points. This technique is used to quantitatively evaluate the reliability of the classification results obtained from the remote sensing data. Google Earth Pro utilizes high-resolution commercial satellite imagery sourced from Maxar Technologies (formerly known as DigitalGlobe), along with imagery from aerial photography providers and other satellite image suppliers such as Landsat and Sentinel. When users zoom into an area, Google Earth Pro integrates a mosaic of frequently updated images of spatial resolutions ranging from 0.3 to 1 meter (Google Earth Pro, 2025). This makes it suitable as reference data for the accuracy assessment of land cover classifications.

Leaf-on images from Google Earth Pro dated 7/18/2023, located at 33°20'48"41W were observed for this assessment and compared to the 2023 late summer LULC PlanetScope classification used in this research (Figure 2.12). Following the recommended practices for remote sensing accuracy assessment, random points were generated across the study area (Congalton & Green, 2019). This was performed using the "Create Accuracy Assessment Points" tool in ArcGIS Pro. To ensure sufficient representation of each land cover class, a total of 114 accuracy assessment points were located throughout the 192.65 km² Southeast Atlanta study area. The randomly distributed points functioned as validation samples to assess the classification accuracy.

The generated points were then exported from ArcGIS Pro to a Keyhole Markup Language (KML) file format unique to Google Earth Pro using the "Layer to KML" conversion tool. The resulting KML file was imported into Google Earth Pro, which served as verification points to assess the accuracy of the classified map. Each point was visually inspected in Google Earth Pro to manually interpret and record its true or "reference" land cover classification. After collecting reference points, their attribute labels were compared against the initial classification results in ArcGIS Pro using the "Compute Confusion Matrix" tool. This comparison generated a confusion matrix (Table 2.6, which provided statistical metrics, including overall accuracy, user's accuracy, producer's accuracy, and the Kappa coefficient.

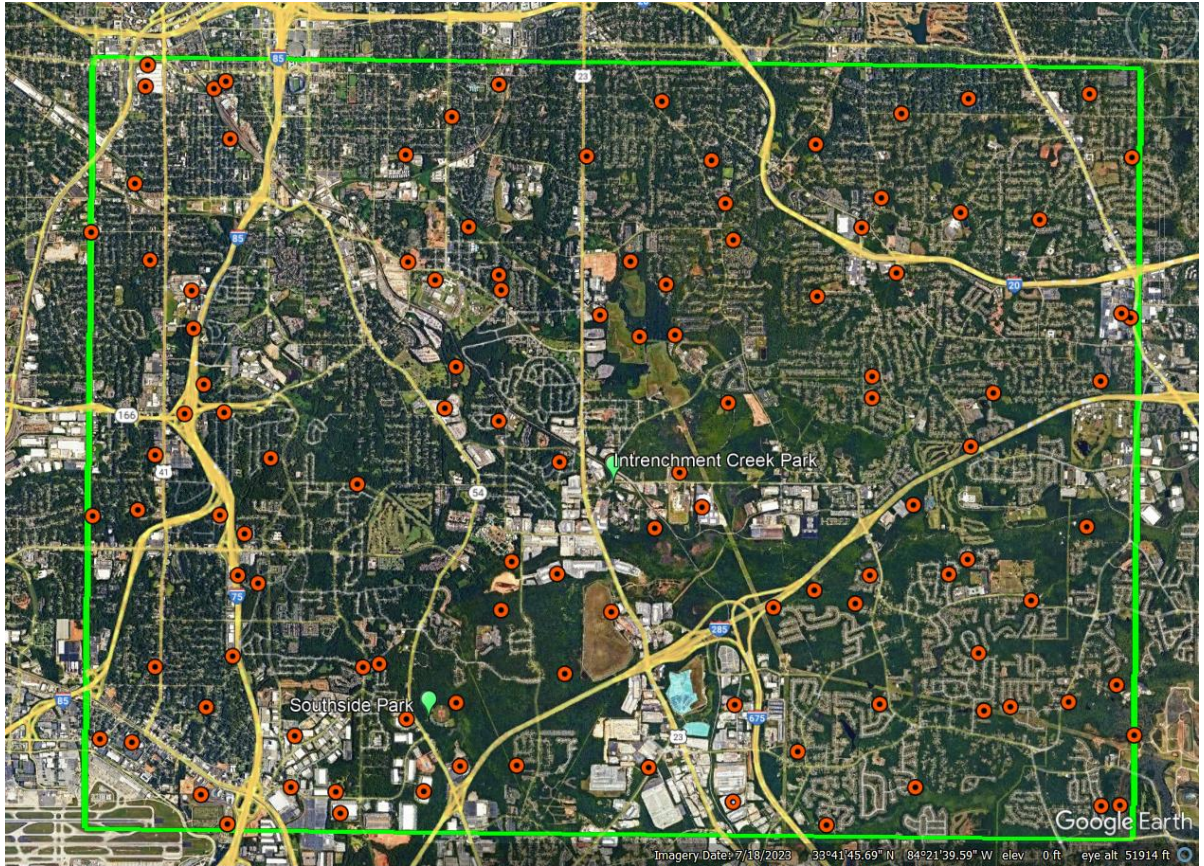


Figure 2.12: Google Earth image with verification points displayed.

Table 2.6: Confusion Matrix using 114 control points for accuracy assessment

Class Value	Water	Green Space	Bare Earth	Impervious	Buildings	Total	U Accuracy
Water	5	0	1	3	0	9	0.56
Green Space	0	54	0	1	0	55	0.99
Bare Earth	0	1	11	1	0	13	0.85
Impervious	0	1	0	26	0	27	0.96
Buildings	0	0	0	0	10	10	1.00
Total	5	56	12	31	10	114	0
P Accuracy	1.00	0.96	0.92	0.84	1.00	0	0.93
Overall accuracy = 93%, kappa statistic = 0.9							

The overall accuracy is 93% and kappa statistic is 0.9. Values above 85% and Kappa statistics greater than 0.75 are considered acceptable and reliable for remote sensing studies and environmental monitoring (Jensen, 2015). The results in this study show an overall accuracy value of 93% and kappa statistic of 0.9, which ensures the classification accuracy is sound and reliable for this research. These metrics assessed the overall efficacy of land use classification, identifying classes with high user accuracy (e.g., buildings, green space, and impervious/developed) while emphasizing those susceptible to confusion or misclassification (e.g., water being confused with impervious surfaces due to their dark color). This structured approach provided a robust and replicable method for validating and ensuring the reliability of the geospatial analysis conducted in this study.

2.5 Discussion

2.5.1 Interpretation of Change Detection

The spatial patterns of urban expansion and green space loss identified in this study align with trends observed in other global urbanizing metropolitan areas rapidly experiencing this phenomenon. In a similar study that characterizes and maps human settlements through a spectral analysis of Normalized Difference Vegetation Index (NDVI) and Enhanced Vegetation Index (EVI) values, both commonly used indices to quantify vegetation health and greenness in remotely sensed data, a decline in vegetation health was confirmed due to rapid urban development in construction zones (Ridd & Hipple, 2006). This example highlights how impervious surface expansion in urban areas leads to the alteration of ecological functions, increased runoff, and soil degradation. Weng (2016) mapped the habitats of endangered species and discussed how high-resolution remote sensing techniques, particularly using multispectral and hyperspectral imagery, improve the detection of subtle but statistically significant vegetation changes and urban encroachment. They further demonstrated that urbanization leads to fragmentation of green spaces, reducing landscape connectivity and increasing patch density, which has a detrimental effect on local biodiversity. These findings align with the results of this study, where a decline in green space within Southeast Atlanta is observed, particularly in zones experiencing high development pressure, such as near the Intrenchment Creek Park area and the perimeter of the former Prison Farm. Although Figure 2.5 shows an overall increase in green space classification in 2024, rising to 81%, a trend likely influenced by vegetation regrowth or classification shifts. This masks the fragmentation and edge loss occurring within critical

ecological corridors. These localized declines are significant because they impact habitat continuity and landscape permeability, even as broader vegetated cover may appear to rebound across the study area.

Additionally, a chapter on urban modeling in the *Manual of Geographic Information Systems* by Lo & Yang (2009) emphasizes how GIS-based spatial modeling using cellular automata for urban planning can track urban sprawl, highlighting land transformation patterns similar to those in Southeast Atlanta. The example shows how spatial autocorrelation techniques such as Moran's I and Getis-Ord G_i^* statistics can be employed to assess clustering in urban expansion patterns. In this example, these methods were applied to examine high-density development zones in Atlanta during the early 2000s, along with their spatial relationships with declining vegetation indices in areas where community displacement pressures have increased. This serves as a tool for weighing different values and planning different outcomes in land development and further emphasizes the importance of why monitoring developed land is a large factor that coincides with green space decline.

In Lo and Yang's (2009) study, a cellular automation model and GIS were used to simulate the spatial consequences of different growth scenarios in the Atlanta Metro Metropolitan Area. The authors applied the SLEUTH model, a cellular automata-based urban growth simulation framework, to predict future urban expansion. SLEUTH, an acronym for Slope, Land use, Exclusion, Urban, Transportation, and Hill shade, incorporates multiple geospatial variables to model and project urbanization trends. The SLEUTH is applied to evaluate how different land cover factors influence development patterns in Atlanta metro and surrounding counties, including areas experiencing green

space loss. The model was trained on datasets from Landsat satellite imagery integrated with topographic slope data from USGS DEMs to refine urban suitability assessments. Outcomes of this model make it possible to assess the land transformation with outcomes that predict that if urban expansion continues without significant regulatory oversight, it could lead to the loss of nearly 30% of the remaining green space by 2040. The highest-performing model demonstrated an accuracy of 86% (Kappa = 0.86) in predicted urban expansion areas. Integrating SLEUTH predictions with real-time remote sensing data enhances urban planning by providing an adaptive decision-support tool. The findings from these studies support the interplay between developed lands and green space as crucial components in monitoring the health and well-being of urban communities.

The findings of this study indicate that stable natural areas, which include water and green space, make up about an average of 52% of the entire study area from 2018 to 2024. Although these areas remain significantly vegetated, there is a general trend of ecological decline over most of the study period, despite a notable increase in green space classification in 2024, which may reflect temporary regrowth, seasonal imagery variation, or classification shifts. This late-stage increase does not offset the ongoing fragmentation and land-use pressure observed in key locations throughout Southeast Atlanta. Despite some evidence of greening between 5% to 8% annually, land transitioning from stable natural, including forested and grasslands, to developed, such as impervious surfaces and buildings, accounts for approximately 7% to 15% annually. This highlights a noticeable and ongoing rate of urban expansion into previously natural areas over the 7-year time frame. Stable developed areas or regions already featuring

built environments constitute about 26% to 32% annually of the study area (Table 2.6). This indicates substantial existing urban development that continues to persist and expand. These factors emphasize how Southeast Atlanta's ecosystems are under increasing pressure of urbanization, underscoring the significance of well-rounded urban planning techniques. Visual interpretation of these land change analyses reinforced the community's perception of these findings, clearly showing reduced vegetation in critical areas experiencing significant construction activities, most notably around the 'Cop City' Intrenchment Creek Park area.

Table 2.7: Table of average annual land use changes

Land Use Category	Area (%)	Observations and Trends
Stable Natural (vegetation and water)	52%	Vegetated areas such as forests and grasslands remain the same
Natural to Developed (forests/ grasslands to impervious surfaces/buildings)	7%-15% annually	Urban encroachment, indicating either initial construction phases or installations of new development.
Developed to Natural (impervious surfaces reverting to green)	5%-8% annually	Transition back to green spaces, reflecting modest gains in ecological restoration.
Stable Developed (existing built environments)	26%-32% annually	Developed areas, such as impervious surfaces and built environments, remain the same.

The ecological consequences of these changes also intersect with social justice concerns, particularly green gentrification. The findings in this study support previous research in which underscores the role of satellite-based land cover classification in identifying environmental disparities (Prakash et al., 2020). Weng (2016) highlights urban remote sensing, which has provided crucial insights into how urban sprawl and densification influence vegetation indices, thermal variations, and ecosystem fragmentation. The observed decline in green space is consistent with urban heat island

(UHI) effects noted in remote sensing studies, where increased impervious surfaces lead to localized temperature increases and reduced evapotranspiration (Weng, 2016).

2.5.2 Impact on Residential Areas

Historically, satellite imagery, such as those from the Landsat, SPOT and Sentinel missions, provided regional assessments of urban extent, vegetation cover, and generalized land-use mapping. In contrast, modern analyses of urban landscapes like those presented in this research utilize advanced high-resolution PlanetScope imagery (3.7m resolution) that offers detail and higher temporal coverage for urban environmental monitoring. Nichol (2007), for example, provides a strong argument for using very high spatial, spectral, and radiometric multispectral data from sensors like IKONOS and QuickBird, with resolutions between 0.6 to 4 meters, to accurately delineate urban features and vegetation health. Research reported here incorporates a similar multispectral analysis using standard techniques that assess image patterns and textures within the unsupervised classification by grouping like pixels. The results, with an initial high accuracy assessment in classifying and identifying vegetation loss due to urban development activities, demonstrate the effectiveness of remote sensing applications for understanding the dynamics between green spaces and urban development in Atlanta.

The findings also highlight significant landscape changes in Southeast Atlanta, demonstrating the critical role of geospatial and mixed method technologies in urban land use planning. The observed vegetation loss in particular areas undergoing new development underscores the direct impact of urban expansion on local ecosystems and community spaces. Such urban transformation is consistent with global

urbanization trends, wherein rapid urban development often encroaches upon green spaces, affecting ecological integrity and community well-being (Ridd & Hipple, 2006).

Modern satellite platforms such as Sentinel-2, PlanetScope, and Maxar's WorldView series offer image data with spatial resolutions as fine as 31 cm to 10 meters with higher temporal frequency, enabling precise monitoring of urban expansion, infrastructure development, and green space fragmentation (Zhou et al., 2021; Li et al., 2023). Additionally, integrating machine learning and object-based image analysis (OBIA) with high-resolution imagery has advanced urban classification accuracy, supporting automated detection of construction zones, impervious surfaces, and land-use transitions in real-time (Abdollahi & Pradhan, 2023). These technological developments continue to transform the field of urban remote sensing, providing essential tools for sustainable urban planning and environmental justice analysis.

Atlanta Metropolitan currently has a population of around 6.5 million and is expected to reach 7.9 million by 2050 (ARC, 2023). In Southeast Atlanta, the pressure for urbanization to expand with population growth will only increase. This will also lead to pressures on local natural resources and ecosystems. Expanded populations necessitate increased infrastructure, housing, and commercial spaces, which inevitably intensify land-use conflicts, threaten biodiversity, and strain existing green spaces and ecosystems. Consequently, the demand for conservation initiatives to protect ecological integrity, biodiversity, and public green spaces becomes more critical. This is notable in several key Southeast Atlanta areas exhibiting this landscape transformation. As observed in this research, urban growth is extending northward from Hartsfield-Jackson Atlanta International Airport, particularly visible through the spread of impervious

surfaces and large-scale commercial buildings. These changes are especially concentrated near major infrastructure corridors like I-285 and I-20, where logistical and industrial activity, including the expansion of the trucking industry, continues to shape land use. Significant deforestation is observed in the area near the Intramural Creek Park and the former Prison Farm, aligning with ongoing debates around the Cop City development and raising critical environmental justice concerns. Additionally, rapid infrastructure growth associated with the film industry, particularly the expansion of Shadowbox Studios, contributes to a shift from vegetation land to industrial use. These trends reveal localized hotspots of land cover change and underscore the need for targeted conservation and policy strategies to protect remaining green space while planning for equitable urban development.

The annual rate of 7%-15% land conversion from natural to developed states since 2018 is significant because it represents rapid and sustained urban encroachment and exceeds ecologic thresholds commonly referenced in landscaped ecology literature, leading to substantial ecological and social consequences. According to Turner et al. (2001), landscape ecology studies suggest annual land cover changes greater than 1-2% can disrupt ecosystem connectivity and threaten biodiversity, particularly in sensitive or already fragmented landscapes. A loss of green spaces at this scale can severely compromise ecological integrity, reduce biodiversity, disrupt ecosystem services such as air quality, and lead to flooding while reducing natural resources vital to community health and well-being (Wolch et al., 2014; Deng et al., 2016). This is especially true in Atlanta, where stormwater runoff is already a critical issue. Additionally, such extensive urbanization often exacerbates issues related to

environmental justice, disproportionately impacting marginalized communities by increasing vulnerability to environmental degradation, pollution exposure, and displacement pressures associated with rising property values and taxes, a phenomenon known as "green gentrification" (Anguelovski et al., 2019). The U.S. Environmental Protection Agency (EPA, 2014) and the U.S. Geological Survey (USGS, 2017) recognize land use changes exceedingly roughly 5% annually as environmentally impactful, necessitating immediate management and mitigation efforts to preserve ecological integrity. Therefore, understanding and mitigating these rapid transitions through proactive urban planning and conservation strategies is crucial to ensuring equitable and sustainable urban growth.

2.5.3 Future Work and Recommendations

Recommendations for future research should include systematic stakeholder engagement, combining qualitative community insights with quantitative geospatial data to ensure equitable urban greening initiatives that prevent green gentrification and displacement (Johnson Gaither & Aragón, 2024). The integration of demographic information with remote sensing data in Athens-Clark County, Georgia, to assess disparities in urban livability is further substantiated by the findings of Lo and Faber's (1997) prior research. Their study emphasizes that while urban greening efforts improve environmental conditions, they often do not benefit lower-income communities equally and reinforce socioeconomic divides. Linking satellite-derived LULC data with census variables, Lo and Faber (1997) illustrate access to urban green spaces correlates strongly with income levels, further highlighting the need for equity-focused planning in Southeast Atlanta. Fast forward to modern technologies, this information is more

accessible due to advancements in remote sensing platforms such as PlanetScope and Sentinel imagery, high-resolution drone surveys, and enhanced spatial analysis tools like Google Earth Engine. These technological improvements offer unprecedented opportunities for continuous monitoring and real-time analyses, enabling urban planners and researchers to identify and respond to emerging socio-ecological disparities quickly.

Recommended longitudinal studies and continued monitoring of land changes employing remote sensing data analyses would provide deeper insights into temporal trends and long-term impacts of urban developments. This approach would inform adaptive management strategies for developed areas in Southeast Atlanta's dynamic urban landscape. Increasing the accuracy assessment points used in this study to identify land cover classes requiring ground truthing would improve the data quality. Along with green space, it would also be beneficial to build a better understanding of vegetation community and species-level classification within the urban forested, shrub, grass, and wetland areas to provide details that are fundamental for maintaining biodiversity and health of the ecosystems. For example, Dawson (2018) compared vegetation across 72 cities, and Mohimi and Esmaeily (2024), who analyzed urban sprawl using multi-technique geospatial approaches, explored the variations of land coverage in urban spaces categorizing land use and identifying changes over time. These studies show how urban growth affects available green spaces. Much like the research in this study, their findings emphasize how effective management of these spaces can lead to improved biodiversity and better urban living conditions. This collection of literature can guide future planning endeavors. When integrated analysis of green space and both community and developer's perspectives, land cover trends can

provide a more thorough understanding of urbanization impacts and sustainable initiatives to urban policy planners engaged in land use decisions.

2.6 Conclusion

The study employed an unsupervised classification algorithm, ISODATA clustering, to quantify changes in vegetation cover, classifying areas into various land uses and vegetation types. The results are then cross-referenced with infrastructure data to assess the implications of these changes on local communities and highlight potential areas for sustainable development and green space conservation. These methods enable detailed examinations of how urbanization patterns impact ecological systems and potential biodiversity (Prakash et al., 2020). Specifically, high-resolution satellite imagery, effectively tracking vegetation dynamics and urban growth, offers critical insights into the relationships between human activities and environmental change (Neuman, 2005). Through this approach, the study contributes to a better understanding of how urban and green space dynamics shape Southeast Atlanta's future.

Understanding the dynamic nature of encroaching human development plays a crucial role in the formation of a holistic perspective of urban environments. This research utilized a robust geospatial analysis that underscores the critical role of remote sensing in assessing annual urban land cover trends in Southeast Atlanta between 2018 and 2024. By integrating insights into remote sensing of human settlements (Ridd & Hipple, 2006), urban remote sensing, and remote sensing for sustainability (Weng, 2016), this study advocates for a data-driven approach to sustainable urban planning to ensure Southeast Atlanta's development trajectory is environmentally and socially

responsible. The findings reveal substantial green space loss within local areas of development, attention to areas of development effects, and socio-environmental green space degradation leveraging high-resolution satellite imagery from PlanetScope.

The research contributions to the field lie in its application of remote sensing methodologies and detailed temporal examination of land cover changes specific to Southeast Atlanta. It offers a replicable model for assessing land-use changes in rapidly expanding urban environments. For Southeast Atlanta, this means decision-makers can prioritize conservation and restoration areas, which leads to better urban management strategies. This research highlights the importance of using geospatial analysis and clearly defined land cover classifications to support urban planning and policymaking aimed at balancing ecological preservation with development. This study demonstrates how high-resolution remote sensing can effectively capture localized patterns of land transformation in rapidly changing urban environments. In Southeast Atlanta, key changes include urban expansion extending north from Hartsfield-Jackson Atlanta International Airport, land conversion along major corridors such as I-285 and Moreland Avenue, and deforestation near the former Atlanta Prison Farm, where the Cop City development was proposed. The emergence of large building footprints, particularly in industrial zones, may reflect the growing imprint of the trucking and logistics industry. These spatial insights highlight how remote sensing can be a powerful tool for identifying land-use conflicts, supporting more equitable planning, and informing sustainable development strategies not only in Southeast Atlanta but in similarly evolving urban landscapes worldwide.

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CHAPTER 3

COMMUNITY PERCEPTIONS AND STAKEHOLDER ENGAGEMENT IN THE SOUTH
RIVER FOREST

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Abstract

This study examines community perceptions and stakeholder engagement within the South River Forest (SRF) area of Southeast Atlanta, a region undergoing significant land use transitions amid competing interests in conservation and development. As urban greening efforts intensify, understanding how residents interpret and prioritize green space becomes critical to equitable planning outcomes. This analysis aims to examine local perceptions of urban greening initiatives, focusing on how residents value green spaces and assessing potential development scenarios within the South River Forest (SRF) Vision area. The SRF Vision area is a proposed 1416 hectares (3,500-acre) network of interconnected parks, forests, and underutilized land in Southeast Atlanta, identified by local planners and community organizations as a critical site for long-term conservation and public access. The SRF area has become a focal point of debate over competing land uses, including recreation, ecological preservation, and large-scale development projects.

Using a mixed-methods approach, this research applies a two-part approach to interpret and analyze community feedback derived from the Atlanta Regional Commission (ARC) survey conducted in 2022 and qualitative data from South River Forest Coalition (SRFC) meetings. The primary community responses referenced here come from the ARC survey, which provides structured data to assess values, concerns, and desired outcomes related to the SRF. Community responses were categorized into key themes: ecological value, recreational use, environmental concerns, and social equity. Results reveal strong support for green space preservation and public access alongside widespread concerns about displacement, limited political representation, and

long-term environmental degradation. This research also provides a foundation for integrating qualitative community input into geospatial modeling efforts. Specifically, the findings inform the development of a Land Use Conflict Identification Strategy (LUCIS) model, where community priorities and stakeholder feedback are translated into weighted spatial criteria to guide future land use planning (Carr et al., 2007). By highlighting the values of local residents and their relationship to green space, this study contributes to more inclusive and responsive urban planning frameworks.

3.1 Introduction

3.1.1 Understanding Local Community Perceptions and Land Use Priorities in the South River Forest (SRF) and Surrounding Areas

Southeast Atlanta is undergoing a significant transformation driven by urban greening and developmental pressures, posing substantial competing factors for community residents, ecosystems, and economic interests. Recognizing these interrelated dynamics is crucial for achieving equitable and sustainable urban development (Anguelovski et al., 2019; Wolch et al., 2014). This research focuses on examining how residents in Southeast Atlanta perceive the South River Forest (SRF), a 3,500-acre mixture of public, private, and undeveloped ecologically significant focal points for environmental preservation, recreational access, and urban development (Gaither & Aragón, 2024). Specifically, the study investigates local community perspectives on the future of this area, including how residents prioritize land use (such as conservation, recreation, or development), what they expect in terms of environmental protection and access, and how they envision the SRF contributing to

their neighborhood's well-being and identity. This analysis integrates survey data, qualitative insights, and spatial data to offer a holistic understanding of community engagement with green spaces, community priorities, and challenges regarding environmental preservation and urban development in the area. Stakeholder involvement is essential for ensuring environmental justice, as community input shapes land-use planning that considers socio-economic and cultural implications (Anguelovski et al., 2019).

Qualitative data on community sentiment plays a critical role in supporting the Land Use Conflict Identification Strategy (LUCIS) model by grounding land use suitability analysis in community-driven values. Originally developed by Carr et al. (2007), the LUCIS model is a spatial analysis framework that uses multi-criteria decision analysis within a geographic information system (GIS) to identify areas of alignment and conflict among competing land-use interests, such as conservation, development, and agriculture. While the model was initially designed to incorporate stakeholder preferences through structured weighting, subsequent research has expanded how community perspectives are gathered and integrated.

Carr et al. (2007) emphasized that public input, often collected through stakeholder workshops or planning sessions, can be used to assign weighted values to different land-use priorities. Brown and Raymond (2007) expanded this approach by discussing Public Participation Geographic Information Systems (PPGIS), in which residents identify personal or community value areas on maps. These values are then spatially analyzed and converted into land use suitability modeling criteria, creating a

direct link between qualitative sentiment and geospatial outputs. However, PPGIS is just one part of a broader set of participatory geospatial methodologies.

The terms Participatory GIS (PGIS) and PPGIS are often used interchangeably, though they emerged in different contexts. PGIS typically refers to community-driven mapping practices rooted in the Global South, while PPGIS originated in more formalized, developed-world planning environments (Rambaldi et al., 2006; Ndzabandzaba, 2018). Scholars such as Nyerges et al. (1997) and Bugs et al. (2010) emphasize that PPGIS grew out of efforts to democratize GIS access and enable public use of mapping capabilities, while Brown and Kytä (2014) suggest the distinction reflects the varying social and institutional settings in which these practices evolved. Tulloch (2008) recommends using the terms inclusively to capture the diverse participatory processes shaping geospatial planning.

In parallel, Volunteered Geographic Information (VGI), as conceptualized by Goodchild (2007), introduces another participatory layer where citizens act as sensors—producing spatial data through digital tools, mobile apps, and web-based platforms. This approach is particularly relevant in crowd-sourced environmental monitoring and community-based planning initiatives, further blurring the boundaries between expert-driven and citizen-driven GIS.

Elwood (2010) also highlighted the importance of qualitative GIS techniques in capturing localized, experiential knowledge through interviews, participatory mapping, and community-based fieldwork tools that can reveal lived experiences often overlooked in conventional planning processes. Similarly, Anguelovski (2016) and Pearsall and Anguelovski (2016) explored how marginalized communities perceive green

infrastructure projects, using interviews and ethnographic methods to surface concerns about displacement and access. Together, these studies offer valuable models for integrating community voices into environmental planning, reinforcing the need for participatory, inclusive GIS tools that reflect diverse priorities in land use decision-making.

Omidipoor (2017) applied the LUCIS model to assess land use suitability and conflict in the Kohgiluyeh and Boyer-Ahmad Province of southwestern Iran, an area experiencing competing demands for agricultural development, conservation, and urban expansion. In this study, community perspectives were gathered through field observations and local planning documents and then incorporated into the model using stakeholder-defined criteria for each land use type. These criteria were assigned relative weights based on perceived importance, reflecting the region's socio-economic conditions and environmental priorities. The model's output identified areas of high conflict, where conservation goals overlapped with development pressure, as well as zones of alignment that could inform more sustainable regional planning. The study demonstrated how LUCIS can be adapted to incorporate qualitative, context-specific knowledge into geospatial models, particularly in regions with limited data availability and complex planning needs (Omidipoor, 2017).

