

Park Supply and Demand Part II: Downtown Silver Spring

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Introduction

As Downtown Silver Spring continues to urbanize, it becomes increasingly important to provide its residents and workforce with adequate recreational space. In conjunction with the the Maryland- National Capital Park and Planning Commission (M-NCPPC), this report investigates which areas of Downtown Silver Spring are adequately served by parks and those that lack robust access to these facilities.

Using an ArcGIS-based model that combines pedestrian and bicycle access, population demographics, and data on local parks, our model assesses the degree to which Downtown Silver Spring's residents and workforce have adequate access to parks.

The report begins with a literature review on the value of parks and summarizes ways that supply and demand for recreational space have been geospatially analyzed. The second section details the methodology used to create the supply and demand model. The results section offers an analysis of gaps in park supply and demand, combining findings with population and workforce data. The report concludes with a list of recommendations to assist M-NCPPC in planning for parks in Downtown Silver Spring.

Background Research

An extensive body of literature has identified the economic, social, and health benefits of parks and other green spaces. Conversely, there is a relatively scant amount of literature discussing the factors that drive supply and demand regarding parks.

The Value of Parks

The economic benefits of parks to nearby commercial and residential units is long established. Most of the value added by parks occurs within 500 feet of a park boundary, although a marginal but statistically significant benefit also occurs within 2,000 feet.¹ In a separate study, homes within 100 feet of a park gained property premiums of 20 percent, homes within 300 feet of a park received premiums of ten percent, and homes within a quarter mile saw a negligible but significant increase in property value. The establishment or rehabilitation of a park has also been documented to improve the value of nearby properties. After New York City's Bryant Park was rehabilitated in 1992, nearby buildings saw property increases of up to 114 percent over a ten-year period, compared to increases ranging from 41 to 67 percent in competitive submarkets.²

In addition to increased property values, parks can provide several other ancillary economic benefits. An American Planning Association study found that the creation of a greenbelt network in Boulder, Colorado generated an additional \$500,000 in annual tax

¹ Harnick, Peter, and Ben Welle. "Measuring the Economic Value of a City Park System." , The Trust for Public Land, 2009. Accessed 27 Feb. 2018.

² Kozloff, Howard. "The Payoff from Parks." *Urban Land*, Urban Land Institute, 29 Aug. 2012. Accessed 27 Feb. 2018.

revenues. Furthermore, parks have been cited in attracting retirees and knowledge workers to residential areas.³

When measuring the supply and demand of its park system, Montgomery County Parks should examine adjacent land uses and demographic profiles, considering the potential economic impact of adding additional recreational facilities to residential districts.

Parks have also been documented to provide an array of non-economic benefits to communities. The exercise opportunities provided by parks carry significant public health benefits for communities. For example, the exercise in parks by residents of Sacramento, California was found to prevent almost \$20 million in health costs annually.⁴ Furthermore, a study conducted by Lincoln R. Larson, Viniece Jennings, and Scott A. Cloutier found that the quantity of parks “was among the strongest predictors of overall wellbeing” within a community, contributing to the sense of purpose for many residents.⁵

Measuring Park Supply and Demand

While the value of parks is well established, relatively little attention has been paid to how to measure supply of and demand for parks. Much of the research on this topic focuses on the degree to which marginalized populations can access parks. According to Ming Wen, people of color have higher access to parks than their white counterparts.⁶ However, Carolyn Finney notes that African-Americans tend to avoid using parks, as these spaces have historically been

³ Lewis, Megan. "How Cities Use Parks for Economic Development." *APA Knowledge Center*, American Planning Association, 2007. Accessed 27 Feb. 2018.

⁴ Harnick and Welle, "Measuring the Economic Value of a City Park System"

⁵ Larson, Lincoln R., Viniece Jennings, and Scott A. Cloutier. "Public Parks and Wellbeing in Urban Areas of the United States." *PLOS One*, PLOS, 7 Apr. 2016. Accessed 27 Feb. 2018.