The Analytic Hierarchy Process (AHP), developed by Saaty (1980), is a multi-criteria decision-making technique that structures complex problems into a hierarchy and uses pairwise comparisons to assign weights to different criteria based on stakeholder preferences. Similarly, Jing et al. (2021) integrated AHP into a LUCIS-based framework to evaluate multi-objective land use suitability in China's rapidly

urbanizing Nanchang City region. AHP allowed stakeholders, including local government officials, planners, and residents to systematically rank the importance of competing land use priorities such as ecological preservation, urban infrastructure, and agricultural productivity. These rankings were used to calculate weighted criteria layers for each stakeholder group, which were then overlaid within the LUCIS model to identify spatial patterns of agreement and conflict. The study not only produced suitability maps that aligned with both technical and social priorities but also demonstrated how participatory weighting systems from participatory engagement can enhance the transparency and legitimacy of spatial planning tools. Jing et al.'s (2021) approach highlights the growing trend of integrating community preferences and expert knowledge in land suitability analysis using hybrid methodologies that blend qualitative insights with robust geospatial models.

This study builds on these approaches by synthesizing community responses from the Atlanta Regional Commission (ARC) survey with qualitative data from South River Forest Coalition (SRFC) meetings (ARC 2023; South River Forest Coalition, 2024). ARC data was analyzed using the Thematic Analysis Approach to identify themes (Braun et.al., 2006). Thematic categories, such as recreational use, environmental preservation, environmental justice and development concerns, are then weighted and applied as decision criteria in preparations for use in an investigation of development impacts in Southeast Atlanta. Community sentiments derived from this research will be considered within the LUCIS framework to model competing interests of neighborhood residents, developers and conservationists in an historic and ecologically important area of Atlanta. Consequently, this research contributes to an evolving methodological

tradition that combines participatory engagement with spatial analysis to support more equitable and context-sensitive urban planning.

3.1.2 Study Area

The study area includes the South River Forest (SRF) Vision Area as the study boundary, a vital component of Southeast Atlanta spanning approximately 1,416 hectares (3,500 acres) across portions of Fulton and DeKalb Counties (Figure 3.1). Located at the headwaters of the ecologically significant South River watershed, this area is characterized by urban neighborhoods, industrial sites, and significant green spaces. The SRF is intersected by major transportation routes, including Interstate 285 (I-285) to the east, Interstate 20 (I-20) to the north, and Moreland Avenue as a prominent north-south corridor linking neighborhoods and influencing local development patterns. Important parks and natural areas within the SRF vision area include Intrenchment Creek Park, Constitution Lakes, Lake Charlotte Nature Preserve, the Urban Food Forest at Browns Mill, Southside Park, and the historic Atlanta Prison Farm site. These green spaces provide essential ecological services, recreational amenities, and community identity anchored in an area facing significant developmental pressure and environmental justice challenges. This setting provides the context for evaluating community perceptions, stakeholder engagement, and local values toward urban greening and development initiatives addressed in this chapter.

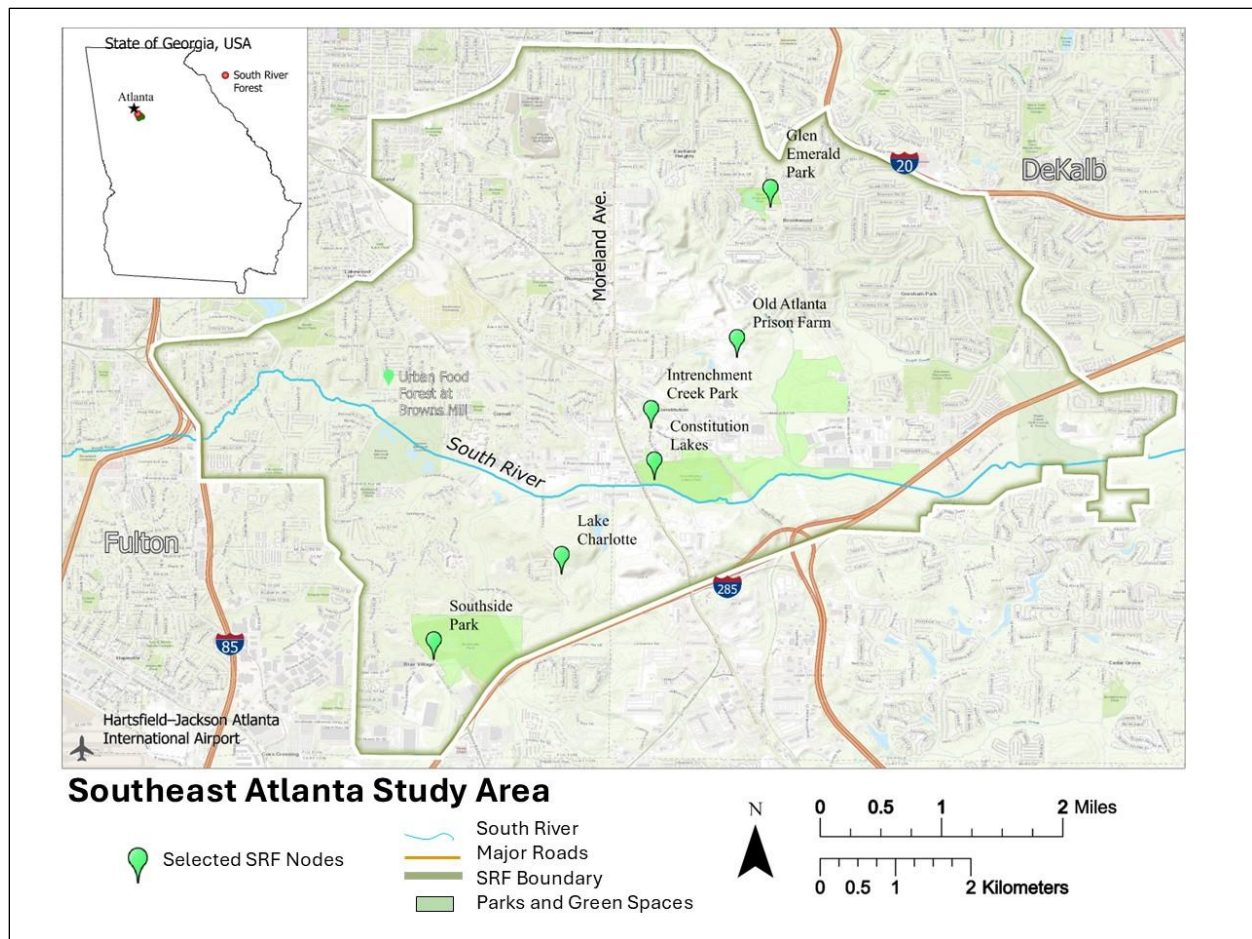


Figure 3.1: Southeast Atlanta study area.

Southeast Atlanta study area with major roads, rivers, green spaces, and urban developments. This map includes both Folton and Dekalb county and the South River Forest Vision Area boundary as critical South River Forest node landmarks to help identify locations of land use and land changes.

3.2 Data and Methods

Community engagement data were sourced primarily through surveys administered by the Atlanta Regional Commission (ARC) and meetings facilitated by the South River Forest Coalition (SRFC) from 2018 to 2023 (ARC, 2023). Surveys were distributed primarily online but also through mail, door-to-door flyers, and community events. Celebrations such as the 2022 Juneteenth event at the Urban Forest at Browns Mill were used by members of the SRFC to pass out flyers promoting the ARC survey

(Figure 3.2). The final report produced by the Community Development Assistance Program (CDAP), a technical assistance initiative of the ARC outlines a strategic vision for the preservation and development of the 3,500-acre South River Forest in Southeast Atlanta and Southwest DeKalb County. It highlights key stakeholder engagement efforts to integrate local voices into planning decisions, including surveys, community meetings, and public feedback sessions (ARC, 2023). These sources provided robust qualitative data on local perspectives, highlighting nuanced community attitudes toward environmental preservation, development pressures, and displacement risks. Elwood's (2010) mixed-methods framework was instrumental in conceptualizing this research in terms of integrating both quantitative data (spatial analyses and mapping) and qualitative data (community narratives and perceptions), providing a deeper understanding of complex social dynamics. This approach along with Gaither and Aragón (2024), whose work highlights the importance of incorporating local stakeholder priorities and historical contexts into land-use planning frameworks, informed the data integration approach.



Figure 3.2: Distribution of flyers on June 18th, 2022, at a Juneteenth event at the Urban Food Forest at Browns Mills promoting the ARC survey and educational materials to community members.

In photo, Daron Davis, former Director of The Nature Conservancy of Georgia, festival attendees, and Amanda Aragón, at the Juneteenth event.

By directly integrating community-derived weights into the LUCIS model, this study helps to ensure that land-use suitability analysis aligns with the lived experiences and concerns of Southeast Atlanta’s residents. To do this, numeric values of importance computed using methods established by Saaty (1980) are used to translate qualitative insights into quantitative criteria. This approach enhances transparency in urban planning by ensuring that stakeholder-driven data informs land-use decisions, reinforcing the principles of environmental justice and sustainable urban development (Jelks, 2021; Pearsall & Anguelovski, 2016). The methodology builds upon prior research emphasizing the importance of participatory planning in understanding land-use conflicts and integrating ecosystem services into urban decision-making (Brown & Raymond, 2007; Elwood, 2010; Gaither & Aragón, 2024). By assigning weights to different land-use perspectives based on stakeholder engagement, this study seeks to establish a data-driven, community-informed framework for reconciling development and conservation in Southeast Atlanta’s rapidly changing urban landscape.

Similar methods have been effectively employed in urban greening studies to analyze land-use prioritization and environmental justice concerns. One consideration to weigh the different criteria is the Analytical Hierarchy Process (AHP) where stakeholders and expert decision-makers are asked to rank multiple attributes. For example, Matori (2016) conducted a multiple-criteria decision model to prioritize urban green space features in Ipoh City, Malaysia. Their study analyzed the preferences of park users and expert decision-makers to rank nine attributes that influence green spaces, such as safety, maintenance, accessibility, and facilities. In this example, their AHP results showed that the community places a high value on safe and well-kept recreational spaces, with safety features being ranked as the most crucial, followed by accessibility and maintenance. The same could be applied to the community values of green spaces in Southeast Atlanta. However, because this study involves a single researcher interpreting community data previously derived by a survey, rather than a multi-stakeholder or expert panel, and the number of land use categories and decision criteria is relatively limited compared to more complex multi-criteria studies, AHP-derived weights were not possible. Instead, average weights were assigned to each value category based on their frequency and relative importance, as indicated by survey responses and qualitative feedback, as explained below in Section 3.6.1. It is important to acknowledge that this process of assigning weights carries a degree of subjectivity, particularly in the absence of formal consensus-building methods like AHP. However, this model represents one iteration of a flexible innovative framework, and the weighting scheme can be modified and expanded in future work as more community engagement and expert feedback are incorporated.

In addition to the weight system, which is critical for informing a structured model to address areas of agreement and conflict among the major groups of stakeholders, the often conflicting and complicated social microcosm of diverse communities themselves should be recognized. For example, the proposed construction of the Atlanta Public Safety Training Center, also known as "Cop City," located within the South River Forest Vision Area has sparked widespread concern among major groups of stakeholders. Many media sources, including The Wall Street Journal, have deemed ongoing acts of "domestic terrorism" during protests to protect the green space. (Timms & McWhirter, 2023). In the ARC survey, this becomes apparent as some of the respondents have strong opinions related to this location. This prompted the surveyors to place this topic as a dedicated category focused on the Public Safety Training Center due to its high prominence among respondents. The report is intended to serve as a roadmap for implementing equitable and community-driven conservation strategies while addressing concerns such as green gentrification, ecological preservation, and sustainable urban growth. However, new developments and city initiatives to expand may not reflect these actions, and with the aid of the data, this can be determined.

3.2.1 Key Data Sources and Community Engagement

This research employs a two-part analytical approach to understanding better community preferences and perceptions regarding the South River Forest (SRF) and residential neighborhoods in Southeast Atlanta. The first component involves a structured interpretation of survey responses collected through the *Explore South River Forest Survey* (ARC 2023), conducted by the Atlanta Regional Commission (ARC). Feedback from 190 respondents was categorized into nine distinct themes,

representing various ways the SRF is valued and used by respondents. This sentiment aligns with Checker's (2011) concept of "place-keeping," where community members prioritize the preservation of their historical and cultural connections to local green spaces over externally driven place making initiatives. The dominant themes derived from the report include recreational use, conservation priorities, environmental justice concerns, and residential perspectives. This classification facilitates a systematic examination of community values and land-use priorities, ensuring the data are organized for meaningful interpretation.

The second component consists of a critical review and analysis of the ARC's reported findings. In light of the thematic interpretation of open-ended survey responses this comparison assesses the degree to which the ARC's summaries reflect the full spectrum of community sentiment, while also identifying gaps in representation and potential demographic bias. Notably, the ARC survey data skew toward **non-resident and white respondents**, as shown in **Table 2 of Johnson Gaither and Aragón (2024)**, where over 80% of survey participants were white, and the majority reported neither residing in nor owning businesses in the SRF area—despite the surrounding communities being predominantly Black and historically underserved.

To provide additional perspective, the author participated in weekly South River Forest Coalition (SRFC) meetings from January 2022 through 2023. While not a comprehensive representation of all viewpoints, these meetings offered direct exposure to evolving community priorities, land use concerns, and grassroots discourse, as represented by environmental interests. This qualitative insight was used to contextualize the survey themes, particularly in identifying issues of access, equity, and

displacement that may not have been fully captured in the ARC's reported findings. Together, these sources informed the weighting of criteria in the LUCIS Community Perspective and supported a more inclusive modeling of land-use priorities in the South River Forest region.

By integrating these two components and supporting the researcher's interpreted weights with subject matter expertise from the literature, this study provides both an interpretive framework for understanding community feedback and a critical assessment of the ARC's survey analysis. This dual approach enhances the reliability of the findings and contributes to a more comprehensive understanding of stakeholder priorities within the SRF planning process. This methodology aligns with previous research on survey-based urban planning approaches. Studies such as Elwood (2010) highlight the importance of mixed-methods research, which combines qualitative insights with quantitative categorization to ensure a comprehensive analysis of community feedback. Similarly, Gong et al. (2016) emphasize the role of structured thematic analysis in urban land-use studies, which helps identify patterns and priorities in public sentiments.

These sources provided detailed perspectives on community uses of green space, cultural values associated with SRF, environmental and health concerns, and demographic representation. This mixed-method approach ensured that the analysis captured a broad spectrum of community voices, with some demographic limitations, as discussed below. This survey is also the primary data source for informing weights that could be input to a LUCIS model.

3.2.2 Thematic Interpretation of ARC Survey Responses

To analyze qualitative responses to the ARC SRF Survey question, “How would you describe your relationship to the South River Forest area today?”, this study applied a manual coding and thematic analysis approach grounded in established qualitative methodologies. This process followed the six-phase framework of thematic analysis outlined by Braun and Clarke (2006), which involves: (1) familiarization with the data, (2) generating initial codes, (3) searching for themes, (4) reviewing themes, (5) defining and naming themes, and (6) producing the final analysis.

Each open-ended response was read multiple times to ensure familiarity, and initial codes were created based on recurring phrases, expressions of sentiment, and references to place, memory, or experience. Following Braun and Clarke’s structure, these codes were then grouped and re-organized into higher-order thematic categories that reflected common relationships to the SRF, such as “recreational use,” “community activism,” “spiritual or cultural connection,” “lack of awareness,” and “concern about development.”

The grouping of codes into themes was further guided by the methodological principles of Birks, Chapman, and Francis (2008), who emphasize iterative reflection and constant comparison to ensure themes are not artificially imposed but rather emerge from the data. This method allowed for nuanced interpretation while maintaining fidelity to the language and values expressed by survey respondents. In cases where responses were ambiguous or multilayered, a combination of semantic and latent coding was used to capture both the surface meaning and underlying assumptions.

The resulting thematic categories provided insight into how different stakeholders conceptualize their relationship to the SRF area. These interpretations were later used to inform the community perspective criteria and weightings in the LUCIS model, ensuring that the values expressed by participants were meaningfully integrated into the spatial decision framework (Johnson Gaither & Aragón, 2024).

3.3 Survey Interpretation Categorization

3.3.1. Survey Response Categorization

The research systematically analyzed responses to the survey question, “How would you describe your relationship to the South River Forest area today?”. Survey responses were categorized into nine thematic areas by the researcher: recreation, conservation, residential, environmental justice, physical activities, mental health and wellness, education, indigenous, and anything that mentions the police training center. This classification method aligned with previous research that emphasizes the importance of nuanced categorization to accurately reflect community values in urban planning processes (Elwood, 2010; Gong et al., 2016). The survey data were dissected question-by-question and filtered to create distinct categories of responses, ensuring a structured understanding of the feedback. Responses were systematically categorized into the following nine themes and percentage mentioned (Figure 3.3).

The following reflections and quotes directly sourced from the ARC survey reveal how community members understand the forest not just as a physical space but as a vital part of their environment, identity, and shared future. Through this lens, the SRF is

not merely a site for recreation or conservation, it is deeply intertwined with concerns about justice, climate resilience, public health, and cultural memory.

One participant emphasized the forest's ecological function and urgency, stating:

“This forest is essential to the air quality, flood mitigation, the water quality of our South River, and struggling native species” -SRF Community Member (ARC Survey, 2023).

This response reflects a strong awareness of the forest's role in supporting essential ecosystem services that sustain both environmental and human health in Southeast Atlanta.

Another respondent offered a more emotional and community-centered reflection:

I deeply cherish it as an old, comforting friend. It is a great source of peace for me, and I worry that the threats that surround it will not be overcome. I also greatly value it as an opportunity for a diverse coalition of voices to unite for real, tangible justice” -SRF Community Member (ARC Survey, 2023).

This perspective highlights the SRF as both a space of healing and a potential foundation for collective organizing and justice-driven action.

A third respondent captured the deep personal, even spiritual, significance of the forest, writing simply:

“It is my neighbor. It is sacred. It should be preserved” -SRF Community Member (ARC Survey, 2023).

This succinct response underscores many residents' intimacy and reverence toward the SRF and reflects broader community calls for long-term protection and stewardship.

These reflections, along with all responses, illustrate SRF's multidimensional value to the community. They reinforce the need for planning approaches that reflect not only spatial and environmental data, but also the emotional, cultural, and justice-based priorities of those most affected by land-use decisions.

3.3.2 Insights from Categorization

As illustrated in Figure 3.3 and summarized in Table 3.1, using the thematic distribution method of community responses reveals several distinct categories of concern and interest regarding the SRF. Responses were coded inductively, meaning themes emerged organically from the data rather than being pre-assigned. This involved systematically reviewing open-ended responses from the ARC survey and SRFC meeting notes, identifying repeated ideas, and grouping similar sentiments into thematic categories. Key phrases or references were tagged, and frequency counts were used to determine percentages of which themes were the most prominent across responses.

Recreation stands out as the highest priority, with 88% of respondents referring to activities such as walking, hiking, and cycling, indicating a strong public preference for accessible green space that supports physical activity. Conservation and preservation followed closely at 70%, reflecting widespread concern for protecting the forest's ecological health and natural character.

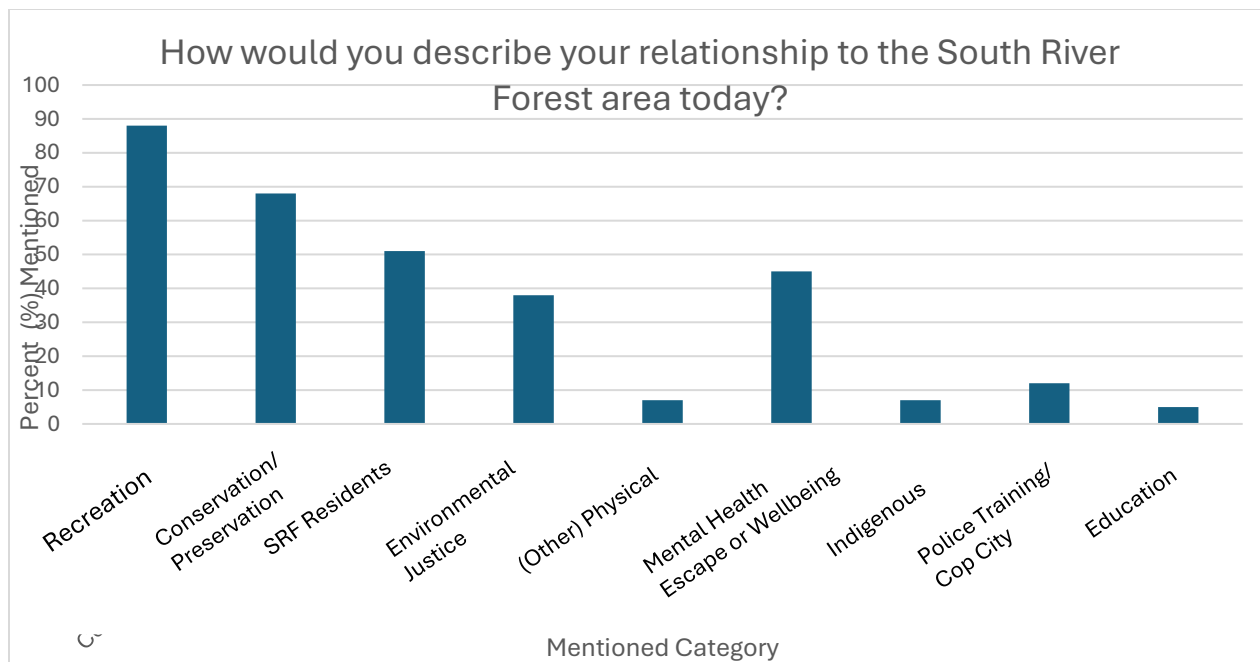


Figure 3.3: Response weights based on 190 community member’s feedback to the question “How would you describe your relationship to the South River Forest area today?” in the ARC survey (ARC 2023).

Table 3.1: Categorization of Themes

Category	Percent Mentioned	Description
Recreation	88%	Activities like walking, hiking, and cycling make up the largest proportion of responses.
Conservation/Preservation	70%	Expressions of concern for protecting the forest and its ecological significance.
SRF Residents	55%	Perspectives of individuals lifestyles living near or within the SRF area.
Mental Health/Escapes/Well-being	47%	References to the forest's role in providing peace and mental rejuvenation.
Environmental Justice	39%	Issues related to equitable access and protection of green spaces.
Police Training/Corp/City COP	13%	Concerns or mentions related to law enforcement presence or activities in the area.
(Other) Physical Activities/Trails	8%	Activities outside of formal recreation spaces.
Indigenous	7%	Tribal, cultural lands, land relationships, or historical awareness of the land
Education	6%	Suggestions for the use of the forest for educational initiatives and learning opportunities.

Responses emphasizing the perspectives of SRF residents accounted for 55%, indicating an awareness of the lived experiences. Related to this, 39% of participants raised environmental justice concerns, including issues of equitable access, protection from environmental harm, and the historical neglect of marginalized communities. Mental health, escape, and well-being were referenced in 47% of responses, underscoring the forest's value as a space for psychological restoration and emotional resilience.

Less frequently mentioned but still notable were other physical activities and trail use, which made up 8% of responses highlighting informal or less-structured engagement with the landscape. Police training and references to the proposed "Cop City" facility appeared in 13% of responses, reflecting a layer of political tension and civic resistance embedded in perceptions of the SRF. Indigenous perspectives, including references to cultural history and ancestral land, accounted for 7%, while education-related themes, suggesting the forest's potential as a learning environment, comprised 6% of the total.

3.4 ARC Survey Categorization

3.4.1 Community Uses and Preferred Activities in Green Spaces

The survey data highlighted diverse uses of green spaces in SRF. Respondents indicated a range of activities and preferred land uses, from recreational trails to environmental conservation zones. Figure 3.4 and Table 3.2 show the summarized distribution of these preferred uses from the figure in the ARC report. The importance of Recreation and Conservation/Preservation was further emphasized by their prominence

in the feedback, which was integral to shaping land-use priorities in this study. The percentages shown in the recreated donut chart (Figure 3.4) are sourced directly from the *Explore South River Forest* report published by the ARC (ARC, 2023). They have been adapted here to align with the design and narrative of this research. During the first community meeting, ARC asked participants to prioritize ten key planning themes identified through earlier survey efforts. Each participant ranked their top priorities, and the final percentages represent the proportion of responses each theme received relative to the total set of ranked responses. These values reflect aggregated community input and indicate the most pressing ten themes identified by local stakeholders, with environmental justice and economic equity tied at the top (17% each), followed by recreational opportunity (14%) and sustainable development (12%).

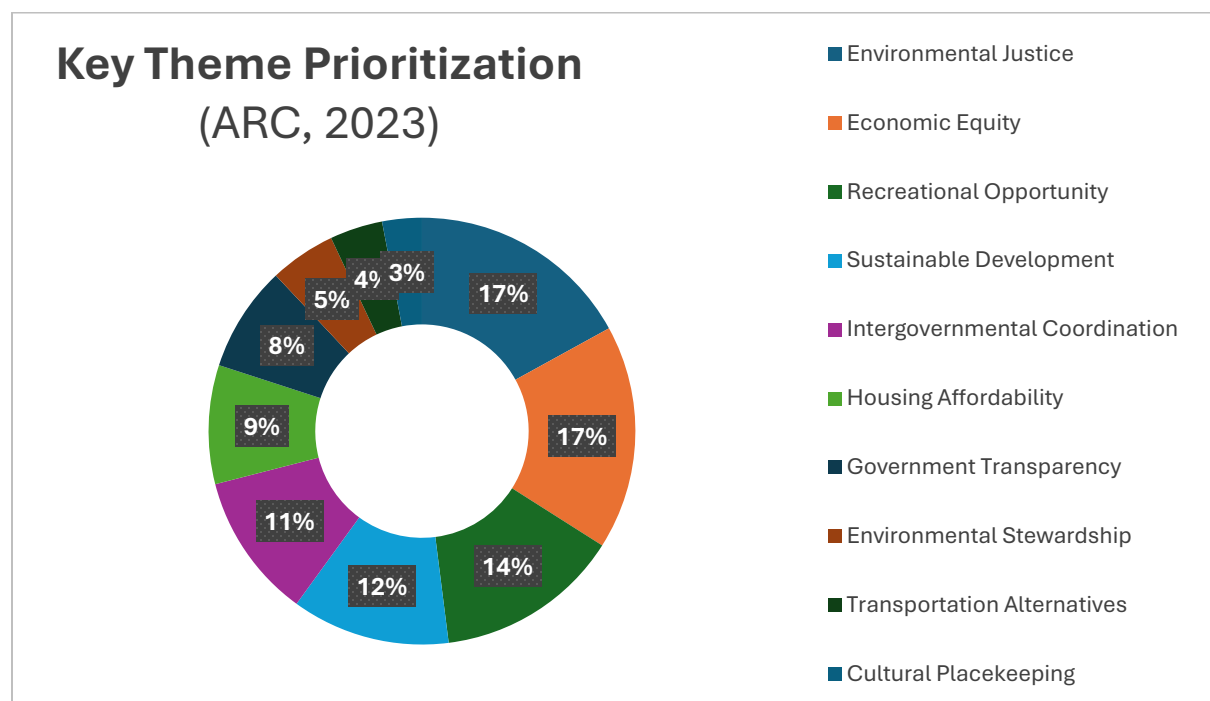


Figure 3.4: Key findings adapted from the 2023 ARC report on green spaces by respondents' community sentiments (ARC 2023).

Table 3.2: Preferred Uses of SRF Summary (ARC 2023)

Use of Green Space	Percentage of Respondents
Recreation (trails, parks, family spaces)	45%
Environmental conservation	30%
Community events and gatherings	15%
Other uses (cultural heritage, education)	10%

This insight can be used to inform the Land Use Conflict Identification Strategy (LUCIS) model by providing a guideline for assigning land-use conflict strategies ranks. Categories such as Recreation and Conservation/Preservation would feed into the information for weighting the importance to the community, while lower-priority categories such as indigenous (i.e. Indigenous peoples, cultural knowledge, land relationships, or historical stewardship) or Police Training influenced secondary or indirect considerations in the model.

This systematic approach ensured that the model reflects community needs and values, balancing conservation and sustainable urban development. Additionally, this method provides a replicable framework for integrating community feedback into broader land-use planning strategies.

Along with the survey, the results from both the categorical analysis and the diagram in the ARC report show a strong preference for recreational activities (45%), with community members seeking more accessible and safe trails, parks, and picnic areas. Environmental conservation also emerged as a prominent value (30%),

emphasizing the community's desire to protect and enhance the area's natural resources, including trails, parks, picnic areas, and passive recreational zones.

3.4.2 Value of the SRF - Environmental, Cultural, and Community Identity

The community perceives the SRF as an invaluable asset for several reasons.

Table 3.3 summarizes the different values from the survey into four categories to underscore the SRF's ecological, recreational, cultural, and community significance.

Table 3.3: Community Perceptions of SRF's Value (ARC 2023)

Value of SRF	Description	Percentage of Responses
Ecological (biodiversity, air quality)	Protects local wildlife, improves air quality, and provides ecosystem services	40%
Recreational	Offers spaces for outdoor activities such as hiking and family gatherings	35%
Cultural and Historical	Preserves the area's heritage and cultural significance	15%
Community Identity	Strengthens community bonds and local identity	10%

3.4.3 Environmental and Health Concerns Related to SRF

Survey respondents raised several concerns about environmental and health issues within the SRF area. The four key concerns include air quality, water contamination, and industrial encroachment. Table 3.4 presents the community's most pressing environmental concerns.

Table 3.4: Top Environmental Concerns in SRF (ARC 2023)

Environmental Concern	Description	Percentage of Respondents
Air quality	Concerns about pollution from nearby industrial areas	35%
Water contamination	Issues with pollutants affecting local rivers and streams	30%
Industrial encroachment	Fear of industrial expansion affecting natural habitats	25%
Deforestation	Loss of trees and green cover in urban expansion zones	10%

These concerns highlight the community's awareness of SRF's vulnerability to industrial impacts and the urgent need for protective land-use policies. Air quality (35%) and water contamination (30%) are particularly noted, with residents worried about pollution's effects on health and local ecosystems. Participants consistently expressed concerns regarding environmental health impacts, such as pollution and flood risks, due to proposed developments like "Cop City." These community concerns correspond with those discussed by Immergluck and Balan (2018), highlighting local apprehensions about urban development's ecological and health impacts. Such anxieties are common in communities adjacent to green developments, particularly where environmental degradation and increased health risks may accompany new infrastructure (Wolch et al., 2014; Checker, 2011).

3.4.4 Land Use Priorities and Development Preferences

When asked about future land use in the SRF and surrounding areas, respondents indicated a preference for development that aligns with environmental preservation and community needs. Table 3.5 below outlines the community's primary land use priorities, emphasizing green infrastructure and public recreational spaces.

Table 3.5: Preferred Land Use Priorities in SRF (ARC 2023)

Preferred Land Use	Description	Percentage of Responses
Green infrastructure	Development of eco-friendly systems like rain gardens and green roofs	40%
Public recreational spaces	More parks, playgrounds, and community areas	35%
Mixed-use development	Small businesses alongside residential areas	15%
Urban agriculture	Community gardens and urban farms	10%

3.4.5 Civic Leadership and Black Community Visions: Perspectives Beyond the ARC Survey

While the ARC SRF Survey provides valuable insights into public sentiment about the South River Forest, it underrepresents key voices within the predominantly African American communities most directly impacted by urban greening and development in Southeast Atlanta. To address this gap, this study draws from additional sources that include public statements by civic leaders, neighborhood associations, and community advocacy organizations that offer critical perspectives not fully captured in the ARC dataset.

Notably, Patricia Culp, president of the Cedar Grove Neighborhood Association, exemplifies a segment of the community advocating for a more integrative approach to land use. Culp publicly supported the proposed land exchange between DeKalb County and Blackhall Studios, which involved swapping a portion of *Intrenchment Creek Park* for nearby privately owned land. This was an agreement that would allow the studio to expand while the county would receive land elsewhere to develop into new greenspace, citing the potential for economic revitalization, improved park infrastructure, and enhanced safety amenities. These views were shared in a 2019 video posted by the

Great Park Connection Conservancy, where Culp emphasized the importance of job creation, ADA-compliant playgrounds, trail networks, splash pads, lighting, surveillance cameras, and emergency call boxes as essential features for equitable community development (The Great Park Connection Conservancy, 2019; Estep, 2021).

Another prominent civic voice contributing to the development conversation in Southeast Atlanta is **Jamal Millsap**, a local advocate and resident who publicly supported the proposed land swap between Intrenchment Creek Park and land owned by Shadowbox Studios. Millsap argued that the swap could bring much-needed investment, job opportunities, and improved park amenities to underserved communities, framing the exchange not as a loss of greenspace but as a way to revitalize neglected areas and enhance public access to quality infrastructure. His position reflects broader support within parts of the South DeKalb Black community, particularly through the efforts of the Great Park Connection Conservancy, which spearheaded a campaign in favor of the land swap. This included a community-wide petition, appearances at DeKalb County planning board meetings, and organizing through a Facebook group, all aimed at advancing a vision of developed, accessible greenspace that prioritizes safety, inclusion, and economic opportunity. These collective efforts illustrate that support for development. When framed around community-driven goals there is a significant thread within the larger tapestry of Black civic engagement in the area (The Great Park Connection Conservancy, 2019).

These expressions of support underscore a broader vision held by many Black civic leaders, one that does not necessarily oppose development, but rather demands that development be shaped by and for the benefit of the communities it affects. This

orientation contrasts with dominant narratives that often frame urban greening efforts solely through the lens of ecological conservation or resistance to change. As Johnson Gaither and Aragón (2024) argue, “Important in this case study is Black agency—the right of African Americans to participate fully in decisions that directly affect communities where they are in the majority, and to support environmental agendas that may not align completely with established environmental priorities”.

By incorporating these civic perspectives into the LUCIS model’s Community criteria and weighting schema, this research affirms the legitimacy and complexity of Black community visions that integrate environmental stewardship with socio-economic development. These views inform criteria such as proximity to enhanced park amenities, support for mixed-use recreational space, and prioritization of safety and accessibility features. They also highlight concerns around traffic, warehouse development, and industrial encroachment that disproportionately affect Black neighborhoods, suggesting the need for negative weights in areas experiencing these burdens.

To capture these themes alongside the ARC survey findings, this study developed a complementary framework summarizing community priorities expressed by civic leaders and community perception. This framework provides a more nuanced and complete representation of the values shaping the Community Perspective in the LUCIS model. The estimated community priority percentages in Table 3.6 were derived through qualitative coding of open-ended responses, combined with thematic analysis of public comments from South River Forest Coalition (SRFC) meetings and campaign materials (e.g., Great Park Connection videos and statements). Each criterion reflects a

synthesized estimate of its relative importance based on how frequently and emphatically it appeared across sources. The values were normalized to 100% to allow for comparison and do not reflect statistically weighted survey results, but rather a subjective interpretive framework grounded in community narratives and civic priorities.

Table 3.6: Community Priority Rankings by Perceived Importance

Theme Grouping	Criterion	Estimated Community Priority (100%)	Justification
Green Space (54%)	Support for Community-Driven Land Use Visions	23	Emphasizes Black agency and alignment with local civic visions for balanced development
	Proximity to ADA-Accessible Park Amenities	14	Valued for inclusive and accessible recreation improvements linked to proposed park upgrades
	Equitable Park Access in Underserved Areas	9	Recognizes long-term inequities in access, though slightly lower in ranked priority
	Recreational & Cultural Mixed-Use Greenspace	8	Supports flexible community use of parks but not always a central priority in public statements
Industry (46%)	Job Creation Potential (e.g., Film Industry Zones)	22	Reflects community support for economic revitalization and job creation from the land swap
	Public Safety Infrastructure (Lighting, Cameras)	16	Civic leaders emphasized lighting, cameras, and safety as essential park features
	Minimize Industrial Spillover (e.g., truck traffic)	8	While important, this was less emphasized compared to active development and amenity concerns.

3.5 Results

3.5.1 Final Criteria Grouping from Survey and ARC Report

To determine the final weight for the criteria to be used effectively in qualitative studies, all of the themes and categories from both the survey question and ARC report were grouped together into four separate classes. The classes were chosen based on their relevance to the study and their ability to be optimized for use in GIS modeling. For example, residential areas, green spaces, public health (hospitals), and transportation layers can be incorporated into a LUCIS model and sourced from a combination of datasets, including satellite, governmental, open-source, and property boundaries.

As both a geospatial researcher and an active participant in the South River Forest Coalition (SRFC), the author contributed an informed perspective to this classification and weighting process. Regular engagement in weekly SRFC meetings throughout the study period allowed the author to remain attuned to evolving community priorities, ongoing land use debates, and grassroots concerns that may not be fully captured in the ARC's summary report or SRFC meetings. This direct involvement ensured that the weights assigned to each criterion were not only supported by thematic analysis and established literature but also grounded in lived community dynamics.

Below is a list that describes the rank of each criterion used in Table 3.6, where 9 is the highest importance and 1 the lowest from the group ARC report and the survey interpretation. The criteria are assigned values based on Saaty's 1980's scale of relative importance (Saaty, 1980).

1: Equally important
 2: Equally to moderately more important
 3: Moderately more important
 4: Moderately to strongly more important
 5: Strongly more important

6: Strongly to very strongly more important
 7: Very strongly more important
 8: Very strongly to extremely more important
 9: *Extremely more important*

Table 3.7: Criteria for Community Input

Criteria	Grouped Survey and ARC Report Theme	Justification
Green Spaces (8)	- Recreation (Hiking, Trails, Parks) - Conservation/Preservation - Environmental Justice - Mental Health/Escape - Park Amenity Upgrades (Splash Pads, ADA Trails) - Security Infrastructure (Lighting, Cameras, Call Boxes) - Revitalization via Mixed-Use Greenspace-	Most valuable for recreation and urban resilience (45% and 30%, respectively). ARC showcases the dual need for public outdoor access and ecological preservation . Civic leaders expand this to include specific park improvements, ADA accessibility, and public safety concerns, aligning greenspace with quality-of-life enhancements and revitalization.
Residential Area (6)	- SRF Residents' Perspectives - Housing & Neighborhood Integrity - Concerns over Displacement - Police Training Facility Mentions - Community Revitalization without Displacement	High prioritized due to community concerns over housing affordability and displacement. The ARC report highlights strong concerns about gentrification and maintaining local identity. Civic leaders expressed nuanced views supporting development (e.g., film studio) if it delivers jobs and infrastructure.
Public Health (5)	- Public Health Access - Air & Water Quality Concerns - Community Events & Well-being - Indigenous & Cultural Identity - Desire for Safer Parks & Walkability - Environmental Health via Maintenance	Ranked lower by respondents but remains essential for ensuring equitable access to healthcare (35%). Civic leaders tie this to safer park infrastructure and cleaner environments especially near industrial corridors.
Transportation (3)	- Roads & Transit Accessibility - Connectivity to Community Spaces - Concern Over Increased Truck Traffic - Desire for Pedestrian-Friendly Corridors - Avoiding Traffic Spillover from Industrial Sites	Identified as important but less critical than other factors in survey responses (10%). The primary concern was ensuring accessibility without disrupting existing communities. The desire for transit access is tied to protecting walkability and minimizing industrial burden, especially near residential zones.

These Saaty values are used to compute ratios of relative importance for each criterion that, when added together, sum to 1. For example, green spaces in Table 3.7 has a value of 8. Since the total value of all criteria is $8+6+5+3 = 22$, the ratio of importance is $8/22 = 0.36$. The fractional values can then be used as weights in the LUCIS model for the community portion of the model and each preceding perspective.

3.5.2 Community Perception Table

The data in Table 3.8, used to inform the assignment of weights in Table 3.8, reflects strong support for green infrastructure (54%) and industrial spaces (46%). These insights provide valuable input for the LUCIS model, suggesting that sustainable, community-focused green space development are as important as commercial or industrial expansion. The information gathered from this research also serves as a foundation for integrating qualitative community input into geospatial modeling efforts. Specifically, the findings inform the development of a Land Use Conflict Identification Strategy (LUCIS) model, where community priorities and stakeholder feedback are translated into weighted spatial criteria to guide future land use planning (Carr et al., 2007). By highlighting the values of local residents and their relationship to green space, this study contributes to more inclusive and responsive urban planning frameworks. ARC (2023) Survey ranks or weights can now be used in future suitability models.

Each criterion was assigned a weight reflecting its relative importance, as determined through community responses to the ARC survey and reinforced by literature on urban sustainability, environmental justice, and green gentrification. The results in Table 3.8 show that green spaces areas received the highest weight of 0.36 followed by residential areas at 0.27, public health at 0.23, and transportation access at

0.14. The values all to 1. These weights, directly derived from community priorities, ensure transparency and validity in the modeling process.

Table 3.8: Community Perspective Table with Weights

Criteria	Value	Weight
Green Spaces	8	0.36
Residential Areas	6	0.27
Public Health	5	0.23
Transportation	3	0.14

3.5.3 Justification for Weights Using Literature Support

Green Spaces (0.36) – Most Highly Weighted

Community members ranked green space as the most significant factor, with a value of 7 (0.36), highlighting their importance in preserving local ecosystems, mitigating urban heat island effects, and enhancing community well-being.

The assigned weights are consistent with research on urban planning, environmental justice, and community well-being. Community members ranked green spaces as the most significant factor, highlighting their importance in preserving local ecosystems, mitigating urban heat island effects, and enhancing community well-being. Jelks (2021) emphasizes that the availability of green space significantly affects environmental stressors in urban areas, particularly marginalized communities. This research on Proctor Creek Watershed in Atlanta highlights how communities facing social and environmental stressors prioritize green spaces as vital buffers against pollution, flooding, and climate impacts. Similarly, Wolch et al. (2014) argue that urban green spaces promote environmental justice by reducing disparities in access to recreational and ecological benefits, further supporting the community's prioritization of these areas.

Residential Areas (0.27) – Second Priority

The second highest weight (0.27) was assigned to Residential Areas, reflecting housing affordability, displacement risks, and neighborhood stability concerns.

Research by Pearsall and Anguelovski (2016) on contested green space developments underscores how urban greening can contribute to green gentrification, displacing long-standing communities unless housing protections are in place. Isaac et al. (2020) provides a grounded theory study on community leadership in Southwest Atlanta, emphasizing how residents view housing stability as critical in resisting gentrification and maintaining cultural continuity.

Public Health (0.23) – Emerging Concern

Public Health concerns, particularly related to environmental exposure, air quality, and access to recreational spaces, received a weight of 0.23. Research by Lebow-Skelley et al. (2022) on defining environmental exposure in Atlanta underscores how lower-income communities often experience higher levels of pollution and health risks, making public health a key consideration in land-use planning. Bornioli et al. (2019) found that access to urban green spaces correlates with better mental health outcomes, reinforcing why residents in historically marginalized areas prioritize public health alongside green spaces.

Transportation (0.14) – Lowest Priority

Transportation received the lowest weight at 0.14, indicating that while important, it is not as urgent or pressing as green spaces, residential stability, or public health. Research by Frackelton et al. (2013) on sidewalk accessibility in Atlanta suggests that while transportation infrastructure affects mobility, it is often secondary to housing and

environmental justice concerns in communities experiencing rapid urban change. In a recent study, Schmidt et al. (2024) further highlights how geographic segmentation influences perceptions of critical urban issues, suggesting that while transportation is relevant, it is not as universally prioritized as housing or green space.

These weights can be applied within the LUCIS model to develop suitability maps, conflict assessments, and stakeholder alignment strategies in Chapter 4. The high weight given to green spaces ensures that conservation efforts are emphasized while residential priorities guide urban development decisions. The lower weights for public health and transportation reflect their roles as secondary but still influential factors in community planning. By grounding the weight assignments in both community survey results and peer-reviewed research, this study ensures that the LUCIS model accurately represents the lived experiences and concerns of Southeast Atlanta residents.

3.6. Discussion

3.6.1 Empirical Insights from Community Perceptions and Stakeholder Engagement

The weighting of community priorities based on this two-step interpretation approach of evaluating the ARC report reflects an empirical insight into the survey for data optimization in preparation for GIS modeling. This, backed by expert justification, broadens the academic literature on urban sustainability, green gentrification, and environmental justice. For example, as Schmidt et al. (2024) demonstrate in their study across Georgia, understanding the hierarchy of community values can directly influence

funding allocations, the prioritization of development projects, and the design of public initiatives. Based on their data, weights may indicate that community youth and family development are prioritized in a particular community. In this instance, policymakers may allocate more resources to these issues. On the other hand, if other economic opportunities become a top community concern, investments may be allocated toward supporting local businesses and job training programs better to meet the residents' needs. Resources like this aid in pinpointing locations and demographics that ensure urban planning decisions align with the specific needs of different communities. By integrating these weighted priorities into GIS models, planners can spatially analyze areas with data to inform development potential, leading to more precise and equitable policy decisions.

Research has demonstrated that access to green spaces can improve mental health and overall well-being. However, introducing new green infrastructure without addressing a community's social and economic realities can exclude current residents and lead to inequitable benefits (Immergluck & Balan, 2018). Therefore, integrating public perception data from community input like the ARC Survey into a GIS analysis can assist planners in designing interventions that enhance urban resilience without contributing to environmental injustices.

This study reinforces the importance of participatory GIS approaches, where local knowledge is directly incorporated into land-use planning decisions. Traditional GIS-based urban planning relies on land-use datasets collected and stored through cartographic surveys, remote sensing technologies, and demographic sources such as census data, tax records, and property assessments. While these datasets provide

valuable quantitative insights and are important to incorporate into the research, they often fail to capture local communities' nuanced, place-based experiences. The social and cultural dimensions of urban landscapes are often overlooked, and it is difficult to capture localized knowledge. This approach helps to address gaps in census data, which may be outdated, aggregated at a scale that is obscure to neighborhood-levels, or misrepresent marginalized populations due to movement in and out of the community. Incorporating both traditional GIS datasets and qualitative community inputs allows for a more comprehensive, equity-driven approach to spatial decision-making, ensuring that urban development efforts align with the priorities and lived experiences of the residents they impact.

3.6.2 Demographic Representation and Engagement Gap

While the survey provides valuable insights, it is crucial to recognize its demographic limitations. Approximately 80 percent of the South River Forest (SRF) community identifies as African American, yet only 20 percent of survey respondents reflected this demographic (Table 3.9). The remaining 80 percent of respondents were predominantly white, with a large proportion identifying as homeowners and long-term residents of surrounding neighborhoods outside the SRF target area (Johnson Gaither & Aragón, 2024). This disparity suggests that many survey responses may reflect perspectives from individuals who do not live directly within the SRF Vision Area boundary or are not representative of the forest-adjacent communities most impacted by land use changes. As such, future community engagement efforts must be more inclusive and targeted to ensure greater participation from African American residents, renters, and others historically underrepresented in regional planning processes.

Ensuring a representative response base is essential for developing an urban planning strategy that accurately reflects the needs and priorities of the community.

Table 3.9: The Underrepresentation of African American Voices

Demographic Group	SRF Community (%)	Survey Respondents (%)
African American	80%	20%
Other Demographics (Total)	20%	80%

The spatial analysis of these trends reinforces the need for equity-driven urban greening policies, which acknowledge past injustices and integrate restorative planning principles to ensure that environmental benefits are distributed fairly (Cutter & Morath, 2013; Johnson Gaither & Aragón, 2024).

3.6.3 Community, Cultural Identity, and The Green Space Paradox

Recent studies have emphasized that while green spaces can have positive effects on community health and well-being, they may also produce unintended negative consequences particularly when their development leads to displacement or unequal access. For example, Schusler et al. (2023) mention in Chicago, Illinois, improvements in neighborhoods through park creation can significantly increase property worth and aesthetics while causing strain on the local community. When the value of the property increases, long-term residents can have difficulty paying for their homes and living expenses, which leads to their eventual displacement. This situation has frequently been observed in urban renewal projects across the USA and worldwide, where green spaces are introduced, which reflects ongoing tensions between park and walkway renewal projects and displacement.

In addition to survey and meeting data, this research also considers public expressions of community values from civic leaders and neighborhood associations. One example includes Patricia Culp, president of the Cedar Grove Neighborhood Association in southwest DeKalb County, who publicly voiced support for the proposed land exchange between Intrenchment Creek Park and Blackhall Studios (now Shadowbox). Culp's support captured in a video posted by The Great Park Connection Conservancy (2019) highlighted the potential for economic revitalization and the addition of public amenities such as ADA-accessible playgrounds, trails, splash pads, and public safety infrastructure. This perspective complicates the narrative that all community members oppose development, demonstrating a locally informed vision that integrates economic development with environmental enhancement.

The South River Forest is not just a visual resource, it is also a cultural milestone rooted in the lives of the residents of its neighborhood. As Johnson Gaither and Aragón (2024) highlighted, the area has a significant historical value and embodies the stories and identities of the communities that have lived there for years. As improvements are made in green spaces, there is also a growing concern regarding preserving cultural identity. The new developments and an influx of different demographic groups can dilute the unique features of the South River Forest community. Research and feedback from these findings of stakeholders reveal significant information about how community members perceive green spaces in the Atlanta Forest in the South River.

3.7 Conclusion and Future Work

Future work could expand this research to include a combination of techniques mentioned in previous studies to improve the survey and inform future models. Photo-

elicitation methodologies, for example, have shown that direct engagement with residents allows planners to visualize how people interact with and perceive their urban environment (Copes et al., 2018). Participants are shown a photograph taken by the researcher or the participants themselves to initiate a discussion and reflection. This method has been widely used in social science and urban planning to gain deeper insights into people's lived experiences, perceptions of their surroundings, and emotional connections to specific places (Noland, 2006). Researchers can capture context-specific narratives that may not emerge through traditional surveys or interviews by encouraging participants to describe what they see, how they feel about the images, and why certain features stand out to them. This technique could be applied in future research to refine GIS-based models by incorporating community narratives alongside spatial data, ensuring that planning reflects both qualitative and quantitative perspectives. It is especially useful in GIS and remote sensing as it provides ground truthing and imagery to coincide with maps derived from satellite imagery when evaluating green spaces.

The Analytic Hierarchy Process (AHP) can also be integrated into survey design to enable structured, quantifiable decision-making. This would involve adapting the survey by expanding the pool of stakeholders, and adjustments to quantifiable questions that clearly compare competing priorities. This means designing the survey with ranked-choice questions, numerical rating scales, and weighted preference selections that can be directly integrated into a pairwise comparison scale. When applied in a GIS framework, this method enhances multi-criteria decision analysis (MCDA) by converting community preferences into rank-ordered decision factors

(Saaty, 2008). By structuring responses in this manner, policymakers and planners can systematically evaluate trade-offs between key urban planning factors, such as housing affordability, green space access, economic opportunities, and community safety.

Additionally, future surveys could incorporate geospatial data collection techniques, such as GPS-tagged responses or interactive mapping tools used in PPGIS, where participants can pinpoint areas of concern or desired development (Brown and Raymond, 2007). This spatial component would help create localized, data-driven insights that further refine GIS-based models, ensuring that urban planning efforts are participatory and create a learning experience for the community. Expanding the methodology in this way would strengthen decision-support systems in GIS, enabling planners to prioritize interventions that align with community needs while mitigating displacement risks and environmental inequities.

In conclusion, this research highlights the importance of integrating community perceptions and priorities into the planning and management of the South River Forest (SRF) of Southeast Atlanta, Georgia. By analyzing survey responses, workshops, and stakeholder interviews, the study captures the community's multifaceted value on the SRF, including its ecological, recreational, cultural, and community significance. Key insights emphasize strong support for recreational spaces, conservation efforts, and green infrastructure while underscoring environmental and health concerns such as air quality and water contamination.

However, the analysis also reveals a demographic engagement gap, with a significant underrepresentation of African American voices in the survey data.

Addressing this gap through more inclusive and targeted outreach efforts is critical for creating equitable and representative urban planning strategies.

This research contributes to a critical advancement in GIS-based modeling for environmental justice by preparing these data to address community concerns through geospatial modeling. The findings of this research are directly set-up and ready to inform the Land Use Conflict Identification Strategy (LUCIS) model, ensuring that community-driven data on the values and sentiments of local residents play a central role in prioritizing areas for conservation and sustainable development based on the priorities of the people living there. By aligning the model's weighted factors with community preferences, this mixed methods approach promotes a balanced vision for the SRF that preserves its ecological and cultural assets while meeting its residents' social and recreational needs. This integration serves as a replicable framework for community-focused land use planning and underscores the vital role of stakeholder engagement in achieving sustainable urban development.

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CHAPTER 4

MAPPING SYNERGIES AND CONFLICTS OF COMMUNITY, DEVELOPMENT, AND
GREEN SPACES: A LUCIS MODEL APPROCH

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Abstract

This research operationalizes the LUCIS (Land Use Conflict Identification Strategy) model, an integrative geospatial approach to evaluate and map land-use suitability conflicts in Southeast Atlanta's rapidly urbanizing and ecologically sensitive environments. Conflicting viewpoints of community members, developers, and environmental advocates promoting urban green spaces were analyzed to provide a comprehensive framework for urban planning. Southeast Atlanta represents a crucial intersection of historical African American heritage, dynamic urban growth, and pressing environmental justice issues, making it an essential focus for understanding how urban greening initiatives impact local communities experiencing rapid ecological, demographic, and economic transformations.

This mixed-method study integrates a combination of high-resolution, 3.7-m remote sensing imagery from PlanetScope, community values derived from stakeholder engagement, and recent development trends to model land-use conflicts and identify areas where community sentiment, development, and conservation interests agree or are in conflict. The methodological framework utilized in this research follows a structured multi-criteria decision analysis (MCDA) approach within a geographic information system (GIS) to build and implement the LUCIS model. A series of annual satellite imagery from 2018 to 2024 indicates significant land cover and vegetation health shifts, highlighting encroachment patterns in residential neighborhoods and green spaces due to increased development pressures. Additionally, qualitative data derived from community surveys conducted by the 2023 Atlanta Regional Commission (ARC), the South River Forest Coalition (SRFC), and civic leaders provide insights into

residents' perceptions about the neighborhoods' environmental conditions and their accessibility to green spaces. Although 192.65 km² of the South River Forest study area was found to be in conflict, and desired by all three stakeholder groups, the LUCIS model output also located areas of low conflict, best serving one stakeholder but not suitable for the other two. This sets the stage for participatory decision-making and optimal urban planning.