⁶ Wen, Ming. "Neighborhood Race, Poverty, and Access to Parks and Green Space." *Annals of Behavioral Medicine*, vol. 41, no. 1, 2013, pp. 18-27.

sites of “insecurity, exclusion, and fear born out of historical precedent, collective memory, and contemporary concerns.”⁷ Finney’s comments suggest caution when relying on quantitative data to measure park supply across subgroups. Specific communities may technically have access to parks, but they may avoid using these spaces for reasons not immediately apparent.

Scholars have also focused on how distance and multimodal access affects the ability of residents to use parks. Proximity is ultimately the largest barrier to park accessibility; parks are typically used by individuals living or working a half mile or less away from the site. That being said, park use decreases by 50 percent as distance doubles. Public use is also inhibited when pedestrian street networks are “incomplete and disconnected,” or when walking conditions are deemed uncomfortable or unsafe.⁸ With this in mind, it is important that demand scores include layers detailing the quality of a park’s adjacent pedestrian network.

There have been relatively few attempts to geographically measure park supply, demand, or access. The most notable case of park supply mapping is ParkScore, which analyzes the quality of a city’s park system across measures of supply, funding, and access in 100 American jurisdictions. Each of the aforementioned categories is given equal weight, while cities themselves are weighted based on population density, density of children aged 19 and younger, and density of households earning less than 75 percent of a city’s median income.⁹ While ParkScore doesn’t account for a comprehensive list of factors that may influence supply and

⁷ Mock, Brentin. “For African Americans, Park Access is About More Than Just Proximity.” *Citylab*, 2 June 2016. Accessed 27 Feb. 2018.

⁸ “Safe Routes to Parks; Improving Access to Parks through Walkability.”, National Recreation and Park Association, 2 June 2016. Accessed 27 Feb. 2018.

⁹ Bliss, Laura. “Why the Grass is Greener in Some U.S. Park Systems.” *Citylab*, 2 June 2016. Accessed 27 Feb. 2018 and “ParkScore Methodology.” *ParkScore 2017*, Trust for Public Land. Accessed 27 Feb. 2018.

demand (for example, it doesn't assess how pedestrian networks influence access), it nevertheless provides a methodological framework to apply to future assessments.

The body of literature on park value, supply, demand, and access demonstrates that green spaces provide a clear benefit to cities and supply and demand are influenced by a variety of factors. This literature review demonstrates that there are several gaps in the body of existing research, and a park supply and demand analysis for Montgomery County could serve as a model for other jurisdictions seeking to better understand whether or not their stocks of green spaces are adequate and accessible.

Cycling in Downtown Silver Spring

Cycling is an increasingly popular, environmentally-friendly mode of transportation. It is also traffic-friendly in that it does not contribute to congestion (especially if riders use dedicated bike lanes), and it brings several health benefits for riders. In the last 18 years, the number of biking commuters has doubled in Washington, DC, and increased by almost 60 percent nationwide in the last decade.¹⁰

Planners have increased bicycling infrastructure throughout Montgomery County, and efforts have especially concentrated on urbanized areas like Downtown Silver Spring. This area has seen several changes, including the implementation of new dedicated bike lanes with plastic bollards for protection, as well as bikeshare stations, dockless bikes, and bike parking facilities. There have also been new pavement markings at intersections for cyclists, and construction on a

¹⁰ Copeland, L. (2014). Biking to Work Increases 60% in Past Decade. *USA Today*. Retrieved from <https://www.usatoday.com/story/news/nation/2014/05/08/bike-commuting-popularity-grows/8846311/>, and Alpert, D. (2014). DC Bike Commuting More than Doubled since 2000. *Greater Greater Washington*. Retrieved from <https://ggwash.org/view/34683/dc-bike-commuting-more-than-tripled-since-2000>

new two-way separated bike lane is slated to start this year. The final goal is to create a shared-use path that will loop around Downtown Silver Spring. One can attribute many of these changes to the increased bicycle budget and funding for the Capital Improvements Program.¹¹

Methods and Methodology

Pivoting from the employment-focused work completed in the Fall semester, this semester's project uses housing data to quantify the demand for parks in Downtown Silver Spring. The Fall semester focused on creating an extensive one-mile walkshed and acre grid network for the entire county, using EPS output and facilities data provided by M-NCPPC at the project's start. In the initial stages, private properties were identified, along with their proximity to nearby parks to create park scoring criteria, based on each park's active, contemplative, and social features. This set of criteria, originally developed by M-NCPPC, was expanded to include other active and passive park amenities. Data was spatially joined with the demand scores, based primarily on employment data at the block level, and the walksheds in ArcGIS. Additional data used to determine demand included overall park use and walkability. Ultimately, this dataset was used to create separate supply and demand maps, which were then incorporated to create a composite map that demonstrated service gaps in the county.