4.1 Introduction

4.1.1 Land Use Conflict Identification Strategy (LUCIS)

The Land Use Conflict Identification Strategy (LUCIS) model employed in this study integrates multi-criteria decision analysis (MCDA) to assess land-use suitability in Southeast Atlanta, particularly focusing on the South River Forest (SRF) area, where historically marginalized communities face increasing development pressures. Urban greening initiatives have emerged as a potential solution to enhance environmental quality and improve residents' quality of life (Wolch et al., 2014). Communities advocate for cultural and social preservation as environmentalists emphasize the need for sustainable conservation efforts (Checker, 2011; Anguelovski et al., 2019).

Originally developed by Carr et al., (2007) at the University of Florida, LUCIS leverages MCDA, or the identification of weighted criteria of multiple geospatial data layers and overlay analysis, to balance the conflicting interests of multiple stakeholders such as residential use, development, and ecological conservation. By implementing MCDA within GIS, the LUCIS model accommodates the perspectives of diverse stakeholders and evaluates potential trade-offs in land use planning. Integrating quantitative data on trends in urbanization derived from a time series of remote sensing

data aligns with established methodologies in urban remote sensing. Wang (2007) details techniques such as spectral analysis and change detection for monitoring urban land-use dynamics. Ridd & Hipple (2006) emphasizes the importance of urban land-use classification in understanding urban transformations effectively. By combining remote sensing capabilities to document trends in urban growth and green spaces with community sentiments from stakeholder engagement, the LUCIS model provides a robust framework to identify zones of conflict and agreement. The results of this research can ultimately inform sustainable urban planning strategies tailored to Southeast Atlanta's unique socio-environmental context.

Capturing the highest priority criteria and values of; 1) residents of local neighborhoods; 2) urban developers, and 3) groups promoting ecosystem services and recreational use of green spaces as MCDA weights are key to the success of LUCIS models to evaluate land use/land cover suitability that balances stakeholders' preferences. Community data for this model are derived from summarized responses of a 2022 Atlanta Regional Commission (ARC) survey, and previous studies emphasize neighborhood characteristics valued by local residents (Anguelovski, 2016; ARC, 2023; Checker, 2011; Pearsall & Anguelovski, 2016). Prior research on urbanization also notes the significance of criteria such as proximity to transportation infrastructure, population density, and availability of vacant or underdeveloped lands as determinants for urban development (Clark et al., 2017; Lo & Yang, 2002). Developers often prioritize infrastructure connectivity, recognizing roads and transportation access as essential factors influencing economic viability, property value, and market desirability (Weng, 2018). Additionally, population density indicates potential market demand, influencing

developers' choices for investments, economic returns, and future urban growth patterns (Eastman et al., 1997). For ecosystem services, criteria include vegetation cover, proximity to water bodies, habitat connectivity, and soil stability, collectively representing critical environmental considerations (Geneletti, 2010; Costanza et al., 2014). These elements are essential to maintain ecosystem functions, reduce environmental vulnerability, and enhance community resilience against urbanization pressures (Daily & Matson, 2008; McHarg, 1969).

In this research, the unique geography, growth, and culture of Southeast Atlanta were important considerations in investigating competing stakeholder interests. A novel contribution of this research lies in its application of temporally granular, annual-scale remote sensing analysis to a rapidly developing urban region where stakeholder interests around conservation, development, and environmental justice are in active conflict. Whereas most land use and land cover (LULC) studies rely on multi-year intervals or decadal assessments, this work captures subtle but consequential year-to-year transitions that are often overlooked. The resulting spatial insights provide a foundation for understanding the pace and spatial patterns of urbanization pressure in Southeast Atlanta and offer a critical resource for planning strategies that promote ecological resilience while safeguarding community integrity.

4.1.2 Study Area

The study area for this analysis encompasses a portion of Southeast Atlanta, spanning approximately 1,416 hectares (3,500 acres) across Fulton and DeKalb Counties, and includes the SRF Boundary depicted in Figure 4.1 follows the area of interest defined by the South River Forest Coalition (SRFC 2024). Situated at the

headwaters of the ecologically important South River, a major river system flowing southeast from Georgia's largest city to the Atlantic Ocean, the area lies between downtown Atlanta to the north and Hartsfield International Airport to the south. It is bounded by major transportation corridors, including Interstate 20 (I-20) to the north, Interstate 285 (I-285) to the east, and Interstate 85 (I-85) to the west. Moreland Avenue serves as an important north-south arterial road, bisecting the study area and connecting various neighborhoods and land uses. This urban region features significant green spaces interwoven among residential neighborhoods and industrial zones, notably Intrenchment Creek Park, Gresham Park, Constitution Lakes, Lake Charlotte Nature Preserve, Southside Park, Urban Food Forest at Browns Mill, and the historical Atlanta Prison Farm. These parks and conservation areas are critical ecological assets, providing habitat continuity and recreational opportunities amid growing development pressures. The South River, flowing prominently through this landscape, serves as an ecological corridor, a central element of community identity, and is the center of conflicting land-use discussions. Understanding this complex mosaic of natural and built environments sets the stage for analyzing land use conflicts and stakeholder values within rapidly transforming Southeast Atlanta.

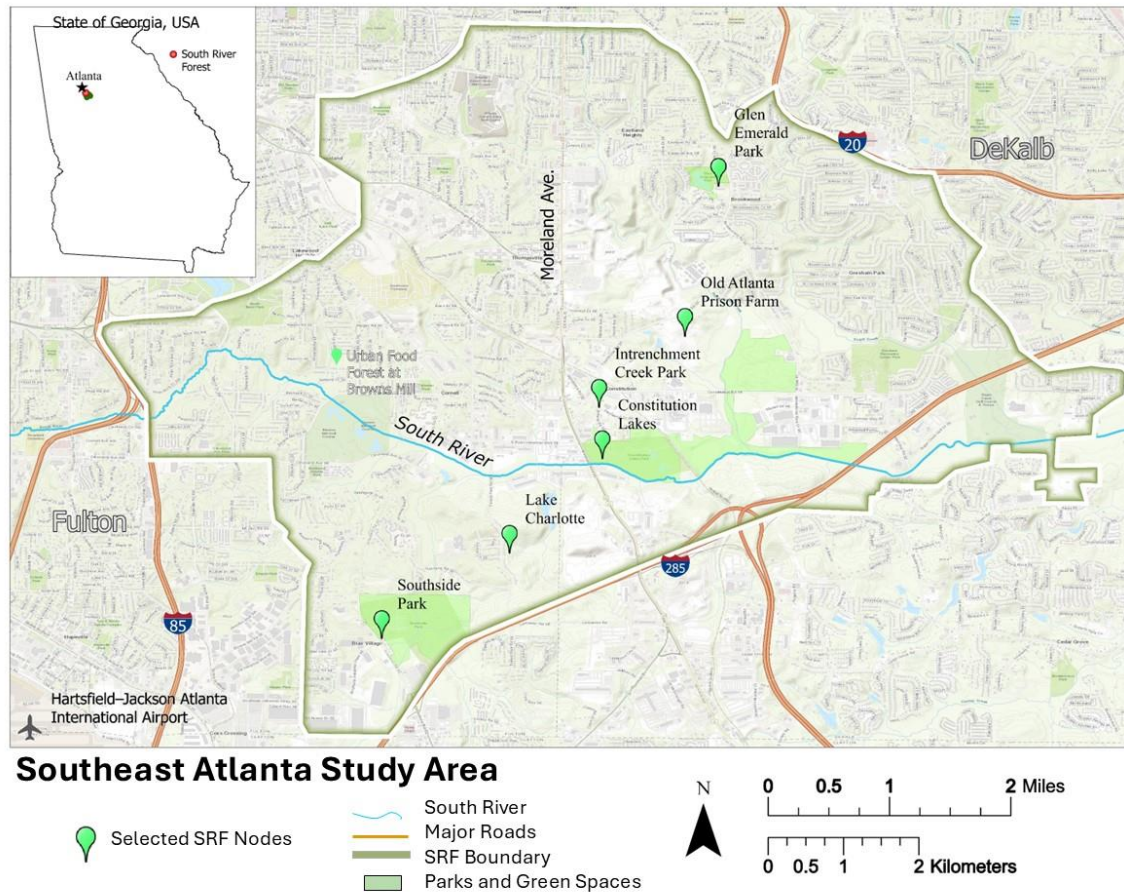


Figure 4.1: Southeast Atlanta Study Area.

4.2. Methods

4.2.1 LUCIS Model Overview and Application in GIS

The LUCIS model is a decision-support tool designed to identify and analyze competing land use priorities within a given geographic area. Developed as a GIS-based methodology, LUCIS provides a structured approach to categorizing land into different suitability classes based on stakeholder priorities (Carr et al., 2007). The adaptability of the LUCIS model allows it to be personalized to various political, social, and environmental contexts, which is particularly important in marginalized communities characterized by various perspectives of stakeholders (Boostani et al., 2018). This

process can be operationalized through surveys and workshops to engage stakeholders to help identify local priorities and conflicts of land use. Satellite imagery of high spatial and temporal resolution, such as PlanetScope, can inform the model of critical green spaces, land use/land cover changes, and areas experiencing development pressures. Qualitative surveys, expert opinions and a comprehensive literature review support the selection of appropriate data layers and the formation of criteria reflecting the values and geospatial constraints of multiple stakeholders having different landscape perspectives. Such an approach promotes an inclusive platform where community members can express their opinions and experiences through community surveys, while balancing the operations of outside developers and conserving green spaces providing ecosystem services to the city and the state.

This LUCIS model built in this study incorporates three primary stakeholder perspectives to assess land-use suitability and potential conflict. The community perspective emphasizes the importance of preserving neighborhood character, cultural identity, and equitable access to green spaces, particularly in historically marginalized areas facing rapid change. The developer perspective centers on economic viability, site accessibility, and infrastructure readiness, reflecting priorities tied to growth and investment opportunities. Lastly, the ecosystem services perspective focuses on maintaining biodiversity, protecting forest cover, and ensuring water quality and other critical ecological functions. By combining these three perspectives within a single geospatial framework, the model facilitates a balanced analysis of land-use decisions that reflect both human and environmental needs. A list of data layers used in the LUCIS model, along with their properties and sources can be found in Appendix B.

4.2.2 Weighting Criteria for Suitability Analysis

Unlike more complex weighting methods, such as the full Analytic Hierarchy Process (AHP), which relies on pairwise comparisons and hierarchical decision-making (Saatay, 1980), this study applies a simplified version of the AHP method by assigning direct importance scores to each criterion using the Saaty 1–9 scale. Rather than conducting exhaustive pairwise comparisons between all criteria, each factor was independently rated based on its perceived influence on land use suitability, then normalized to produce z-weights. This streamlined approach retains the conceptual foundation of AHP, using relative importance for decision weighting. This approach ensures transparency, ease of interpretation, and alignment with the study's practical application in geospatial analysis (Eastman, 1999). Each factor was assigned a value to calculate the weight based on its relative influence on land use suitability for each perspective. The outcome of the analyzed data layer for each criterion used in the suitability model was given a value of 1 through 9 according to the Saaty (1980) scale of relative importance relative importance scale of Saaty (1980).

- 1: Equally important
- 2: Equally to moderately more important
- 3: Moderately more important
- 4: Moderately to strongly more important
- 5: Strongly more important
- 6: Strongly to very strongly more important
- 7: Very strongly more important
- 8: Very strongly to extremely more important
- 9: Extremely more important

The ratio of each criterion value to the sum of the values computes the assigned weights that are normalized to sum to **1** to facilitate their integration into the GIS-based suitability model. The weight for each criterion (W_i) was determined based on its

significance to land use suitability. The normalized z-weight (zW_i) for each criterion was calculated as seen in equation table 4.1 (1).

$$zW_i = \frac{W_i}{\sum W} \quad (1)$$

where:

Table 4.1: Normalized Weighted Criteria z-Weights

W_i	is the assigned Saaty value for a given criterion i ,
$\sum W$	is the sum of all assigned Saaty values for one perspective.
zW_i	is the normalized weight for criterion i used in the GIS suitability model for each perspective.

Although the criteria, values, and weights for each of the three perspectives are discussed below, details on each GIS data layer input to the LUCIS model to address a criterion, link to its data source, application in the model, and justification are provided in Appendix B.

4.2.3 Community Perspective Criteria, Values and Weights

To accurately reflect the priorities of residents in Southeast Atlanta, the community perspective in the LUCIS model draws from survey data collected by the Atlanta Regional Commission (ARC) through its 2023 *Explore South River Forest Survey*, as well as insights gathered from participating in weekly meetings and engagements with the South River Forest Coalition (SRFC), and civic leaders. Chapter 3 outlines how these data sources reveal local preferences for equitable access to green space, environmental protection, and cultural preservation. The report emphasizes how residents consistently expressed a desire for parks and natural green space areas that support mental and physical well-being while also voicing concerns

about displacement, overdevelopment, and loss of neighborhood character. These sentiments mirror broader literature on green gentrification that pertains to areas in Atlanta and warns that well-intended green initiatives can lead to unintended consequences for long-standing communities (Anguelovski et al., 2016; Checker, 2011; Gaither & Aragón, 2024).

Before assigning weights to the LUCIS model, it was essential to translate community priorities into spatial criteria and values that could be operationalized in GIS. The following Saaty values were assigned to GIS data layers in the LUCIS model to reflect the values of the community as derived from stakeholder engagement and existing planning data. This study incorporated a spatial-temporal buffer layer representing proximity-based community preferences. Specifically, manually digitized residential zones were buffered outward at 500, 1000, and 1500 feet and clipped to green space to simulate walkable access to parks and forest areas, aligning with public health, recreation, and equity concerns. These values capture key concerns such as access to green space, proximity to health infrastructure, and connectivity to transportation, which were identified as high priorities through responses in the ARC 2023 survey and supported by prior literature on urban equity and environmental justice.

Green Spaces (Saaty Value: 8) – Top Priority

The Green Spaces criterion was assigned the highest value due to its multifaceted importance and critical role in promoting places of recreation, ecological function, and mental restoration. Respondents viewed green spaces as aesthetic enhancements and essential infrastructure for environmental resilience and public enjoyment. This value aligns with prior literature, such as by Wolch et al. (2014) and

Jelks (2021), on urban nature's psychological and ecological benefits, particularly in marginalized communities where access to green infrastructure has historically been limited. This was especially highlighted when addressing the stressors on green spaces caused by pollution, flooding, and climate impacts.

Residential Areas (Saaty Value: 6) – Community Stability

Maintaining residential integrity and cultural identity was a strong theme across community surveys and stakeholder meetings. Many respondents expressed concern over displacement, gentrification, and losing long-established neighborhoods. This value reflects the urgency to protect cultural heritage, affordability, and the social fabric of predominantly Black communities in Southeast Atlanta. This proximity-to-greenspace reflects high community value placed on accessible greenspace. This community stability value aligns with the literature on green gentrification and environmental justice (Pearsall & Anguelovski, 2016; Isaac et al., 2020; Gaither & Aragón, 2024).

Public Health (Saaty Value: 5) – Equitable Access to Wellness

Public Health, while less dominant than green space and housing concerns, a value of 4 acknowledges the strong link between equitable access to natural areas and community wellness, especially in neighborhoods historically burdened by environmental hazards and lack of recreational infrastructure. Areas where green spaces were considered in land-use planning correlated with mental health outcomes in much of the literature strongly supporting green spaces in marginalized communities (Lebow-Skelley et al., 2022; Bornioli et al., 2019). Participants pointed to the role of green spaces in providing opportunities for exercise, reducing pollution, and supporting mental well-being.

Transportation (Saaty Value: 3) – Supporting Factor

In contrast, Transportation was valued lower because although mobility was recognized as important, especially for parking access, it was not as frequently emphasized by residents as issues related to housing, green space quality, and health. Expert reviewers supported this prioritization, noting that while transportation infrastructure supports green space connectivity, it does not define suitability for greening alone. Lack of access to green spaces can create fragmentation and influence perceptions of community experiences. For instance, sidewalks and accessibility to parks and green spaces affect mobility and are often secondary to housing in environmental justice concerns (Frackelton et al., 2013; Schmidt et al., 2024).

The final values, therefore, represent a carefully balanced representation of community sentiment, qualitative insight, and geospatial planning logic (Carr et al., 2007), ensuring that local values are meaningfully embedded in the model's spatial decision-making framework. Building on these findings, the LUCIS model translates qualitative community values into a spatial quantitative decision-making framework through weighted criteria (Table 4.2).

Table 4.2: Community Perspective Criteria, Values and Weights

Criteria	Saaty Value	z-Weight (Normalized)	Justification
Proximity to Green Spaces	8	0.36	Highest priority in ARC survey and SRFC engagement. Seen as critical to health, recreation, and cultural identity.
Proximity to Residential Areas	6	0.27	Reflects concerns about displacement, gentrification, and cultural identity. Community values stability and legacy presence
Proximity to Hospitals and Access to Public Health	5	0.23	Ensures equitable health access; Residents link green access to health outcomes, mental wellness, and safety.
Proximity to Transportation	3	0.14	Considered important for access but not a primary community concern in the ARC survey. Included to maintain equity in mobility planning.

Through careful quantifiable measures derived from qualitative interpretation, these weights represent the lived experiences, aspirations, and concerns voiced by those most affected by development decisions. Their inclusion in the LUCIS model ensures community input is heard and spatially represented. As Carr et al., (2007) emphasize, modeling land use conflicts requires balancing diverse interests, and the community voice is a foundational pillar in ensuring equitable and sustainable planning.

4.2.4 Developer Perspective Criteria, Values and Weights

Developer priorities center around factors that enhance logistical access and economic return and minimize community disruption. This perspective aligns with the need for accessible infrastructure and market demand, as reflected in Table 4.3. Unlike community-driven priorities that emphasize environmental justice and social stability, developer perspectives often align with economic return, logistical efficiency, and the long-term viability of investments. A buffer layer was created using a -500 ft interior buffer within residential zones, representing potential gentrification pressure to capture where displacement risk may begin, particularly in historically marginalized communities where green investments can drive rising property values. The following justifications support the assigned weights using key literature sources.

Road Infrastructure (Saaty Value: 7) - Highest Priority

Road networks play a crucial role in urban development by enabling efficient transportation, facilitating commercial activity, and reducing logistical costs. In *Remote Sensing of Human Settlements*, Ridd and Hipple (2006) highlight how transportation networks are among the most significant factors driving urban expansion, facilitating commercial activity, and influencing land-use transitions. Similarly, Zwick et al., (2015)

highlights that proximity to major roadways significantly influences land-use conversion, with well-connected areas experiencing faster and more profitable urban expansion. Revuelta-Acosta et al. (2022) further demonstrate that areas with dense road networks experience higher land-value appreciation, making them attractive for large-scale investments and commercial and residential projects.

Population Density (Saaty Value: 6) - Market Demand Indicator

Population density is a key determinant of commercial viability and residential development demand. Higher-density areas provide a stable business consumer base, ensuring sustained economic activity. As Weng (2018) notes in *Urban Remote Sensing*, high population density correlates with increased urbanization, necessitating infrastructure expansion and commercial investments. Similarly, in *Remote Sensing of Human Settlements*, Ridd and Hipple (2006) emphasize the role of geospatial analytics in predicting future urban hotspots based on population density trends.

Vacant Lands (Saaty Value: 5) - Development Potential

Vacant lands present opportunities for cost-effective development without the social and financial burdens associated with displacement. Developers target these areas to minimize community pushback and capitalize on underutilized spaces. Research in *Remote Sensing for Sustainability* (Weng, 2018) indicates that vacant land repurposing is a key driver in sustainable urban expansion, reducing urban sprawl while optimizing land-use efficiency. Bare Earth was often grouped with Developed land uses because, in the SRF study area, bare surfaces typically indicate construction zones, cleared lots, or disturbed areas associated with ongoing or imminent development. This

grouping reflects their transitional urban function and improves the model's ability to capture active land transformation.

Gentrification Potential (Saaty Value: 4) - Economic Revitalization

Underserved areas often become focal points for investment due to incentives such as tax breaks and government-backed redevelopment programs. Revuelta-Acosta et al. (2022) show investments in less developed tracts lead to significant land-use changes, often accelerating economic revitalization in historically underutilized regions. Additionally, in the *Manual of GIS*, (Lo & Yang, 2009) outline how GIS-based spatial modeling supports the identification of high-potential redevelopment zones.

Commercial Proximity (Shops) (Saaty Value: 0.2) - Walkability & Economic Activity

Research in Remote Sensing for Sustainability (Weng, 2018) demonstrates that mixed-use developments incorporating commercial services contribute to increased land values and stronger local economies. Proximity to essential services such as hospitals, retail centers, and transportation hubs is often a determining factor in zoning.

Table 4.3: Developer Perspective Criteria, Values and Weights

Criteria	Saatay Value	z-weight (normalized)	Justification
Proximity to Roads	7	0.29	Essential for transport costs and accessibility; reduces logistics expenses.
Population Density	6	0.25	Maximizes investment potential and meets market demand.
Vacant Lands	5	0.21	Enables efficient land use without displacement, aligning with stability goals.
Gentrification Potential	4	0.17	Reflect residential zones with high investment potential.
Proximity to Shops and Commercial Services	3.5	0.15	Enhances property value and mixed-use development, creating vibrant spaces.

4.2.5 Ecosystem Services Perspective Criteria, Values and Weights

The third perspective, informed by land use/land cover classification of PlanetScope orthoimage data focuses on conservation priorities. Table 4.4 highlights ecological criteria and their respective values and weights.

Green Space (Saaty Value: 8) – Top Priority

Green Space was assigned the highest value because it is a foundational ecological system supporting biodiversity, improving air and water quality, stabilizing soil, and regulating microclimates. In Southeast Atlanta, green spaces are essential in buffering neighborhoods from pollution, absorbing stormwater, and preserving community health in historically marginalized areas. As Kanga (2017) describes, remote sensing techniques allow for the efficient mapping and monitoring of forest cover changes, which are especially critical in vulnerable urban areas.

Ridd & Hipple (2006) and Weng (2016) further note that forest fragmentation and canopy loss are common indicators of ecological stress in cities, and geospatial analysis can track the pace and intensity of that loss. The prioritization of forest cover reflects its ecological value and visible decline in Southeast Atlanta.

Water Bodies (Saaty Value: 7) – Hydrological and Biodiversity Value

Southeast Atlanta is situated within the South River Watershed, where water bodies provide flood protection, aquatic habitat, and recreational value. These features are significant given the area's high proportion of impervious surfaces and historic underinvestment in green infrastructure. Water bodies are ecologically important because they support aquatic biodiversity, flood regulation, and microclimate control. Remote sensing tools like multispectral classification and thermal imagery are widely

used to track changes in urban watersheds (Weng, 2014). Duan et al. (2020) note that remote sensing of urban water bodies offers a scalable way to monitor health, encroachment, and restoration effectiveness. Weng (2016) emphasizes their role in supporting biodiversity and cooling microclimates. Protecting these water bodies in urban settings like Southeast Atlanta mitigates flood risk and social vulnerability. Additionally, water proximity is linked with increased biodiversity and recreational value in urban ecological networks. Southeast Atlanta includes key ecological resources such as the South River Forest, Lake Charlotte, and forested stream corridors, all facing fragmentation, runoff, and habitat loss.

Slopes (Saaty Value: 6) – Terrain and Erosion Management

Slope received a moderate weight because of its indirect but significant role in maintaining ecosystem integrity. Slope influences erosion risk, vegetation distribution, and habitat stability. In the *Manual of GIS*, Lo and Yang (2009) emphasize the integration of slope models with remote sensing to predict erosion-prone zones and guide land use planning. They apply slope data as part of the SLEUTH urban growth model to simulate land-use scenarios and assess future environmental risk in the Atlanta Metro Area. They integrate slope as a limiting factor to forecast green space loss due to unchecked expansion.

Remote sensing-derived topographic data, or digital elevation models (DEMs), can identify sensitive high-slope areas that need protection to maintain landscape integrity and reduce runoff risk. This is especially relevant in hilly regions where infrastructure development pressures overlap with ecologically fragile zones.

Conservation Areas (Saaty Value: 5) – Legal Protection Zones

Although conservation areas may already have some form of regulatory protection, their inclusion is essential for reinforcing land use boundaries and maintaining ecological continuity. In areas like Southeast Atlanta, conservation zones are often targeted for development under rezoning proposals or overlooked in long-term planning processes (Ridd & Hipple, 2006). Conservation areas protect sensitive species, habitats, and ecosystem services as a buffer against urban encroachment. Duan et al. (2020) demonstrate how satellite data measures effectiveness in protected area management, particularly in tracking deforestation and anthropogenic encroachment. Ridd & Hipple (2006) also emphasizes that landscape fragmentation often begins at the periphery of conservation areas, making monitoring these zones crucial for urban sustainability.

Biodiversity (Saaty Value: 3.5) – Resilience and Habitat Quality

Biodiversity was assigned the lowest value, not because it is undervalued, but because other layers indirectly represent it. Although assigned a lower numerical weight, biodiversity is foundational to long-term ecological resilience. Monitoring biodiversity through remote sensing remains complex but is increasingly supported by vegetation structure proxies and land cover classifications (Weng, 2016; Ridd & Hipple, 2006). This data allows for indirectly estimating habitat quality and species diversity patterns. In Southeast Atlanta, biodiversity hotspots are often found within or adjacent to forests and riparian zones, making those proxies more spatially reliable for a GIS-based model. It is challenging to measure biodiversity by remote sensing alone, as Weng (2016) and Ridd and Hipple (2006) noted. However, protecting forests, slopes, and

water features ultimately supports biodiversity, reinforcing its presence throughout the model without inflating its weight.

Table 4. 4: Ecosystem Services Perspective Criteria, Values and Weights

Criteria	Saatay Value	Z-Value (Normalized)	Justification
Proximity to Green Spaces	8	0.29	High priority is given to cooling, carbon sequestration, and habitat preservation.
Proximity to Water Bodies	7	0.25	Supports biodiversity, mitigates flood risks, and aligns with community values.
Slope	6	0.21	Addresses erosion control and habitat stability.
Proximity to Protected Conservation Areas	5	0.19	Guides development away from sensitive areas, preserving ecosystem integrity.
Biodiversity Index	2	0.07	Contributes to ecological health, even in urban contexts.

4.2.6 Data Integration and Operationalization of the LUCIS Model

The LUCIS model is a robust framework for analyzing land use suitability, conflict, and development potential. At its core, the model integrates diverse datasets and applies geospatial analysis to identify conflict areas and opportunities for sustainable development. Model Builder in ArcGIS Pro was used to streamline this complex workflow to create a LUCIS model. This tool simplifies geospatial data processing and automates workflows, ensuring reproducibility, efficiency, and transparency in analysis. Model Builder enabled a modular, transparent, and reproducible approach to synthesize the diverse data layers used in the multi-criteria suitability analysis following the guidance established by Carr et al. (2007).

The methodology began with importing and preparing foundational geospatial datasets to address the criteria described above. This included vector and raster layers representing roads, parks, forest cover, slope, water bodies, conservation zones,

population density, vacant lands, commercial centers, and other relevant features mentioned in the stakeholder weighting framework (see Appendix B). Each dataset was georeferenced and standardized to a common coordinate system (WGS 1984 Web Mercator) to ensure spatial consistency across layers.

Once the data were prepared, layers were assigned to the relevant stakeholder perspective: community, developer, or ecosystem services, within Model Builder, as seen in Figure 4.2 workflow. Each dataset was processed using a suite of geoprocessing functions tailored to the LUCIS approach. Key functions include *Buffer* and *Distance To* to establish zones of influence around infrastructure and proximity to important features, *Merge* and *Intersect* to identify areas of spatial overlap, *reclassify* to convert continuous data into discrete suitability values, and *Weighted Overlay* to apply stakeholder-specific weights and generate composite suitability rasters.

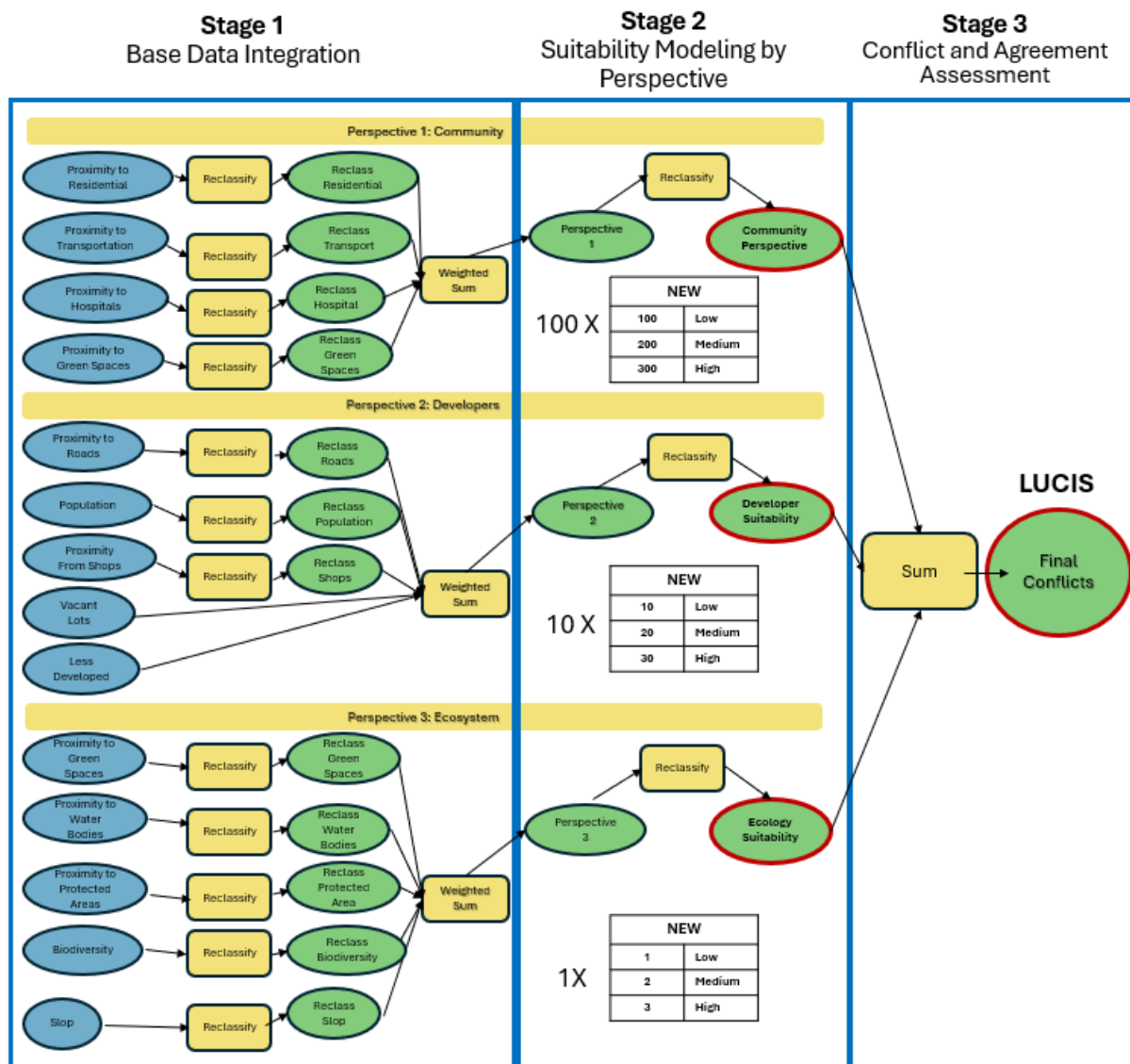


Figure 4.2: Model builder in ArcGIS Pro stages to process the LUCIS model.

The components in Model Builder are represented as follows:

Blue ovals: Input datasets, such as land use, environmental constraints, and infrastructure data that have been prepared by performing proximity analysis.

Yellow rectangles: Geoprocessing functions used to manipulate, analyze, and refine the input data.

Green ovals: Outputs generated at various stages, which serve as intermediate results used for decision-making.

Following the structured procedure recommended by Carr et al. (2007), the analysis proceeded through three stages:

Stage 1: Baseline Data Integration: All input layers were reviewed for accuracy, clipped to the Southeast Atlanta study area boundary, and processed using tools such as *Buffer*, *Euclidean Distance*, *Merge* and *Intersect* to identify stakeholder-relevant features required for each criterion. For Perspective 2: Developers, for example, buffers were created around transportation corridors and parks, in preparation for intersections with high population density or vacant parcels to map potential suitability or conflict areas.

This stage of the LUCIS model involves preparing the foundational geospatial datasets that represent factors influencing land-use suitability from different stakeholder perspectives, community, developers, and ecosystem services. These factors include proximity to residential areas, roads, transportation nodes, green spaces, hospitals, commercial centers, and other environmental or infrastructural features.

Each dataset, often a raster layer containing continuous values (such as distance in meters or population density), is reclassified using natural breaks into a suitability scale (1-10) where 10 represents the highest suitability and 1 the lowest. For example, as shown in the example Figure 4.3. The "Proximity to Green Spaces" layer was reclassified so that cells within 835 meters were assigned a value of 10 (highest suitability), while those farther away received progressively lower scores. Cells beyond a maximum threshold were excluded from analysis using the NoData classification.

Stage 1: Base Data Integration

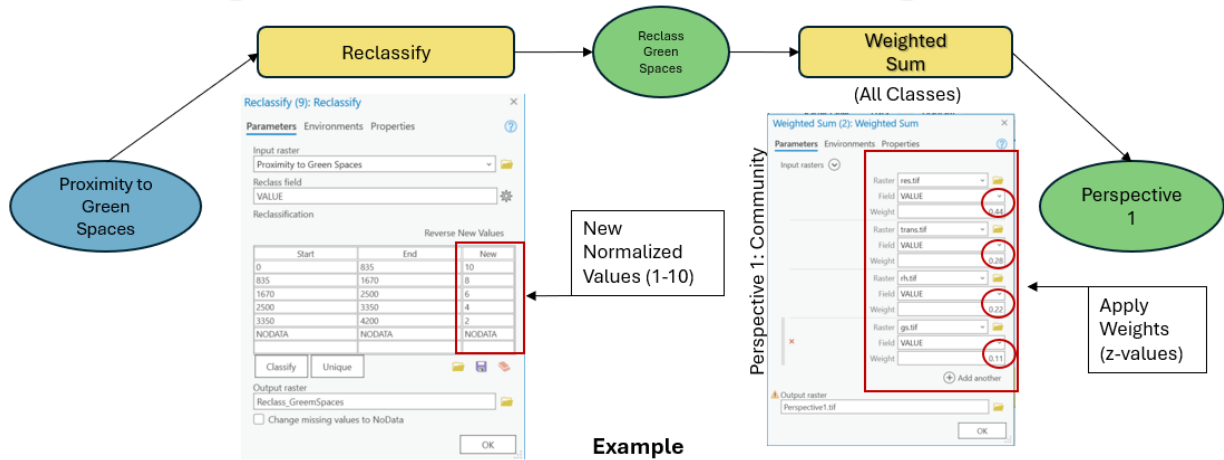


Figure 4.3: Example of reclassifying and weighting spatial criteria for green spaces in the Community perspective in Stage 1 of the LUCIS model.

After reclassification, each stakeholder's criteria were combined using the *Weighted Sum* tool, which allows for applying z-values (or weights) to reflect the relative importance of each criterion. Community perspective layers such as "Proximity to Residential Areas," "Transportation Nodes," "Hospitals," and "Green Spaces" were each assigned a specific weight (e.g., 0.22, 0.11, 0.28, 0.39, respectively). These weights were derived from community feedback (see Sections 4.2.1–4.2.3) and ensured that the combined output reflected stakeholder priorities. All data reclassification tables can be found in Appendix C.

This process resulted in a composite suitability raster for each perspective, where each cell represented a weighted measure of suitability for the stakeholder group. This stage mirrors the structure described in Carr et al. (2007), emphasizing a transparent, modular, and replicable approach to modeling multi-perspective land-use suitability.

Stage 2: Suitability Modeling by Perspective: In Stage 2, the reclassified and weighted raster layers from Stage 1 were aggregated into a single composite suitability raster for each stakeholder group—Community, Developers, and Ecology. To prepare these maps for cross-stakeholder comparison in Stage 3, each suitability raster was reclassified again, following the method outlined by Zwick and Carr (2006). This second reclassification step multiplied Low, Medium and High values for each perspective by a scale factor that allowed the raster calculation of the summed suitability values for each cell to retain the relative suitability of the three perspectives. Specifically, the Community perspective Low (1), Medium (2) and High (3) values were multiplied by 100 (e.g., 100, 200, 300), the Developer perspective values were multiplied by 10 (e.g., 10, 20, 30), and the Ecosystem perspective remained 1, 2, 3 (Table 4.5).

Table 4.5: Digit coding of suitability by stakeholder perspective

1st digit = Community Suitability (100's place)
 2nd digit = Developer Suitability (10's place)
 3rd digit = Ecosystem Services Suitability (1's place)

Community	Developer	Ecosystem
XXX	XXX	XXX

Stage 3: Conflict and Agreement Assessment:

These encoded rasters allowed for a final overlay in Stage 3 using the *Raster Calculator*, where the rasters were summed pixel by pixel to generate a three-digit composite code (e.g., 321, 111, 333). Each code represented a unique combination of stakeholder suitability. For instance, “333” indicated high suitability for all three groups, suggesting the strongest conflict for that pixel; “321” indicated high suitability for the community, medium for developers, and low for Ecosystems; and “111” indicated

mutual unsuitability, and no conflict from all perspectives. No conflict would also be indicated by codes of 311, 131 and 113 since there was high suitability by one perspective but not the other two.

This system, adapted from Zwick & Carr (2006), enabled the classification of zones into high alignment, moderate conflict, or high conflict categories. The model was executed in this research as an example of multi-perspective suitability analysis. However, once the model is built, input weights and criteria revisions are easily made to accommodate stakeholder feedback and what-if scenarios for adaptive decision-making.

4.2.9 Paired Stakeholder Conflict Typology

In addition to the full LUCIS model integrating all three stakeholder perspectives (community, developers, and ecosystem services), a series of pairwise stakeholder comparisons was developed to further examine areas of alignment and conflict between individual stakeholder groups. These maps offer a refined perspective on land use suitability and potential planning tensions by isolating the interactions between each pair of stakeholders. As illustrated in Figure 4.4, pairwise comparisons were conducted in six directions: Community to Developer, Developer to Ecosystem, and Ecosystem to Community and vice versa. Each arrow in the diagram represents a two-way analysis where suitability values were compared between two stakeholder groups using a standardized typology system. This approach allows planners to visualize how each group's values are either in conflict or align spatially, supporting more nuanced land-use decisions grounded in specific stakeholder relationships.

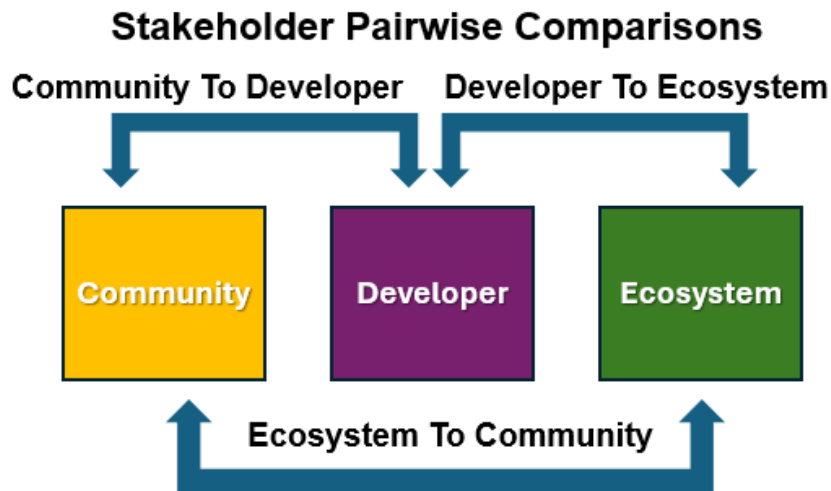


Figure 4.4: Paired Stakeholder Conflict Typology Diagram.

To generate these comparisons, the LUCIS model output combines each stakeholder's suitability, originally derived from weighted multi-criteria analysis. 3 = High suitability, 2 = Moderate suitability, 1 = Low suitability and scaled so the three digit raster value retained the relative suitability of each perspective, was examined by focusing on one pair of stakeholders at a time. For example, in the pairwise comparison of Community and Developers, only the first two digits of the three-digit LUCIS model output would be considered. Grid cell values of 3 or 2 in the first two digits (e.g., "331", "231"), reflect conflict between Community and Developer perspectives because both stakeholders rated the area as highly or moderately suitable. Alternatively, of grid cell values of "113 or 112" indicate low suitability from both perspectives.

These paired codes were categorized into five conflict levels, representing the degree of suitability or conflict between stakeholders, as seen in Table 4.6.

Table 4.6: Conflict Typology Based on Paired Stakeholder Suitability Scores

Paired Suitability Code	Stakeholder Suitability Combination	Conflict Category	Interpretation
33	High – High	Very High	Both stakeholders view the area as highly suitable; direct competition likely.
32,23	High – Moderate, Moderate – High	High	One stakeholder sees high suitability, the other moderate; significant tension.
22	Moderate – Moderate	Moderate	Differing suitability levels; some competing priorities present.
21,12	Moderate – Low, Low - Moderate	Low	Minimal overlap in priority; some divergence, but not contentious.
11, 31,13,	Low – Low High – Low, Low – High,	No Conflict	Neither stakeholder sees value; area is deprioritized by both. Or, High suitability for one stakeholder; low for the other

This classification framework allowed for consistent and interpretable spatial conflict mapping across all stakeholder pairings: Community–Developers, Developers–Ecosystems, and Ecosystems–Community. These maps provided additional insight into stakeholder conflict, offering planners and decision-makers a more granular understanding of where specific stakeholder priorities align or diverge, and supporting the identification of areas for negotiation, compromise, or targeted conservation and development.

4.3 Results

4.3.1 LUCIS Model Results

The LUCIS model output includes three suitability analysis maps from each perspective and a final combined map, which provides critical insights for conflict analysis and the potential for compromise in criteria and weights that decision-makers can use. These maps, supported by the weighted perspectives of community members, developers, and ecosystem service, highlight areas of high conflict, potential for sustainable development, and conservation priorities. The maps also spotlight the spatial opportunities and land-use suitability embedded within the city's ongoing urban transformation. This section presents the results of the LUCIS model and offers a detailed interpretation of the patterns observed, focusing on zones of alignment and contention. The maps utilize a suitability classification system adapted from the original LUCIS framework of Carr et al. (2007), categorizing land-use preferences into classes representing high, medium, and low suitability. This classification approach remains highly effective for visualizing conflicts and potential resolutions in land-use planning.

4.3.2 Stakeholder Suitability Maps

Three individual suitability maps were generated, each representing the land-use preferences of one stakeholder group. These maps were created using weighted overlay analysis informed by survey data, planning documents, and spatial criteria derived from geospatial datasets. Each pixel within these raster maps was assigned a suitability score ranging from 1 (low suitability) to 3 (high suitability), corresponding to how favorable that location is for each group's objectives.

The Community Suitability Map (Figure 4.5) identified high-value areas near parks, cultural landmarks, and community centers. Neighborhoods such as South Atlanta and Lakewood Heights featured prominently as areas of high suitability. These locations reflect a preference for walkable access to green infrastructure, recreational amenities, and spaces that support social cohesion. Suitability criteria were informed by community input from ARC surveys and South River Forest Coalition (SRFC) meetings (Chapter 3), combined with spatial data from the 2024 land use classification (Chapter 2). Criteria included proximity to industrial zones (from land-use data) and cultural preservation (from community insights), grounded in extensive literature emphasizing the importance of community-driven planning to mitigate displacement risks associated with green gentrification (Wolch et al., 2014; Checker, 2011; Anguelovski et al., 2019).

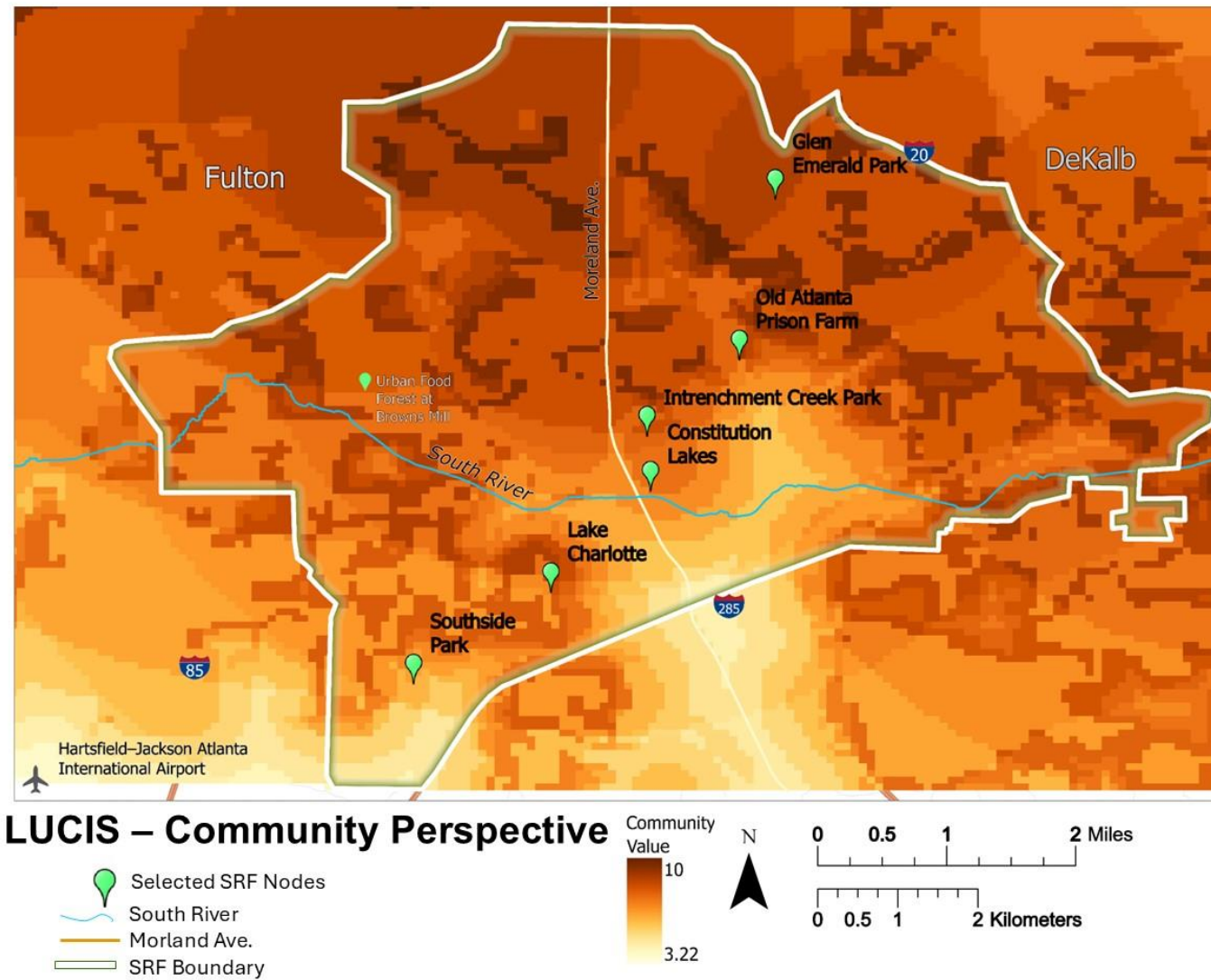


Figure 4.5: Land Use Conflict Identification Strategy – Local Community Perspective.

The Developer Suitability Map (Figure 4.6) emphasized criteria essential to urban developers, including proximity to roads, population density, proximity to commercial areas (shops), availability of vacant land, and identification of less developed census tracts for targeted economic revitalization. The data layers informing these criteria included major road networks from the City of Atlanta Department of City Planning (City of Atlanta, 2023), population density from NASA's GPWv4 dataset (NASA/SEDAC, 2023), commercial area locations sourced from GeoFabrik OpenStreetMap data (GeoFabrik, 2023), vacant land parcels derived from Fulton and DeKalb County Tax Assessor databases (Fulton County & DeKalb County, 2022), and economically underdeveloped areas based on U.S. Census Bureau data (U.S. Census Bureau, 2023). High-suitability zones emerged prominently along Moreland Avenue, near Metropolitan Parkway, and adjacent to BeltLine expansion areas, reflecting their strong market potential, infrastructure connectivity, and alignment with sustainable development priorities (Carr et al., 2007; Anguelovski et al., 2019).

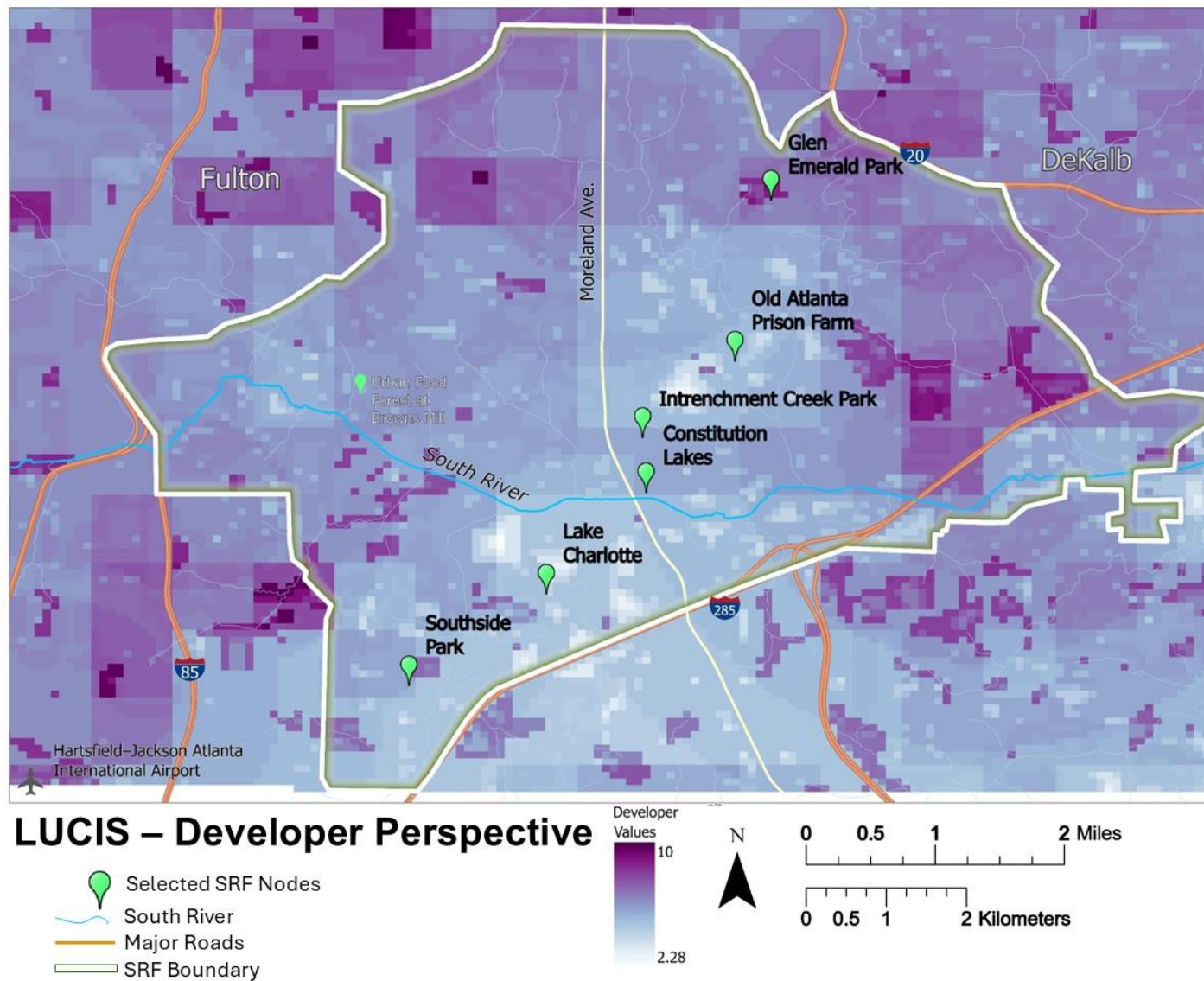


Figure 4.6: Land Use Conflict Identification Strategy – Developers Perspective.

The Ecosystem Services Suitability Map (Figure 4.7) focused on environmental priorities, such as biodiversity richness, hydrological connectivity, and forest integrity. The highest scores were concentrated in and around the South River Forest area, Intrenchment Creek Park, and other parcels containing intact forest stands or wetland features. Data layers informing these criteria included the Biodiversity Intactness Index (GEE Community Catalog, 2023), proximity to water bodies derived from the Global Inland Water dataset (Pekel et al., 2016), protected area boundaries from Protected Planet's World Database on Protected Areas (Protected Planet, 2023), proximity to green spaces assessed through PlanetScope satellite imagery classifications (Planet Labs, 2024), and slope calculated from the USGS Shuttle Radar Topography Mission (SRTM) DEM (USGS, 2023). The highest suitability scores were concentrated in the South River Forest area, Intrenchment Creek Park, and parcels featuring intact forest stands or wetland ecosystems. These zones represent critical ecological assets, vital for urban climate resilience, flood mitigation, biodiversity conservation, and habitat connectivity.

4.3.4 The LUCIS Model

The final output of the LUCIS model brings together the weighted priorities of community members, developers, and ecosystem service advocates into a single composite visualization. This model offers a spatially explicit view of where land-use suitability overlaps or diverges across Southeast Atlanta, highlighting areas of alignment as well as zones of potential conflict. Figure 4.8 along is the final LUCIS composite map, which is a critical tool for visualizing the broader dynamics of land-use and identifying where inclusive, community-driven planning will be most important moving forward. Table 4.7 provides a key to reading the codes, and maps offer a systematic way to understand and visualize these integrated perspectives.