To conduct a more thorough gap analysis, this phase of the project focuses on a smaller section of the county, the Downtown Silver Spring Central Business District. This project addresses the accessibility of parks to Downtown Silver Spring residents. Accessibility is

¹¹ Metcalf, A. (2017) Downtown Silver Spring Bike Network Beginning to Come Together. *Bethesda Magazine*. Retrieved from <http://www.bethesdamagazine.com/Bethesda-Beat/2017/Silver-Spring-Bike-Network-Beginning-To-Come-Together/>

determined by a walkability radius of within 0.5 mile (2,640 feet) and 1 mile for bicyclists (5,280 feet). Inspired by M-NCPPC's suggestion, the gap analysis includes a bikeshed, and features per-acre grids located within the bikeshed but outside the walkshed boundary; areas within this "donut" boundary receive a partially weighted score. This helps demonstrate an additional layer of accessibility to additionally assess if residents are able to access nearby parks and open spaces without a car.

This being said, there are other factors of impedance not included here that may affect how far bikers are willing to travel, such as sloped terrain and intersections with busy traffic. The overall goal of expanding the bounds of accessibility is to account for the supply and demand using all non-vehicular methods within the Downtown Silver Spring Central Business District Area.

Based on recommendations from the Fall semester and the findings of our literature review, demand was calculated by analyzing single- and multi-family housing density, using data provided by M-NCPPC. Additionally, we added accessible but privately-owned public spaces, such as playgrounds and dog parks, to our supply dataset. During last semester's final presentation, we were also advised to use more advanced analysis tools with a higher degree of complexity. This semester, we've edited and enhanced the Model Builder and Python Scripting, provided by M-NCPPC, to calculate supply and demand and then determine gap scores for each acre grid within the Downtown Silver Spring CBD boundary. M-NCPPC provided datasets for the geocoded park locations and housing density per acre, which were easily attached to the grid network. The enhanced model builder provides a more efficient way to determine service gaps; this model can ultimately be expanded to analyze the entire county.

The mo model performs a gap analysis, producing an updated shapefile of acre grids across the downtown Silver Spring area with field “Finalgap” assigned as to each grid. The model uses inputs including:

- “EPSfinwRes.shp”: A base shapefile of acre grids in the downtown Silver Spring area with demand fields:
 - “TOT_SF”- Total Single-Family Units per grid updated using plot data updated and location allocation to each grid.
 - “TOT_MF” - Total Multifamily units per grid updated using plot data and location allocation to each grid.
 - “TOT_JO” - Total Jobs per grid
- “PolygonsWalkshedHalfMile.shp”: A shapefile of walkshed polygons calculated in half-mile increments along a walk network of sidewalks and trails from each grid.
- “BikeshedPolygonsDonut.shp”: A shapefile of bikeshed polygons calculated from the half mile distance boundary of the walkshed polygons to a distance of one mile, creating a donut shape.
- “RecGuidelinesEPS.shp”: A shapefile of park facilities in Montgomery County with field “ID_CODE” to classify each facility.
- “Score_Lookup.csv”: A CSV lookup table with each park facility’s “ID_CODE” and the associated active, contemplative, and social scores for each facility. This table is an input for the walk iterator model.
- “BikeScore_Lookup.csv”: A copy of “Score_Lookup.csv” for input to the bike iterator model.