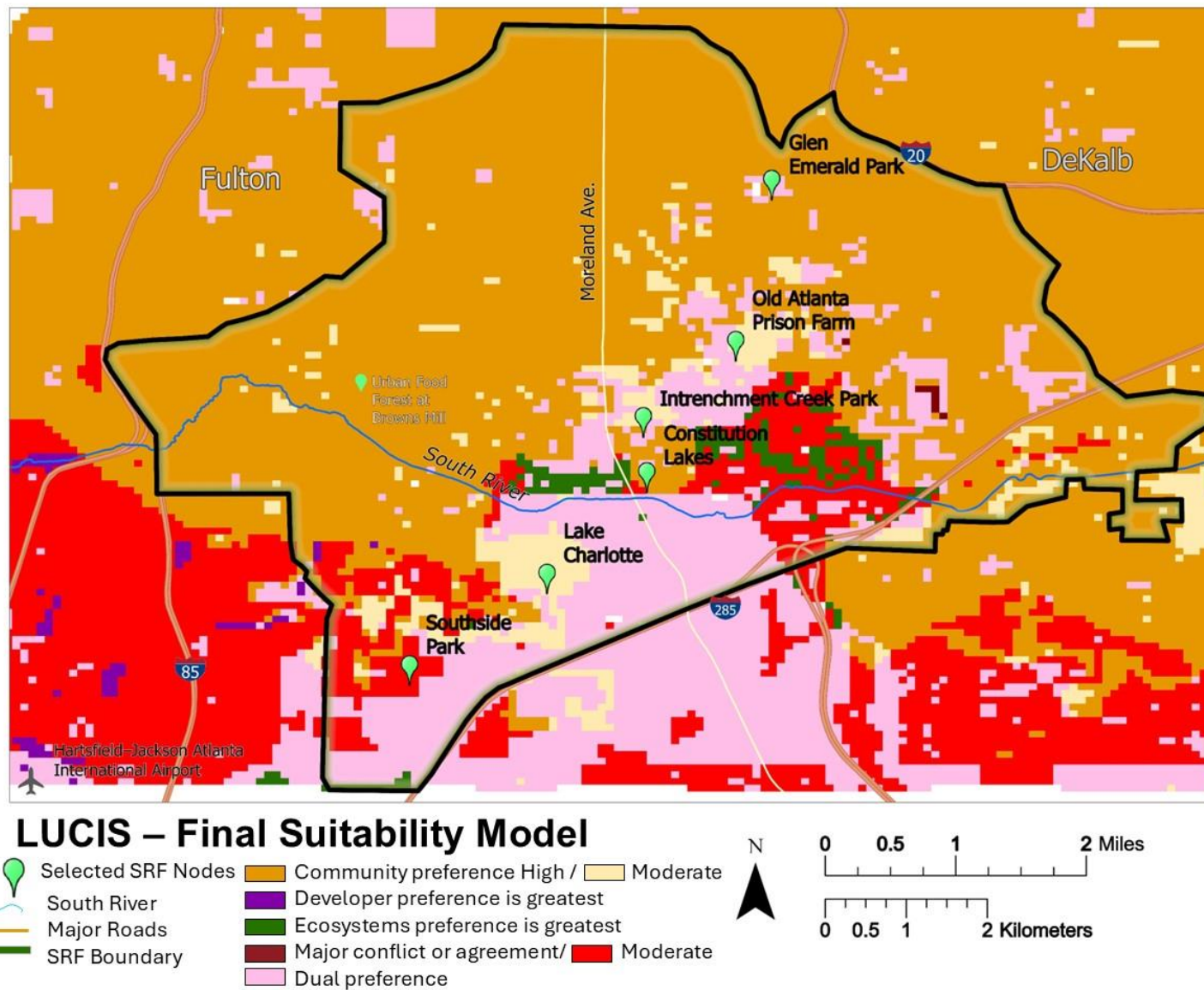


Figure 4.8: Final Land Use Conflict Identification Strategy (LUCIS) model.

Table 4.7: Coding system and color representation of stakeholder preferences in land-use prioritization as a result of the LUCIS model.

Each of the three digits in the ranking code represents a stakeholder group's preference.		The value of each digit (1, 2, or 3) indicates the preference or priority level.	
First digit: Community (XXX) Second digit: Developer (XX) Third digit: Ecosystem (XX)		1: Low preference/conflict 2: Medium preference/conflict 3: High preference/conflict	
Areas of Conflict		Areas of less Conflict	
Code	Description	Code	Description
111	All low preference - No Conflict	112	Ecosystem preference dominates
122	Low community preference conflict Medium developer preference conflict Medium ecosystem preference conflict	113	Ecosystem preference dominates
133	Low community preference conflict High developer preference conflict High ecosystem preference conflict	121	Developer preference dominates
233	Moderate community preference conflict High developer preference conflict High ecosystem preference conflict	123	Ecosystem preference dominates
221,	Medium community preference conflict Medium developer preference conflict Low ecosystem preference conflict	131	Developer preference dominates
212	Medium community preference conflict Low developer preference conflict Medium ecosystem preference conflict	132	Developer preference dominates
222	All moderate preference	211	Community preference dominates
313	High community preference conflict Low developer preference conflict High ecosystem preference conflict	213	Ecosystem preference dominates (Higher conflict in community)
323	High community preference conflict Medium developer preference conflict High ecosystem preference conflict	223	Ecosystem preference dominates (Higher conflict in in community and developer)
331	High community preference conflict High developer preference conflict Low ecosystem preference conflict	231	Developer preference dominates (Higher conflict in community)
332	High community preference conflict High developer preference conflict Medium ecosystem preference conflict	232	Developer preference dominates (Higher conflict in in community and ecosystems)
333	All in conflict, all high preference	311	Community preference dominates
		312	Community preference dominates
		321	Community preference dominates
		322	Community preference dominates

Legend		Area (Km ²)	Percent (%)
	Major conflict	0.08	0.04
	Moderate conflict	30.73	16.02
	Community preference high	119.98	62.55
	Community preference moderate	7.79	4.06
	Developer preference	0.78	0.41
	Ecosystem preference	1.74	0.91
	Dual preference (two categories with equal preference)	1.74	0.91

The spatial analysis revealed clear geographic patterns in the distribution of conflict and consensus. High-Conflict Zones were mainly concentrated around the **Old Atlanta Prison Farm**, also known as the proposed site for the controversial "Cop City" development. Here, the ecosystem and community suitability scores were high (often coded as 313), while developer suitability was low, reflecting widespread public resistance and ecological value. These findings align with urban remote sensing research that demonstrates how rapid landscape change and loss of vegetation often occur in underserved areas under redevelopment pressure (Weng, 2016; Ridd & Hipple, 2006). Another notable conflict hotspot includes the areas adjacent to Entrenchment Creek Park (see Figure 4.5), where recent deforestation activity has alarmed community members and conservationists alike.

Conversely, Consensus Zones, where all stakeholders assigned low suitability scores, tended to cluster near industrial zones and brownfield sites, such as those near the Thomasville Heights area (see Figure 4.5). These "111" zones represent lands of mutual disinterest or concern, perhaps due to contamination, flood risk, or infrastructural neglect. As Weng (2016) noted, urban remote sensing can track and categorize such degraded sites for remediation potential. These areas offer opportunities for ecological restoration or creative community design interventions that enhance environmental equity without triggering displacement. These sites could be candidates for ecological remediation or innovative community design interventions.

Several areas of potential compromise were also identified such as along the southern Metropolitan Parkway and sections of the BeltLine Southside Trail just along the northern extent of the SRF border or the northernmost extent of the study area. The

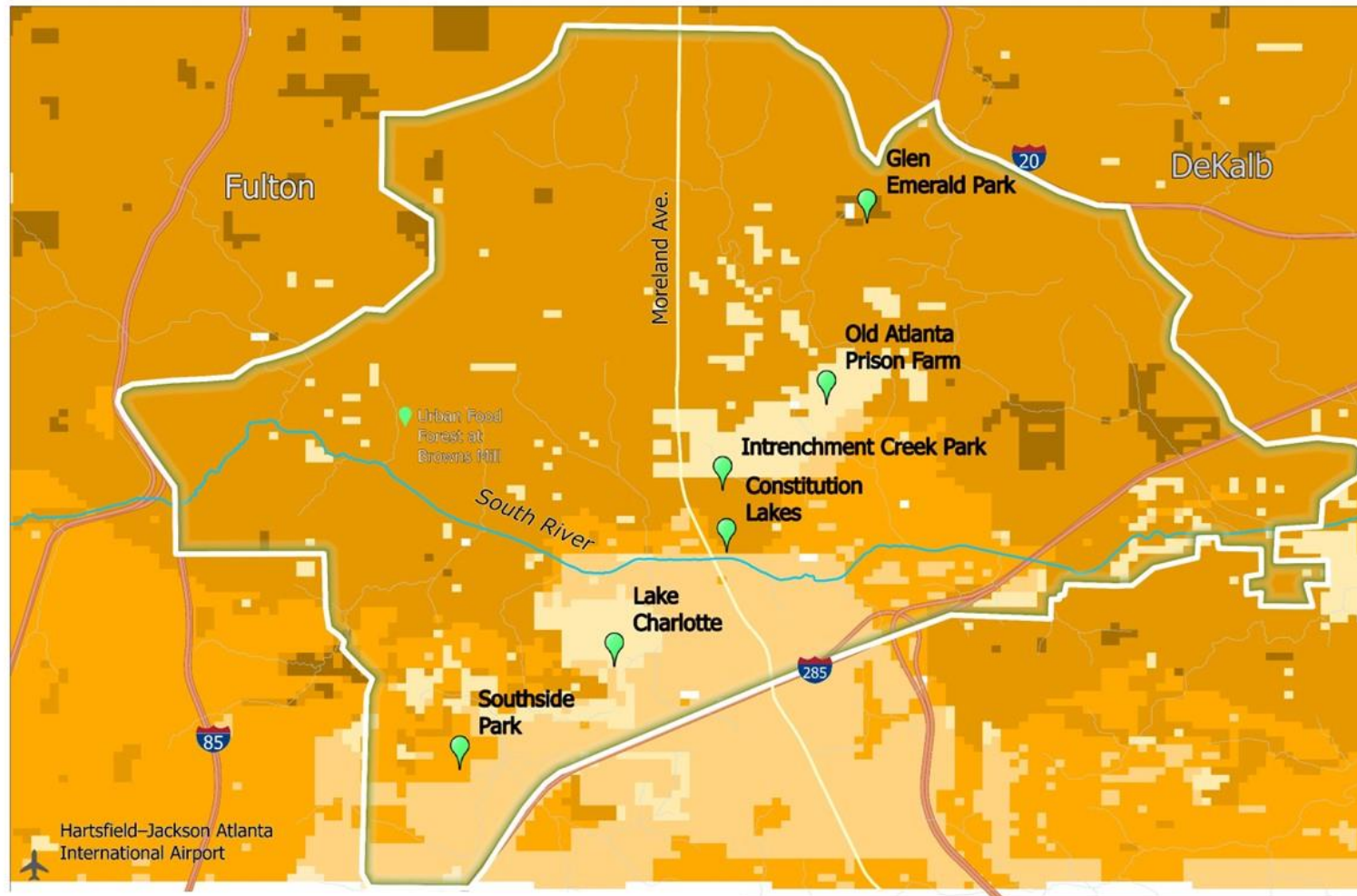
Atlanta BeltLine is a 22-mile loop of multi-use trails, parks, and planned transit built along former railroad corridors encircling central Atlanta (Immergluck, 2018) in Southeast Atlanta. LUCIS codes such as "213" and "231" emerged in this area, indicating shared interest between community and developer groups with less significant ecosystem value. These sites could be prioritized for mixed-use developments that incorporate affordable housing, green infrastructure, and transit-oriented design—approaches that reflect integrative planning principles recommended by Zwick and Carr (2006) and supported by urban resilience literature (Wolch et al., 2014; Gaither & Aragón, 2024).

Focusing on the trucking industry in the southern portion of the study area, particularly near the I-285 corridor and the industrial zones adjacent to the Hartsfield-Jackson Atlanta International Airport, one of the busiest airports in the world, the LUCIS model reveals a clustering of low-suitability Consensus Zones (e.g., codes like "111" and "112"). These areas are heavily influenced by the trucking and logistics industry, which has long dominated the land use in this part of Southeast Atlanta since the mid-1950s with the Federal-Aid Highway Act of 1956 (Wengraf, 1996). Characterized by large impervious surfaces, distribution centers, and high traffic volumes, this landscape offers limited ecological value and minimal appeal for residential or recreational development. The uniformity in low suitability across all stakeholder groups suggests a shared perception of limited desirability or flexibility for transformation. However, these zones may hold potential for ecological remediation, transitional green infrastructure, or environmental buffers that mitigate the impacts of air and noise pollution associated with freight movement. Their proximity to key transportation infrastructure also makes them

candidates for economic reinvestment, provided equity and sustainability are prioritized in redevelopment planning.

4.3.5 Paired Comparison Modeling Results

In addition to the final three-way composite LUCIS output, six supplementary maps were produced to compare the perspectives of stakeholders in pairwise combinations: Community vs. Developers, Developers vs. Community, Ecosystem vs. Community, Community vs. Ecosystem, Developers vs. Ecosystem, and Ecosystem vs. Developers, with the color ramp matching the color of the first stakeholder perspective in the pair (Figure 4.9 A, B, C, D, E, and F). These comparative visualizations allowed for a more focused analysis of stakeholder alignment and divergence by isolating two interests at a time. The Community vs. Developers maps revealed high-conflict zones in areas of rapid development, where residential values of preserving neighborhoods directly clashed with economic opportunities of developer interests. Conversely, the Developers vs. Ecosystem Services comparisons highlighted overlaps at the urban-ecological interface, particularly in zones in green spaces adjacent to commercial or industrial expansion. Finally, the Ecosystem Services vs. Community maps uncovered shared priorities around green infrastructure and conservation, especially in areas such as Intrenchment Creek Park and the Prison Farm, where community identity is strongly tied to environmental stewardship. These paired comparisons enrich the understanding of stakeholder dynamics by clarifying where partial consensus or conflict emerges.



Community to Developer

A

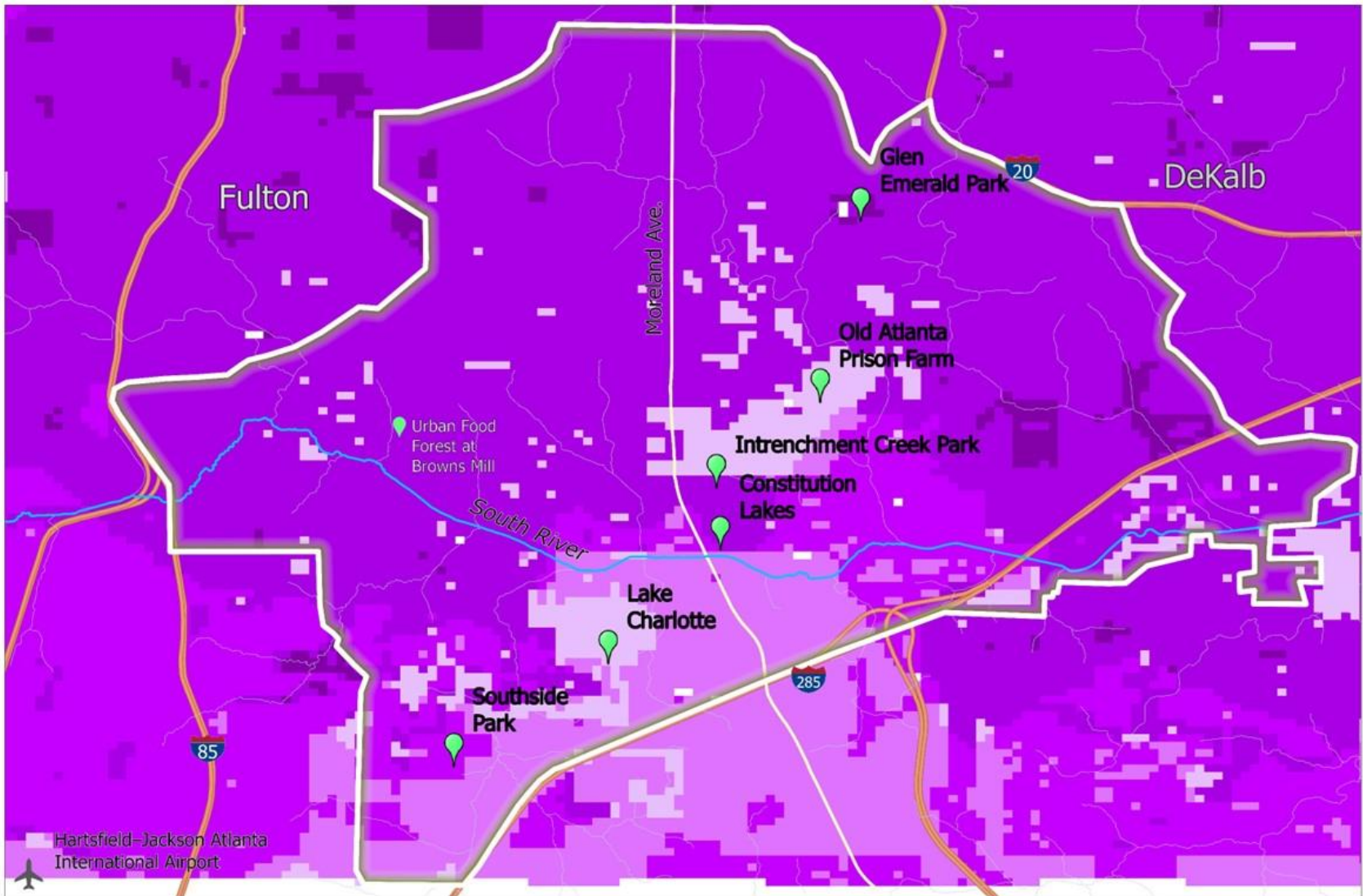
-  Selected SRF Nodes
-  South River
-  Major Roads
-  SRF Boundary

-  Very High
-  High
-  Moderate
-  Low
-  No Conflict



0 0.5 1 2 Miles

0 0.5 1 2 Kilometers

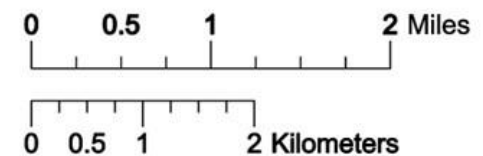


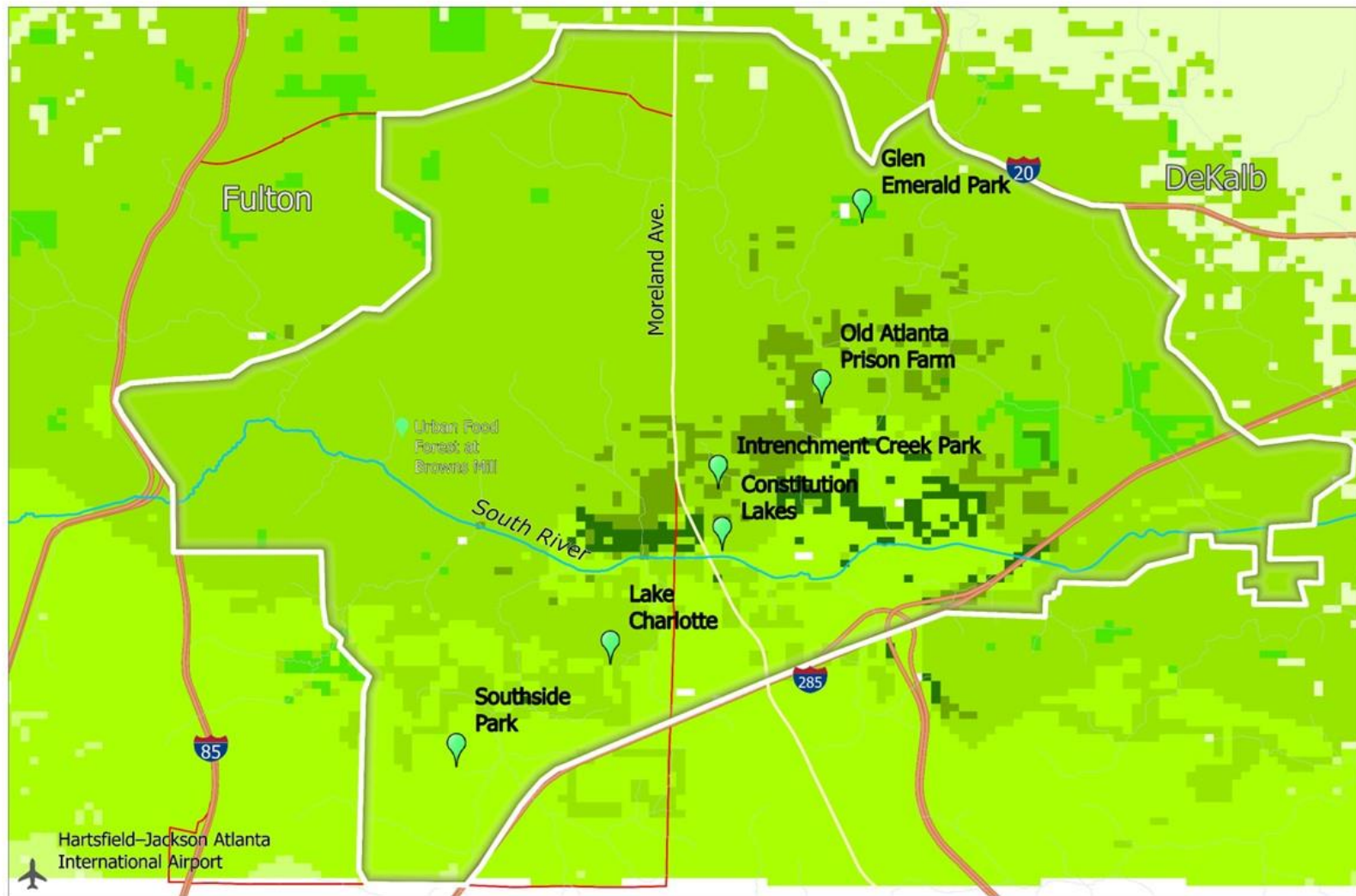
Developer to Community

B

-  Selected SRF Nodes
-  South River
-  Major Roads
-  SRF Boundary

-  Very High
-  High
-  Moderate
-  Low
-  No Conflict



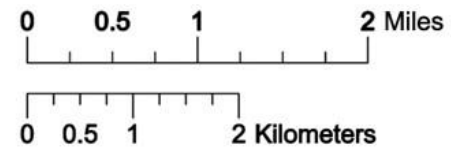


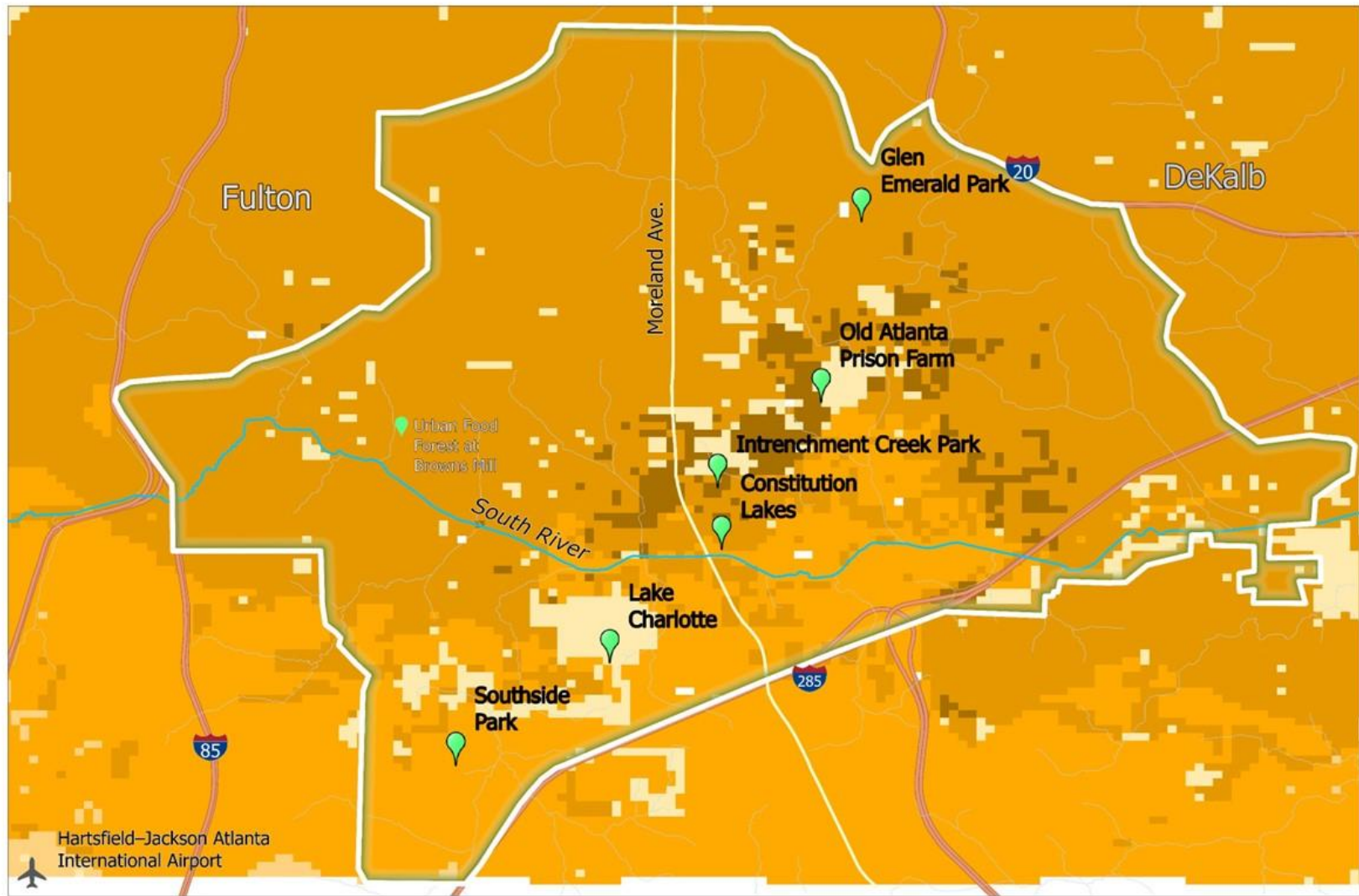
Ecosystems to Community

C

-  Selected SRF Nodes
-  South River
-  Major Roads
-  SRF Boundary

-  Very High
-  High
-  Moderate
-  Low
-  No Conflict



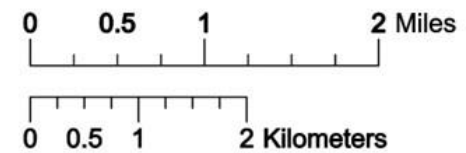


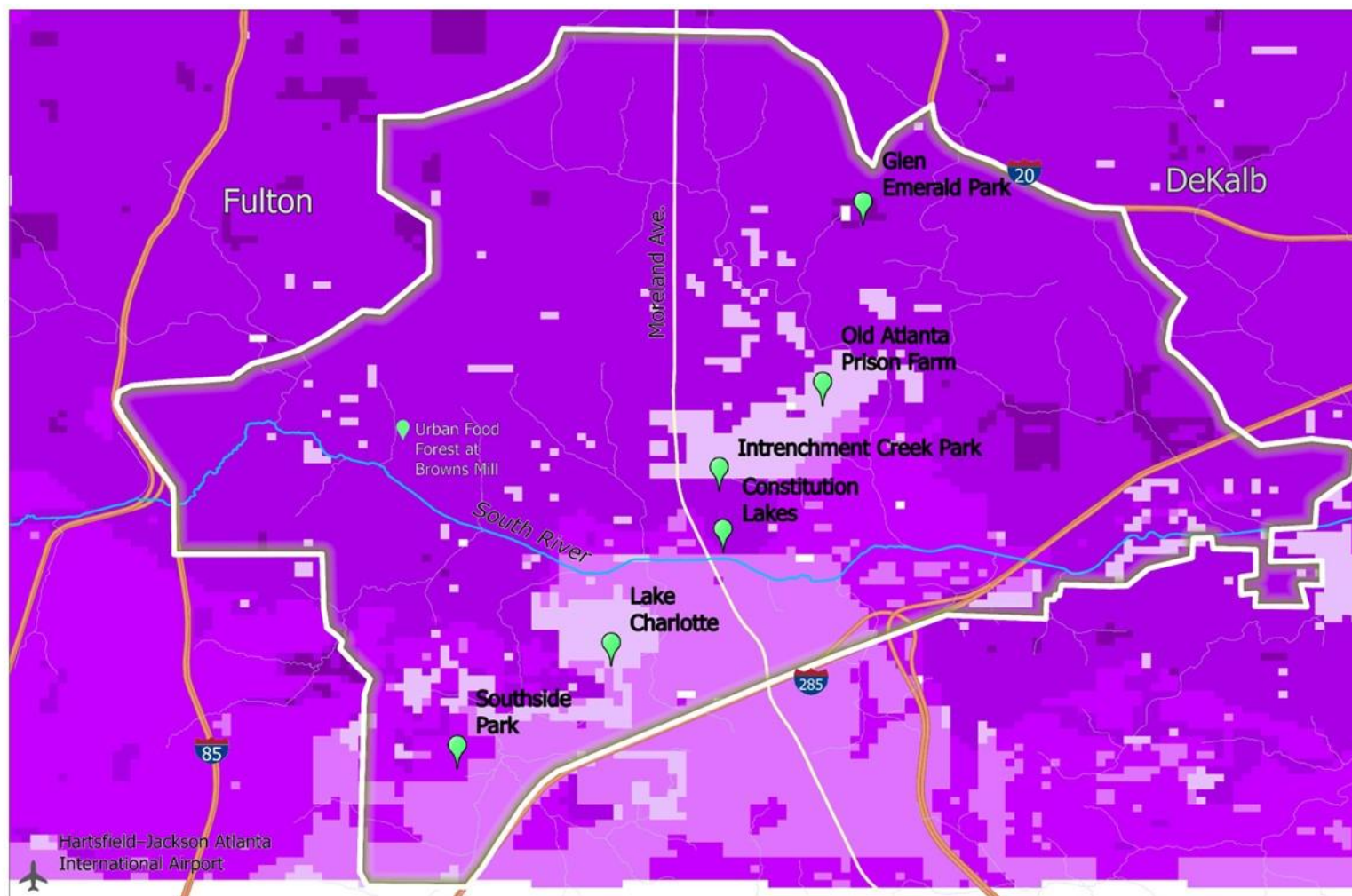
Community to Ecosystems

D

-  Selected SRF Nodes
-  South River
-  Moreland Ave.
-  SRF Boundary

-  Very High
-  High
-  Moderate
-  Low
-  No Conflict



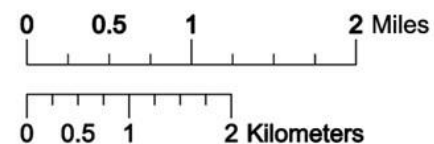


Developer to Ecosystems

E

-  Selected SRF Nodes
-  South River
-  Major Roads
-  SRF Boundary

-  Very High
-  High
-  Moderate
-  Low
-  No Conflict



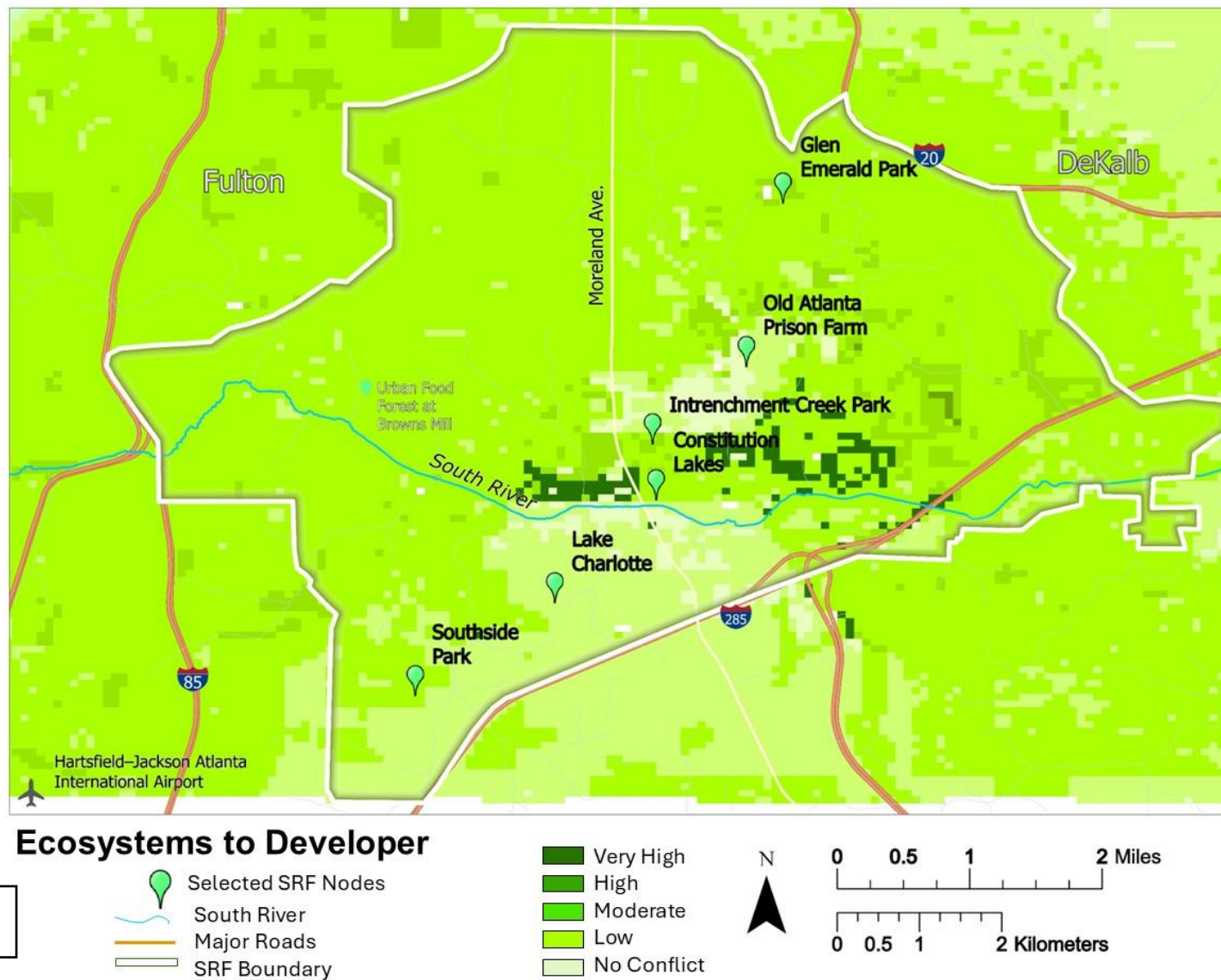


Figure 4.9: Figures A), B), C), D), E), and F) paired comparison maps.

4.3.6 Area Summary Statistics

The area analysis of paired stakeholder conflict typologies reveals several critical insights into the spatial distribution of tension and alignment of land uses across Southeast Atlanta (Table 4.8). The Community to Developer pairing displays the highest overall potential conflict, with a striking 81.19% (155.71 km²) of the landscape falling into the “Moderate Conflict” category and an additional 11.70% (22.45 km²) in “Low Conflict” zones. In contrast to previous findings, this shift away from “Very High” and “High” categories suggests that while tensions remain widespread, their severity has decreased due to recent reweighting and updated criteria reflecting civic engagement and buffered residential areas. The Ecosystem to Community relationship now shows the highest proportion of “Moderate Conflict”, covering 69.03% (132.39 km²) of the study area, with 24.76% (47.49 km²) in “Low Conflict” and only 0.04% (0.08 km²) as “Very High Conflict.” These landscapes may hold value for both habitat and development, but neither stakeholder group views them as top-priority zones, resulting in less severe but still notable conflict. In contrast, Ecosystem to Developer conflict patterns have shifted, with 59.86% (114.82 km²) now categorized as “High Conflict” and 27.08% (51.92 km²) as “Moderate Conflict.” This signals that ecologically sensitive areas are increasingly targeted for development, raising stakes around conservation vs. investment pressure. The areas of very high conflict are concentrated in 1.87% (3.59 km²) of the landscape, generally near the urban–forest interface. Notably, No Conflict areas are most extensive in the Ecosystem–Developer pairing, comprising 10.28% (19.71 km²) of the landscape. This indicates zones of low stakeholder interest, which may represent opportunities for adaptive reuse, infrastructure expansion, or ecological restoration without resistance.

Table 4.8: Typology category ranking and area summary

Typology	Category	Area (km ²)	Percent
Community/Develop	Very High	4.02	2.10
	High	0.64	0.33
	Moderate	155.71	81.18
	Low	22.45	11.70
	No Conflict	8.98	4.68
Ecosystem/Community	Very High	0.08	0.04
	High	8.04	4.19
	Moderate	132.39	69.03
	Low	47.49	24.76
	No Conflict	3.8	1.98
Ecosystem/ Developer	Very High	3.59	1.87
	High	114.82	59.86
	Moderate	51.92	27.07
	Low	1.76	0.92
	No Conflict	19.71	10.28

4.4 Discussion

4.4.1 Interpretation and Implications for Planning

The LUCIS analysis reveals that land-use conflict in Southeast Atlanta is neither random nor evenly distributed. Instead, it clusters around ecologically sensitive areas and historically undervalued neighborhoods that are now at the center of development pressure. The spatial congruence of high ecological and community suitability, especially around the South River Forest, also known as the “Weelaunee” Forest by the Muscogee Creek people who first occupied this region, suggests that these areas hold both cultural and environmental importance (SRF, 2023). However, these areas are also increasingly targeted for urban development, raising significant environmental justice concerns (Checker, 2013).

The alignment between community and ecological priorities across several tracts supports growing scholarship that advocates for the co-management of urban green

spaces, especially in neighborhoods shaped by racialized histories of disinvestment (Anguelovski et al., 2019; Annunziata & Rivas-Alonso, 2018). The identification of stakeholder-dominant zones—such as “311” (community-driven) or “113” (ecosystem-dominant)—can inform more targeted, equity-based policy interventions and participatory planning processes (Elwood, 2010).

In contrast, developer-driven high suitability zones (“131”, particularly in corridors near existing infrastructure and economic incentives, represent areas where proactive planning could help steer development towards areas that are not highly suitable to community or ecosystem perspectives and avoid speculative development that deepens socio-spatial inequality.

4.4.2. Bridging Multiple Stakeholder Perspectives

The study’s findings highlight that urban land-use decisions can balance economic, community, and environmental considerations, paving the way for equitable urban development. By bridging multiple perspectives, the LUCIS model not only identifies potential zones of conflict but also highlights shared priorities that can guide equitable, consensus-driven planning. This is especially important in historically marginalized areas of Southeast Atlanta, where aligning development with community and ecological values is essential to prevent further displacement and environmental injustice.

To gain deeper insights into how individual stakeholder perspectives aligned or diverged, pairwise comparison maps were generated: Community–Developers, Developers–Ecosystem Services, and Ecosystem–Community (see Figure 4.9). These maps used standardized suitability coding and a conflict typology system to classify

spatial relationships, revealing patterns of alignment and tension across Southeast Atlanta (see Table 4.7). The findings below describe the spatial distribution of conflict categories using geographic indicators tied to the South River Forest Vision Area and adjacent urban landscapes.

4.4.2.1 Community vs. Developers

The Community vs. Developers Pairwise map revealed distinct spatial patterns of land-use conflict across the SRF Vision Area, based on LUCIS typology codes that reflect the combined suitability scores of each stakeholder. Areas coded as “33”, representing Very High Conflict where both the community and developers view land as highly suitable, were most prominent around Glen Emerald Park, the Old Atlanta Prison Farm, and northern sections of Intrenchment Creek Park. These zones indicate intense competition, where the community calls for preservation and cultural access directly clash with development interest driven by access to infrastructure and flat, buildable land.

High Conflict areas (“32” and “23”) appeared in the central corridor of the SRF, particularly around Lake Charlotte’s northern rim and near the Constitution Lakes Park buffer, where one stakeholder expressed strong suitability and the other moderate interest. These zones highlight locations where compromise or negotiated use may be feasible but remain contested. Zones categorized as “22”, or Moderate Conflict, were dispersed along the edges of Southside Park and throughout mid-boundary parcels in Fulton and DeKalb Counties, where moderate suitability from both groups indicates shared but less urgent interest.

Low Conflict zones (“21” and “12”) appeared along the southern and southeastern fringes, near I-285, where one stakeholder had minimal interest and the other saw moderate suitability. Finally, No Conflict zones (“11,” “13,” and “31”) were most visible around industrial corridors and degraded tracts west of Lake Charlotte, where neither the community nor developers prioritized land use. These areas may represent opportunities for restoration or low-stakes development interventions.

This pairwise analysis underscores that the highest tensions between community and development interests are located in the northern and central SRF core, while lower conflict zones and potential compromise areas extend toward the peripheral south and east.

Developers vs. Ecosystem

The Community vs. Ecosystem Services pairwise map revealed widespread spatial overlap between areas valued by residents and those identified for ecological conservation, though with varying levels of intensity. Very High Conflict zones (“33”), where both community and ecological stakeholders rated land as highly suitable, appeared prominently across the central and northern South River Forest (SRF) corridor, particularly surrounding the Old Atlanta Prison Farm, Glen Emerald Park, and northwestern edges of Intrenchment Creek Park. These areas serve as important ecological assets—supporting biodiversity, hydrologic functions, and forest integrity—while simultaneously providing recreational, cultural, and psychological benefits to the community. The shared prioritization in these “33” zones underscore potential for synergistic co-management but also highlights the need for careful negotiation to avoid overuse or ecological degradation due to conflicting expectations.

High Conflict areas (“32” and “23”) clustered along the eastern boundary near Constitution Lakes and around the southern fringe of Lake Charlotte, where the community identified areas as highly or moderately suitable for access or use, while ecological assessments emphasized restricted use to maintain habitat quality or mitigate erosion. These transitional edges represent potential flashpoints between recreational desires and ecosystem preservation goals.

Moderate Conflict zones (“22”) were prevalent in the buffer areas surrounding Southside Park, along the SRF southern boundary, and in parts of DeKalb County east of Moreland Avenue, where community and ecological priorities are both moderate—suggesting locations with shared interest but lower urgency. These areas may offer strategic sites for low-impact interventions such as community-supported restoration, educational trails, or forest stewardship programs.

Low Conflict zones (“21” and “12”) appeared mostly on the southern edge near I-285 and in some portions of Forest Park, where either community or ecological stakeholders showed little engagement or value. These locations may be appropriate for light infrastructure, such as trail connections or utility management zones, without compromising priority values.

Finally, No Conflict zones (“11,” “13,” “31”) were sparse but noticeable in the industrial fringe, where neither stakeholder group saw significant benefit or suitability. While currently low priority, these zones may represent long-term opportunities for green infrastructure or ecological restoration if redevelopment occurs.

Overall, the Community–Ecosystem Services map presents an encouraging degree of alignment across the SRF core, but also flags locations—particularly around

Glen Emerald, Lake Charlotte, and Constitution Lakes, where tension between human access and habitat preservation may require collaborative land-use planning and adaptive management strategies.

Ecosystem vs. Community

The Ecosystem vs. Community comparison map illustrates the spatial alignment and divergence between ecological priorities and community values across the South River Forest (SRF) Vision Area. Very High Conflict areas (“33”), where both ecosystem services and community stakeholders rated land as highly suitable, are densely clustered in the northeastern core of the SRF specifically around Constitution Lakes, Old Atlanta Prison Farm, and Intrinishment Creek Park. These sites function as biodiversity hubs, stormwater mitigation zones, and forested cultural landscape spaces highly valued for both their ecological integrity and their roles in recreation, spiritual connection, and cultural significance.

High Conflict areas (“32” and “23”) make up the majority of these ecological cores, extending into the buffer zones of Constitution Lakes Park and near the north and eastern slopes of Lake Charlotte, where high suitability by one group is met with moderate interest by the other. These edges often function as informal trails, fishing sites, or neighborhood “green edges” that are ecologically sensitive but heavily accessed or modified by nearby residents. Strategic co-design, signage, and educational stewardship could help mediate tension in these zones.

Moderate Conflict zones (“22”) appear more widely spread in the southern portions of the study area, particularly south of Southside Park, the Moreland Avenue corridor, and I-285. These locations show potential for shared interest in restoration,

passive recreation, or small-scale green infrastructure, though neither stakeholder group shows immediate high priority.

Low Conflict zones (“21” and “12”) are mainly situated along the southeastern and southwestern boundaries but hardly present, including utility corridors, cleared tracts south of I-285, and areas transitioning into suburban residential neighborhoods. These reflect mismatched interest—where one stakeholder sees limited ecological or social value and the other maintains only moderate engagement.

Lastly, No Conflict areas (“11,” “13,” and “31”) are most visible in industrial and degraded areas in the northeast and scattered zones adjacent to freight and utility infrastructure. These places hold minimal current value for either community or ecosystem services and may serve as candidates for future urban restoration or stormwater retrofits.

Overall, this pairwise conflict layer suggests that the strongest shared values between ecological and community priorities lie within the forest core, yet zones of emerging tension occur on the periphery of high-value ecological areas, where access, informal use, or unmanaged encroachment may challenge conservation strategies.

4.4.3 Land Use Conflict Resolution

The findings from the LUCIS model analysis provide critical insights into the spatial distribution of land use conflicts and areas of agreement in Southeast Atlanta. The LUCIS model demonstrates areas where competing priorities can be reconciled through informed negotiation and adaptive planning. This mixed-methods geospatial analysis offers a layered perspective on land suitability and conflict, revealing areas of convergence and zones where stakeholder priorities diverge.

Key areas of high conflict were detected near controversial development sites such as the "Cop City" training facility and around Intramural Creek Park. These spaces are valued both for their ecosystem services and cultural identity yet are simultaneously targeted for high-density development. The identified conflict areas align with areas of rapid impervious surface expansion detected through PlanetScope remote sensing and vegetation index analysis, confirming recent vegetation loss in precisely these contested areas (Gaither & Aragón, 2024; ARC, 2023, p. 88). Low-conflict zones—where there is not overlap between community, ecosystem, and development—often occur in already designated green spaces or underutilized parcels where conservation could be integrated with modest, community-supported development. This dual-benefit approach reflects what Wolch et al. (2014) describe as “just green enough” planning that attempts to balance ecological gains with social equity.

The integration of community perspective layers, grounded in participatory processes like the South River Forest Coalition workshops and the ARC’s Explore SRF Survey (2023), reveals a strong collective desire to preserve access to nature, maintain ecological integrity, and prevent displacement. These values frequently clashed with development metrics derived from proximity to roads, zoning flexibility, and available vacant parcels—criteria typical for market-driven urban expansion (Isaac et al., 2020; Immergluck & Balan, 2018, p.)

The model further identified “triple conflict” zones—areas rated highly by the community and ecosystem suitability layers but simultaneously flagged as development-suitable in the developers’ lens (coded “333”). These parcels surrounding the Lake Charlotte Nature Preserve and those within the greater South River Forest boundary

are urgent planning priorities and align with emerging frameworks in urban resilience that call for justice-based conservation (Pearsall & Anguelovski, 2016, p. 112; Gaither & Aragón, 2024).

By cross-analyzing suitability maps through LUCIS, this research contributes to a growing body of literature advocating for integrated urban remote sensing and stakeholder-informed land modeling (Carr et al., 2007; Lo & Yang, 2009). The study also echoes findings where Lo & Yang (2009) used Cellular Automaton modeling in Atlanta to project the loss of over 30% of remaining green space by 2040 without regulatory oversight.

Ultimately, this spatial interpretation of conflict reinforces the value of participatory planning frameworks that integrate high-resolution environmental monitoring with grounded community engagement. The LUCIS model shows potential not only as a technical planning tool but also as a mechanism for facilitating dialogue among stakeholders with diverging visions for the future of Southeast Atlanta.

4.4.4 Guidance for Development and Policy Makers

One of the most significant findings is the identification of high-conflict zones where development pressures directly clash with conservation and community priorities, as well as low-conflict zones that may offer alternative areas of development. For example, Zones with high developer suitability but low community and ecosystem suitability (e.g., "131 or 121") can be targeted for strategic investment that mitigates social and environmental impacts. The high-conflict areas, primarily located near transit corridors and commercial hubs, have been flagged for their potential to experience rapid land-use transformation. The results of the LUCIS model underscore a crucial insight for

urban planning in Southeast Atlanta. They offer effective and equitable green infrastructure development that requires deep, sustained participation from the communities most affected by land use decisions. The areas of stakeholder conflict identified in the model are not simply technical outcomes, they are reflections of long-standing power irregularities in urban decision-making processes. As such, resolving these conflicts demands more than optimized land use strategies; it requires participatory planning frameworks that elevate community voices and translate them into enforceable policies.

Participatory planning is a concept that has long been recognized as best practice in urban development in rapidly changing neighborhoods and can help counterbalance the pressures of outside influences such as gentrification. Elwood (2010) stresses the need for “participatory GIS” approaches that integrate spatial data and embed community perspectives directly into planning tools. This dissertation operationalizes this concept by integrating survey data, coalition meetings, and LUCIS modeling, demonstrating that community preferences can and should inform land use prioritization alongside ecological and economic considerations.

The South River Forest Coalition (SRFC) has already laid important groundwork. By organizing forums, visioning sessions, and distributing surveys through the Atlanta Regional Commission (ARC), the SRFC has created a local model for inclusive green space planning. However, the representativeness of these inputs remains a challenge. As noted in the ARC’s 2023 survey, the majority of responses came from non-Hispanic white residents, despite the SRF area being over 80% African American (ARC, 2023, p. 88). This demographic misalignment reinforces the need for targeted engagement

strategies and culturally relevant outreach mechanisms that ensure historically marginalized residents have genuine decision-making power.

From a policy standpoint, the findings of this study align with the growing call for equity-oriented urban green infrastructure plans. Planners and city officials should prioritize zoning overlays, conservation easements, and tax incentives that protect ecologically and socially sensitive areas, especially those identified in the model as conflict zones. These parcels require urgent protection not just for their ecological value, but because they represent green spaces that communities deeply value for cultural, historical, and mental health reasons (Bornioli et al., 2019; Johnson Gaither & Aragón, 2024; City of Atlanta, 2021).

Development pressures in the region are further amplified by the expanding industry logistics and film industries. Southeast Atlanta's proximity to major interstate highways (I-285 and I-20), rail corridors, and industrial-zoned land has made it a hotspot for trucking and warehouse expansion. The growth of the logistics sector, especially freight infrastructure and last-mile delivery hubs, has led to increasing impervious surface coverage, heightened traffic, and air pollution, often in areas adjacent to residential neighborhoods and forest buffers. Similarly, the film and television industry, bolstered by generous state tax credits, has driven land use changes in the form of new sound stages, backlots, and studio campuses. While these uses are often perceived as less intensive than traditional industrial development, they still contribute to habitat loss, forest fragmentation, and increased land speculation, particularly when built on formerly low-density or undeveloped parcels. The LUCIS model reflects this dynamic, as many of the parcels identified as highly suitable for development under current zoning and

market trends are located near freight corridors or within areas recently targeted for film production infrastructure. These shifts illustrate how economic development, though lucrative, can directly conflict with community and ecological values unless balanced by deliberate land use planning (Immergluck & Balan, 2018; City of Atlanta, 2021).

These pressures are also evident in the City of Atlanta's Comprehensive Development Plan (CDP), which presents an ambitious vision for sustainable urban growth. The CDP outlines goals such as expanding green infrastructure, enhancing the city's tree canopy, and improving stormwater management. All of these plans are essential for building environmental resilience (City of Atlanta, 2021). However, these sustainability priorities are often conducted alongside policies that promote high-density redevelopment and economic revitalization in areas like Southeast Atlanta, neighborhoods already vulnerable to displacement. As Schmid (2006) describes, this is where the goals of economic development, environmental protection, and social equity are frequently in tension. As a result, green initiatives may unintentionally contribute to gentrification, even as they improve ecological conditions. To implement these insights, city planners should consider embedding conflict-mapping tools like LUCIS into major developments' permitting and review processes. By institutionalizing such spatial equity tools, municipalities can ensure that community and ecosystem priorities are not overlooked during the push for urban growth. As Carr et al., (2007) emphasize the true value of models like LUCIS lies not in static outputs but in their ability to foster iterative stakeholder dialogue and informed negotiation.

Where policies and decisions are considered, the LUCIS model provides a foundation for visualizing conflict and advancing inclusive, justice-centered urban

planning. Ensuring Southeast Atlanta's development aligns with resident values and ecological realities will require spatially informed policies that are community-driven and explicitly anti-displacement. Without such commitments, green infrastructure may only serve as a new frontier of exclusion rather than a pathway to collective well-being.

4.4.5 Environmental Conservation

From a social perspective, preserving and enhancing green infrastructure also improves urban livability. Community survey data collected by the Atlanta Regional Commission (ARC) in 2022 underscore that residents value these spaces for recreation, relaxation, and physical well-being, particularly in neighborhoods that lack access to formal parks or private green spaces. The mental health benefits of nature access are well-documented, including reduced anxiety, increased cognitive function, and improved social cohesion (Bornioli et al., 2018; Johnson Gaither & Aragón, 2024).

From an environmental perspective, the findings emphasize the importance of preserving ecological corridors and high-biodiversity areas. The model identifies several priority conservation zones at risk of encroachment from urban expansion. Areas dominated by ecosystem preferences ("113") emphasize preserving biodiversity while planning the surrounding development to minimize impacts on green spaces. These zones provide essential ecosystem services, including stormwater absorption, urban cooling, and wildlife habitat, underscoring the need for strategic conservation planning that integrates development goals with ecological integrity in urban areas (Weng, 2016). Green spaces offer multiple ecological services. For example, they play a key role in mitigating the urban heat island (UHI) effect by absorbing solar radiation and reducing surface temperatures. This is particularly critical in Southeast Atlanta, where a high

concentration of impervious surfaces and the loss of forest canopy exacerbate localized heat stress. Studies show that vegetated areas can reduce ambient temperatures by 2° to 5°C, (35.6° to 41° F), contributing to cooler microclimates and improving public health outcomes in vulnerable communities (Weng, 2016).

Vegetated areas and permeable surfaces significantly improve stormwater infiltration and reduce urban runoff, mitigating the risk of flash flooding, a recurrent challenge in the South River Watershed. As development expands, replacing green space with impervious infrastructure leads to increased peak runoff volumes, overwhelming drainage systems, and disproportionately affecting low-lying communities. According to the City of Atlanta and the South River Forest Coalition, forested areas within the SRF boundary are crucial natural infrastructure supporting stormwater retention and soil stabilization (South River Forest, n.d.). The prioritization of these functions within the LUCIS model reflects growing recognition that ecological systems must be treated as cost-effective and scalable stormwater solutions.

Urban green spaces also serve as vital refugia for biodiversity, supporting native flora and fauna that would otherwise be displaced by urban expansion. In Southeast Atlanta, these habitats are embedded within a patchwork of forests, riparian buffers, and community-managed green spaces. The fragmentation of these ecological corridors, particularly in the South River Forest, threatens species diversity and reduces the ability of ecosystems to recover from disturbance events (Sun et al., 2018). Threatened species such as the eastern indigo snake (*Drymarchon couperi*), the smooth coneflower (*Echinacea laevigata*), and the Piedmont blue burrower crayfish (*Cambarus harti*) are particularly vulnerable to habitat loss in the Atlanta region and depend on the

preservation of contiguous green space for their survival (Johnson and Jelks, 2023).

Several zones identified by the LUCIS model overlap with known habitat patches that sustain pollinators, migratory birds, and native understory vegetation. Protecting these areas is essential not only for biodiversity but for maintaining ecosystem functions like pollination, carbon cycling, and nutrient retention.

4.4.6. LUCUS Model Limitations

While the LUCIS model provided valuable insights into areas of alignment and conflict across stakeholder perspectives, limitations must be acknowledged to contextualize its results and guide future iterations of geospatial planning in Southeast Atlanta. First, the model's outputs are only as accurate as the inputs and weightings. While this study incorporated community priorities through survey data and qualitative themes from SRFC meetings, a non-random sample with demographic imbalances still shaped the community perspective layer. The 2022 ARC survey, for example, overrepresented white homeowners and underrepresented long-time African American renters, the very residents most at risk of displacement. As such, the community suitability maps may skew toward preferences that are not fully reflective of all populations within the study area. Future modeling efforts must continue to refine engagement strategies, using tools like participatory mapping and co-design workshops to ensure equitable representation (Elwood, 2010; Gaither & Aragón, 2024).

Finally, while intuitive, the model's visualization output is still a static representation of complex, evolving priorities. There is a critical opportunity to link this kind of modeling with interactive web-based tools that allow communities and decision-makers to adjust weights and explore trade-offs in real-time. This approach would align

with the growing push for open civic technology and participatory digital planning platforms.

Despite these limitations, the LUCIS model demonstrates how multi-criteria spatial frameworks can inform urban sustainability and equity goals when paired with community insight and interdisciplinary data. Future research should prioritize ongoing stakeholder engagement, policy integration, and scenario testing to evolve the model from a one-time analysis into a living planning tool that supports adaptive, justice-centered land management.

While the current LUCIS model provides a structured and transparent framework for identifying land-use priorities and conflicts, it represents just one iteration based on the data and interpretations available at the time of analysis. As discussed, the weighting scheme, particularly in relation to development-oriented perspectives like the Great Park Connection, can and should be refined in future work. Revisions could include additional criteria such as industry-specific benefits of the filming studios and localized negative impacts such as the trucking industry. These adjustments would allow the model to more fully capture the range of stakeholder values and evolving community priorities. Acknowledging that this version may not be optimal, the current model should be viewed as a methodological foundation that remains adaptable to future community engagement and expert input.

4.5 Conclusion

The resulting LUCIS suitability maps will be shared with the South River Forest Coalition (SRFC) and Atlanta Regional Commission (ARC) in community workshops. By adjusting weights interactively, stakeholders can explore alternative scenarios and

identify potential compromises. This study applied a geospatial, stakeholder, and expert-informed land suitability model to examine the land use conflict and agreement model in Southeast Atlanta, an area experiencing intense development pressure alongside pressing demands for ecological conservation and community inclusion. Using the LUCIS framework, the research integrated community priorities, ecosystem service needs, and development incentives to generate composite spatial analysis of suitability and conflict zones. The findings reveal not only where stakeholder perspectives diverge, but also where collaborative, multi-benefit interventions can be pursued.

Key results indicate that conflict zones are concentrated in ecologically sensitive areas such as the South River Forest and along the Intramural Creek corridor, landscapes that provide essential ecosystem services like stormwater regulation, heat mitigation, and habitat connectivity. These spaces are equally vital from a social perspective, functioning as recreational, cultural, and restorative environments, particularly for historically underserved communities (Johnson Gaither & Aragón, 2024). The spatial model facilitates participatory and data-informed decision-making that acts as a planning objective and a structural condition for sustainable urban futures (Pearsall & Anguelovski, 2016).

This work also contributes to the growing field of participatory GIS by demonstrating how community-generated data can be effectively integrated into spatial modeling workflows (Elwood, 2010). While the terms Participatory GIS (PGIS) and Public Participation GIS (PPGIS) are often used interchangeably, they have distinct origins—PGIS emerging primarily from development contexts in the Global South, and

PPGIS from formal planning practices in more developed regions (Rambaldi et al., 2006; Ndzabandzaba, 2018). Scholars such as Nyerges et al. (1997) and Bugs et al. (2010) have argued that these frameworks enable more inclusive planning by incorporating local and experiential knowledge into geospatial decision-making. Additionally, Volunteered Geographic Information (VGI), as introduced by Goodchild (2007), highlights the role of everyday citizens as contributors of spatial data through digital tools, offering a complementary mode of participatory engagement.

By aligning with this interdisciplinary lineage, the present study advances geospatial methods that reflect and actively reinforce principles of environmental justice (EPA, 2013). The model's outputs serve as decision-support tools to inform conservation zoning, adaptive management strategies, and collaborative planning across city agencies and civil society. The study leverages the strengths of a mixed-methods approach by combining qualitative insights from community participation with quantitative spatial analysis. This integration enhances the robustness of the findings, allowing for more nuanced and context-sensitive decision-making processes.

Nonetheless, the model is subject to limitations, including the static nature of remote sensing data, uneven community representation in survey responses, and the need for stronger integration with regulatory and policy frameworks. Addressing these limitations will require iterative model refinement and deeper integration of dynamic land change modeling techniques (Weng, 2016).

From the community perspective, the following assumptions were made based on insights from the ARC (2023) report, the author's engagement with the South River Forest Coalition, and supporting literature on urban equity and environmental justice.

Key criteria include proximity to existing green spaces, affordability, and neighborhood stability. Community members value access to parks, recreational areas, tree canopies, and housing policies that prevent displacement and gentrification. These criteria are weighted to favor conservation and mixed-use areas that support long-term residents while ensuring equitable access to environmental benefits.

From the developer's perspective, economic feasibility and infrastructure connectivity take priority. Criteria such as proximity to major transportation corridors, zoning, and market demand are emphasized. Developers prioritize locations with strong investment potential, often seeking areas that align with planned urban expansions and commercial growth. Weights assigned to these factors highlight areas suitable for high-density residential or commercial projects.

From the environmental perspective, the focus is on ecological integrity, sustainability, and conservation potential. Factors such as vegetation cover, watershed protection, and biodiversity are given higher weights in areas with significant environmental value. Remote sensing data, such as land use/ land cover classification, help quantify vegetation health and guide conservation planning. The model ensures that ecologically sensitive areas receive stronger protection against development pressures.

Future work should expand the model's utility by linking it to interactive platforms that allow community members to explore real-time land use scenarios and adjust suitability parameters. Incorporating climate resilience indicators, housing affordability layers, and socio-political governance data would further enhance the model's relevance for long-term planning. Most critically, ongoing community engagement must

remain at the core of this work, ensuring that the knowledge and values of local resident's shape how land is valued, preserved, and transformed.

In conclusion, this study provides a replicable, equity-centered approach to urban land use modeling that is both spatially rigorous and socially grounded. It demonstrates how geospatial science can be mobilized to reconcile competing land interests, protect ecological integrity, and promote environmental justice in rapidly changing urban landscapes. This participatory approach supports balanced urban growth and protects neighborhood integrity by fostering inclusive community involvement. Workshops would use sample maps that illustrate various compromise scenarios.

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CHAPTER 5

SUMMARY AND CONCLUSIONS

5.1 Summary

As cities grow, they face an increasingly complex set of challenges at the intersection of environmental sustainability, social equity, and urban development. By 2050, over 68% of the global population is projected to live in urban areas (United Nations, 2015), intensifying the need for urban planning strategies that balance ecological health with social inclusion. This dissertation responds to that challenge by exploring how community values, urban development, and green space expansion intersect in Southeast Atlanta, Georgia, a historically marginalized region facing development pressure. The Land Use Conflict Identification Strategy (LUCIS) model presents a nuanced understanding of land-use challenges in Southeastern Atlanta, highlighting areas of conflict and consensus among stakeholders. By spatially visualizing tensions caused by multiple viewpoints and agendas related to the future of urban spaces, the model offers actionable insights for balancing development demands with ecological preservation and community needs. This chapter summarizes and discusses the implications of the findings, identifies the most affected areas and stakeholders, examines the underlying concerns, and explores pathways for future applications and community engagement.

Using a mixed-methods geospatial approach, this study indirectly touches on the phenomenon mentioned in the literature of green gentrification (Checker, 2011; Wolch

et al., 2014), where well-intentioned green infrastructure projects, such as parks and conservation areas, may inadvertently contribute to the displacement of long-time residents. The potential for green gentrification is particularly potent in majority-minority neighborhoods like those in Southeast Atlanta, where historical redlining, disinvestment, and environmental injustice have laid a foundation for current inequities (Perry & Harshbarger, 2018; Berberian, 2022). By integrating remote sensing, community perception data, and a spatial decision support model, this research offers a framework for planning development and urban greening that are both ecologically sound and socially just.

5.1.1 Linking the Chapters

Each chapter of this dissertation contributes a unique but interconnected lens through which the land-use dynamics of Southeast Atlanta may be understood. Together, these chapters reflect the dissertation's overarching theme: **To build an advanced framework for urban planning that balances ecological resilience, community values, and development pressures through mixed-methods geospatial analysis.**

To accomplish this theme, the dissertation has been guided by three primary objectives:

1. **To quantify land use and land cover (LULC) change** and trends in urbanization and greening in Southeast Atlanta using high-resolution satellite imagery and geospatial analysis.

2. **To assess community perceptions and values** regarding urban greening, conservation, and development through municipal surveys that qualitatively document stakeholder perceptions and values.
3. **To model land use conflict and alignment**, using the LUCIS model to identify areas where social, economic, and environmental priorities intersect or collide.

Each chapter addresses one of these objectives, building a multi-dimensional understanding of the region's dynamic landscape and contributing to a holistic urban planning framework. Together, they reflect a central theme of this dissertation that includes sustainable development, and environmental planning should be informed by both spatial data and community voice, especially in historically underserved areas experiencing development pressure.

Chapter 2 focuses on land use and cover (LULC) change detection using high-resolution PlanetScope satellite imagery (2018–2024) to quantify annual changes in the vegetated areas and expansion of the built environment. This spatial analysis situates Southeast Atlanta's green spaces within broader development trends and highlights areas of ecological vulnerability (Deng et al., 2016; Prakash et al., 2020). Areas like the South River Forest and the former Prison Farm show significant declines in vegetation cover and increases in anthropogenic disturbance, trends with both environmental and social implications.

Chapter 3 focuses on the voices of residents through qualitative data gathered via the Atlanta Regional Commission (ARC) survey and involvement in meetings with the South River Forest Coalition (SRFC) and civic leaders. Through this community engagement and a two-part interpretation of the survey data backed by

expert validations from the literature, it becomes clear that residents value access to nature but are deeply concerned about gentrification, policing, and being excluded from planning decisions. These findings support previous studies emphasizing the need for environmental justice frameworks in urban planning (EPA, 2013; Anguelovski, 2016; Pearsall & Anguelovski, 2016).

Chapter 4 integrates the urban, social, and environmental data into a spatial model using the Land Use Conflict Identification Strategy (LUCIS) model developed by Carr et al., (2007). By modeling land suitability from three perspectives: community, developers, and ecosystem services, this chapter reveals areas of high conflict and potential alignment. Resulting maps and areal summary statistics identify areas in the Southeast Atlanta study area that are undergoing development impacting green spaces that are highly valued by local residents for ecosystem services, recreation and well-being. Industrialization linked to cargo warehouses and trucking associated with the Hartsfield-Jackson International Airport to the south and the growing film and television sound stages, backlots, and studio campuses to the north are believed to be major drivers of the changes in land use and land cover that are impacting neighborhoods and natural spaces. Visual and quantitative outputs from the LUCIS model demonstrate how geospatial tools can be leveraged not only to map land but also to mediate conflicting visions of place. Once built, the model input data, criteria and weights can all be adjusted to accommodate alternative scenarios that reflect the requests of different stakeholders and simulate adaptive compromise.

5.1.2 Future Work and Model Advancement

While the LUCIS model proved effective for highlighting spatial zones of land use conflict and consensus, future work can build upon its framework to enhance decision-making power, participatory flexibility, and spatial resolution.

One major avenue for advancement involves integrating more structured multi-criteria decision analysis (MCDA) tools, such as the Analytic Hierarchy Process (AHP). The AHP, originally proposed by Saaty (1980), allows planners to assign quantifiable weights to competing priorities through pairwise comparisons made by multiple stakeholders, thereby formalizing community and expert input into decision matrices. Effort can be made to solicit input from a pool of stakeholders that represent the residents of local neighborhoods, as well as developers interested in economic opportunities and city planners promoting green spaces in Southeast Atlanta. This technique can reflect weighted values from stakeholders and expand into a more robust multi-stakeholder AHP model, facilitating side-by-side comparisons of development, ecological, and equity-based priorities. Such integration could reduce subjective bias and make trade-offs more transparent across stakeholder groups (Dhurkari, 2023; Matori, 2016).

Further, using dynamic, iterative AHP scoring in community workshops, where participants actively adjust the weights, could evolve the LUCIS model into a living tool that supports adaptive planning and scenario-based land-use simulations. This would also align with recent calls for more participatory GIS (PGIS) and decision-support systems that center community voice in model refinement and scenario testing (Elwood, 2010; Guillard-Gonçalves et al., 2015).

From a remote sensing perspective, future iterations should integrate findings in LULC trends from the time-series analysis reported in Chapter 2 rather than use only the classification from the most recent year of 2024. This would enable the detection of longitudinal land cover changes and improve forecasting of future trends. Weng (2016) emphasizes temporal analysis as a way to provide a more comprehensive understanding of urban transformation by capturing seasonal variations, infrastructure cycles, and ecological degradation. This approach would also support proactive planning, allowing municipalities to anticipate rather than merely responding to landscape pressures. Modeling gentrification more robustly would require the integration of socio-economic indicators such as property values, housing tenure, and economic burdens. This data was beyond the scope of this version but should be prioritized in future model refinements to better capture displacement risks and community vulnerability.

Additionally, Weng et al. (2016) stress that urban land modeling must consider how ecosystem services are linked to human well-being, particularly in regions vulnerable to spatial injustice. Future model iterations could incorporate social vulnerability indices, for example, the Social Vulnerability Index (SoVI), developed by Susan L. Cutter and colleagues of the Hazards Vulnerability and Resilience Institute at the University of South Carolina (Cutter et al., 2003; Schmidtlein et al., 2008). The SoVI is a composite index designed to measure the relative social vulnerability of U.S. counties to environmental hazards. It aggregates multiple socio-economic and demographic variables such as income, age, race, education, access to transportation, and housing quality into a single, spatially explicit metric that reflects a population's

capacity to prepare for, respond to, and recover from disasters (Cutter et al., 2003). Cutter's work emphasizes that vulnerability is not just a function of risk exposure, but also of the social inequalities that shape people's ability to respond. Thus, using SoVI as an overlay in conflict modeling would make the LUCIS framework more responsive to the intersection of spatial risk and social disparity.

Advanced classification techniques such as object-based image analysis (OBIA), machine learning or the use of very high-resolution satellite data from platforms like QuickBird or WorldView can further enhance LULC classification accuracy. Nichol (2007) and Wong (2018) recommend these techniques for urban environments where pixel-level changes matter most for capturing fine-grain transitions in vegetation, impervious surfaces, and canopy loss.

Other future directions include the following.

Photo-elicitation and participatory mapping, enabling researchers to blend spatial and narrative data from residents, which would ground the GIS layers in cultural meaning and everyday experience (Copes et al., 2018; Elwood, 2010).

Scenario modeling based on policy shifts or climate adaptation strategies, extending the model from suitability to predictive modeling using land change simulations (Eastman, 1999; Lo & Yang, 2009).

Creating an **interactive web-based planning tool** where residents can modify layers in real time and view projected impacts—strengthening accessibility and transparency of planning processes.

Expanding the mixed methods LUCIS framework to other neighborhoods, incorporate deeper community engagement (e.g., focus groups, participatory

mapping), and explore predictive modeling of displacement risk. By layering geospatial accuracy with participatory structure and blending technical rigor with local knowledge, future versions of this model can play an active role in transforming urban planning from a top-down system to a participatory, justice-oriented practice. Doing so will further position geospatial science not only as a diagnostic tool but as a mediator of equity, ecology, and development in cities like Atlanta and beyond.

5.1.3 Contribution and Innovation

This dissertation contributes to urban geography, planning, and environmental justice by offering a replicable, mixed-methods framework that integrates spatial analysis with community values. While previous studies have explored green gentrification conceptually (Checker, 2011; Wolch et al., 2014), and others have developed participatory planning tools (Brown & Raymond, 2007), few have combined high-resolution remote sensing, community perceptions, and stakeholder-informed spatial modeling into a single framework.

Moreover, by applying the LUCIS model in an environmental justice context, this research builds upon and extends its original use in ecological and agricultural planning (Carr et al., 2007), adapting it for contested urban landscapes. This innovative adaptation demonstrates how geospatial tools can facilitate more democratic planning processes by identifying where consensus may be possible—and where deeper community engagement is needed.

Ultimately, this work offers not just a critique of green gentrification but a pathway toward more equitable urban greening, rooted in the lived realities of communities

historically excluded from planning conversations and a pathway for future applications and engagement.

5.1.4 Implications for Sustainable Land-Use Planning

The LUCIS model is a powerful tool for identifying and addressing land-use conflicts, offering a structured framework for integrating diverse stakeholder priorities. Planners can ensure more equitable and sustainable outcomes by focusing on conflict hotspots and aligning them with policy objectives. However, achieving long-term success will require greater community involvement, technological innovation, and adaptive policy frameworks. Future applications of the model could extend its utility beyond academia to serve as a cornerstone for participatory and transparent planning processes.

By recognizing the critical intersections of community, ecological, and economic priorities, the LUCIS model provides a roadmap for mitigating conflicts and promoting harmonious development. Integrating this framework with participatory platforms and cutting-edge technology will enhance its capacity to address future challenges while fostering inclusive and sustainable growth.

5.2. Conclusions

This dissertation presents a comprehensive and transformative mixed-methods approach to urban planning in Southeast Atlanta, examining the intersection of green space expansion, urban development, and community values in historically marginalized African American neighborhoods. By integrating mixed-methods geospatial analysis with qualitative insights from community stakeholders, the research

addresses the critical need for equitable and sustainable urban growth that honors both environmental and social dimensions.

The research contributes a multi-criterion, data-driven framework for urban planning that enables stakeholders to visualize and prioritize land-use decisions based on real-world constraints and community input. By deriving quantitative geospatial data from qualitative insights, the study provides a nuanced model that aligns urban development with community values, supporting both ecological health and social equity. This approach, which combines remote sensing with demographic and survey data, represents a step forward in environmental justice research, advocating for urban greening that minimizes displacement and strengthens neighborhood resilience.

In conclusion, this dissertation offers a replicable model for cities facing similar challenges where development pressures and gentrification threaten historically underserved communities. By emphasizing community-driven, sustainable planning, the research not only highlights the benefits of green infrastructure but also addresses the unintended consequences of green gentrification. Through the LUCIS model's suitability maps, policymakers, urban planners, and community advocates are equipped with actionable insights to achieve balanced growth that respects environmental sustainability, safeguards cultural heritage, and promotes social equity. This work serves as a critical resource for advancing inclusive urban planning practices that protect and uplift vulnerable communities amidst the complex realities of urban expansion and environmental change.

This research exemplifies interdisciplinarity by bridging the quantitative rigor of remote sensing with the participatory ethos of environmental justice research. Many

studies in the geospatial sciences remain isolated, either focusing on ecological modeling or social survey work. This dissertation, however, demonstrates how these domains can be integrated to produce a more holistic understanding of urban environmental change. By operationalizing the principles of critical GIS and critical remote sensing, it repositions satellite imagery and geospatial tools not only as instruments of analysis but as platforms for community advocacy.

The project also demonstrates the utility of community-weighted suitability modeling, where social values are not just represented in interviews or meetings but encoded directly into the spatial decision process. This methodological advance contributes to the growing toolkit for socially responsible GIS research.

The spatial outputs of this dissertation, conflict maps, suitability surfaces, and land cover change data, are immediately relevant to local planning efforts, community organizing, and policy design in Atlanta. The identification of conflict hotspots provides actionable intelligence to urban planners and nonprofit advocates: these are the locations where development pressure and community vulnerability converge. Policymakers can use these maps to guide land use decisions, consider implementing conservation easements, or develop housing affordability programs in anticipation of greening-related displacement. In particular, the South River Forest region presents a case where proactive, inclusive planning is urgently needed. The models and findings presented here can support transparent negotiations between developers, city officials, and affected communities.

This dissertation deepens our understanding of how urban greening efforts, often framed as public enrichment, can become sites of contestation and exclusion. It

empirically supports theories of urban "green sacrifice zones," where marginalized communities bear the burden of environmental change without enjoying its benefits. At the same time, it highlights areas of stakeholder consensus, suggesting that equitable greening is possible when community values are centered in planning processes.

By offering both critical insight and practical tools, the study contributes to an emerging generation of environmental justice research that seeks not just to diagnose injustice, but to enable more just urban futures. The findings underscore the importance of not only protecting green space but also protecting the people who live around it.

This study extends the application of the LUCIS model to a fine-scale, urban socio-ecological context characterized by land use conflict, environmental justice concerns, and overlapping stakeholder priorities. Unlike prior LUCIS applications focused on regional growth management or conservation planning, this research adapts the framework to explicitly incorporate Black civic perspectives, green gentrification risk zones, and mixed-methods-derived stakeholder criteria in a historically contested urban greenbelt. The LUCIS workflow was designed and constructed entirely in ArcGIS Model Builder by the author, including criteria layers, weighted overlays, stakeholder-specific suitability maps, and conflict rasters. The model is fully documented and replicable, allowing others to apply it to similar urban contexts facing pressure from both ecological preservation and development.

The integration of Community, Developer, and Ecosystem Perspectives provided key insights into spatial convergence and divergence. For example, areas valued simultaneously for their ecological function and development potential revealed high-conflict zones, while the Community Perspective highlighted nuanced preferences such

as support for development that includes park safety, accessibility, and job creation.

These findings demonstrate how a customized, transparent LUCIS model can support more equitable and stakeholder-informed urban planning decisions.

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APPENDIX

Appendix A - List of Abbreviations

Acronym	Definition
AHP	Analytic Hierarchy Process
ARC	Atlanta Regional Commission
COP CITY	A controversial police training facility project in Southeast Atlanta
DEI	Diversity, Equity, and Inclusion
EPA	Environmental Protection Agency
GIS	Geographic Information Systems
HUC	Hydrologic Unit Code
LULC	Land Use and Land Cover
LUCIS	Land Use Conflict Identification Strategy
MCDA	Multi-Criteria Decision Analysis
NDVI	Normalized Difference Vegetation Index
NIR	Near Infrared
OBIA	Object-Based Image Analysis
PGIS	Participatory Geographic Information Systems
RS	Remote Sensing
SoVI	Social Vulnerability Index
SRF	South River Forest
SRFC	South River Forest Coalition
UAS	Unmanned Aerial System
USGS	United States Geological Survey
WHO	World Health Organization

Appendix B - Data Inventory

Detailed Explanation of GIS Layers for LUCIS Model Inputs

Perspective	LUCIS Input Layer	Data Source & Link	Application in Model	Justification
Community	Proximity to Residential	<u>US Census Data (Housing)</u> www.census.gov	Prioritize residential area access to amenities	Supports walkable communities and neighborhood quality
Community	Proximity to Transportation	City of Atlanta Department of City Planning https://www.atlantaga.gov/government/departments/city-planning/maps-and-gis	Assess accessibility to transportation hubs	Enhances mobility and equitable access
Community	Proximity to Hospitals	<u>GeoFabrik OSM Georgia (Hospitals)</u> download.geofabrik.de/north-america/us/georgia.html	Evaluate healthcare accessibility and proximity	Essential public service for community resilience and health
Community	Proximity to Green spaces	PlanetScope Imagery Classification (2024)	Assess access and walkability to green infrastructure	Critical for social cohesion, health, and equity
Developers	Proximity to Roads	City of Atlanta Department of City Planning https://www.atlantaga.gov/government/departments/city-planning/maps-and-gis	Evaluate connectivity and infrastructural accessibility for investments	Essential for development viability and marketability
Developers	Population Density	<u>GPWv4 Population Density (NASA/SEDAC)</u> www.earthdata.nasa.gov/data/catalog/sedac-ciesin-sedac-gpwv4-popdens-r11-4.11	Market demand analysis and strategic investment placement	Indicates development potential based on population
Developers	Proximity to Shops	<u>GeoFabrik OSM Georgia (Commercial Areas)</u> download.geofabrik.de/north-	Assess commercial viability and market attractiveness	Directly supports economic return and viability

		america/us/georgia.html		
Developers	Gentrification	Manual Land Cover Classification Planet (2024)	Identify parcels suitable for immediate development	Optimal use of available land reducing displacement risks
Developers	Less Developed Areas	US Census Data www.census.gov	Target economic revitalization and sustainable growth	Balances development with social equity and investment
Ecosystem Services	Proximity to Green Spaces	PlanetScope Imagery Classification (2024)	Evaluate critical ecological corridors and recreational green areas	Fundamental for ecosystem health, connectivity, and resilience
Ecosystem Services	Proximity to Water Bodies	Global Inland Water Dataset www.tandfonline.com/doi/full/10.1080/17538947.2015.1026420	Identify areas critical for hydrological protection and flood mitigation	Essential for ecological sustainability and flood resilience
Ecosystem Services	Proximity to Protected Areas	Protected Planet WDPA www.protectedplanet.net/en/thematic-areas/wdpa?tab=WDPA	Prioritize conservation adjacent to existing protected land	Ensures biodiversity conservation and ecological integrity
Ecosystem Services	Biodiversity Index	GEE Community Catalog (BII) gee-community-catalog.org/projects/bii/	Assess ecological intactness and prioritize high biodiversity zones	Guides ecological sustainability and conservation strategies
Ecosystem Services	Slope	USGS SRTM DEM (30m) https://developers.google.com/earth-engine/datasets/catalog/USGS_SRTMGL1_003	Determine areas of ecological sensitivity based on erosion and runoff risk	Critical for ecological stability, preventing erosion and habitat loss

Appendix C - Data Reclassify Values

Perspective	LUCIS Input Layer	Values		
Community	Proximity to Residential (m)	Start	End	New
		0	360	10
		360	710	8
		720	1080	6
		1080	1500	4
		1500	1805	2
Community	Proximity to Transportation	Start	End	New
		0	2070	10
		2070	4150	8
		4150	6215	6
		6215	8290	4
		8290	10400	2
Community	Proximity to Hospitals	Start	End	New
		0	2260	10
		2260	4520	8
		4520	6770	6
		6770	9024	4
		9024	11290	2
Community	Proximity to Green spaces	Start	End	New
		0	835	10
		835	1670	8
		1670	2500	6
		2500	3350	4
		3350	4200	2
Developers	Proximity to Roads	Start	End	New
		0	71	10
		71	114	8
		114	216	6
		216	288	4
		288	370	2
Developers	Gentrification Potential	Start	End	New
		0	520	10
		520	1040	8
		1040	1560	6
		1560	2080	4
		2080	2600	2
Developers	Proximity to Shops	Start	End	New
		0	1300	10
		1300	2600	8
		2600	3900	6
		3900	5200	4
		5200	6520	2

Developers	Vacant and Less Developed	Already Classified 1 through 10		
Ecosystem Services	Proximity to Green Spaces	Start	End	New
		0	835	10
		835	1670	8
		1670	2500	6
		2500	3350	4
		3350	4200	2
Ecosystem Services	Proximity to Water Bodies	Start	End	New
		0	0.0125	10
		0.0125	0.025	8
		0.025	0.0374	6
		0.0374	0.05	4
		0.05	0.07	2
Ecosystem Services	Proximity to Protected Areas	Start	End	New
		0	1240	10
		1240	2480	8
		2480	3720	6
		3720	4960	4
		4960	6200	2
Ecosystem Services	Biodiversity Index	Start	End	New
		0	0.2	10
		0.2	0.3	8
		0.3	0.4	6
		0.4	0.5	4
		0.5	0.65	2
Ecosystem Services	Slope	Start	End	New
		0	9.2	10
		9.2	18.5	8
		18.5	27.7	6
		27.7	36.96	4
		36.96	50	2