The overall model (“parent” model) first calculates a join ID in the grid shapefile by adding one to each FID to join the grids to output tables with supply scores later in the parent model. The parent model then uses the walkshed polygon input shapefile to process a nested walk iterator model (“child” model) that selects and processes each walkshed polygon grouping by facility ID. The iterator separates each polygon by Facility ID into separate shapefiles. Each polygon file is then spatially joined to the park facility shapefile to attach all park facilities within the polygon. Then, the shapefile is joined to the lookup table, which adds fields for active, contemplative, and social scores according to the included ID_CODES within the polygon. Each facility’s active, contemplative, and social scores are multiplied by the frequency of each facility within the polygon and then summed to total active, contemplative, and social scores per polygon. The iterator then adds the corresponding facility ID in a field (titled “FacilityID”) to each table. The walk iterator model outputs a table for each polygon, with total active, contemplative, and social fields and facility ID. The parent model uses this output to merge the tables into one table with each polygon facility ID and its total active, contemplative, and social scores.

The parent model then calculates the field “WalkSupply” to total all supply scores for each walkshed polygon within the output table and merges the output table to the input acre grid shapefile. Then, the model runs the nested bike iterator model. The bike iterator model performs the same processes as the walk iterator model with the input bikeshed polygons to output tables for each polygon from the half-mile walk distance boundary to the mile distance along the walk network. The parent model merges the bike iterator outputs into one table with FacilityID “BikeFacilityID” and the corresponding total active, contemplative, and social scores. The parent model then adds the field “BikeSupply,” which sums all scores for each facility ID and

halves each total score to weight facilities within walking distance higher and lessen the weighting for facilities only within biking distance from each grid.

Finally, the parent model joins the merged table with field "BikeSupply" to the grid by FacilityID to create a grid shapefile with facility IDs for walk and bike polygons as well as fields "WalkSupply" and "BikeSupply." The parent model then calculates total supply "TotSupply" by adding "WalkSupply" and "BikeSupply." Further, the parent model calculates a demand field ("Demand") by summing the updated fields total single-family household units, total multifamily units per grid, and total jobs per grid. Lastly, the gap field ("Finalgap") is created by subtracting the demand field from the total supply field and producing an EPS grid shapefile with supply scores, the demand score, and the final gap score.

To provide further analysis, the final gap map also examines layers of various socioeconomic factors by overlaying information such as jobs, median income, ethnicity, age, and future population growth into ArcGIS Online. It can also identify the locations of bikeshare docks. Demographic data was sourced from the Census and M-NCPPC, using specific census tracts that roughly align with the Downtown Silver Spring CBD Boundary, 2403170-25001, 25003, 25004, 26011, 26012, 26013, 26014, 28002. Uploading the final maps to ArcGIS online allows for ease of use by M-NCPPC and provides access to the public. The final ArcGIS Online map, which demonstrates the total jobs in Downtown Silver Spring and Capital Bikeshare dock locations overlaid on top of the park supply-demand gap, is accessible at <https://bit.ly/2INO9Uf>.

We worked collaboratively to produce the final result. Lauren Stamm served as the team leader, coordinating all the members of the team, attending client meetings, ensuring project

deadlines were met, and supporting team members on mapping and research tasks. Sarah Latimer, the mapping lead, took the lead role on modifying the model builder, creating walkshed for Downtown Silver Spring, supporting the rest of the team members in ArcGIS technical tasks, and undertaking the final editing of all maps. Juan Sian, the data lead, managed data from various sources to input into the model builder and built the bikeshed for Silver Spring. Sarah and Juan were also contributors to Part 1 of this project, last semester. Andy Seguin, the policy lead, researched the background literature, created a base map for our final maps, and ensured maps were publicly accessible through ArcGIS online.

Results

Supply and Demand of Parks in Downtown Silver Spring

Figure 1 demonstrates the results of the supply and demand model. After receiving a score for each square-acre parcel, we used ArcMap's natural breaks function to symbolize the gap between supply and demand, and created five score categories. In Figure 1, the darkest red dots indicate locations with a relatively high supply of parks and recreational spaces (supply) and a relatively low amount of users (demand). Conversely, dark blue dots indicate spaces with a dearth of parks and a high amount of users. Green spaces indicate a healthy balance of parks and residents and workers. Functionally speaking, there are several areas with high clusters of red dots near green spaces.

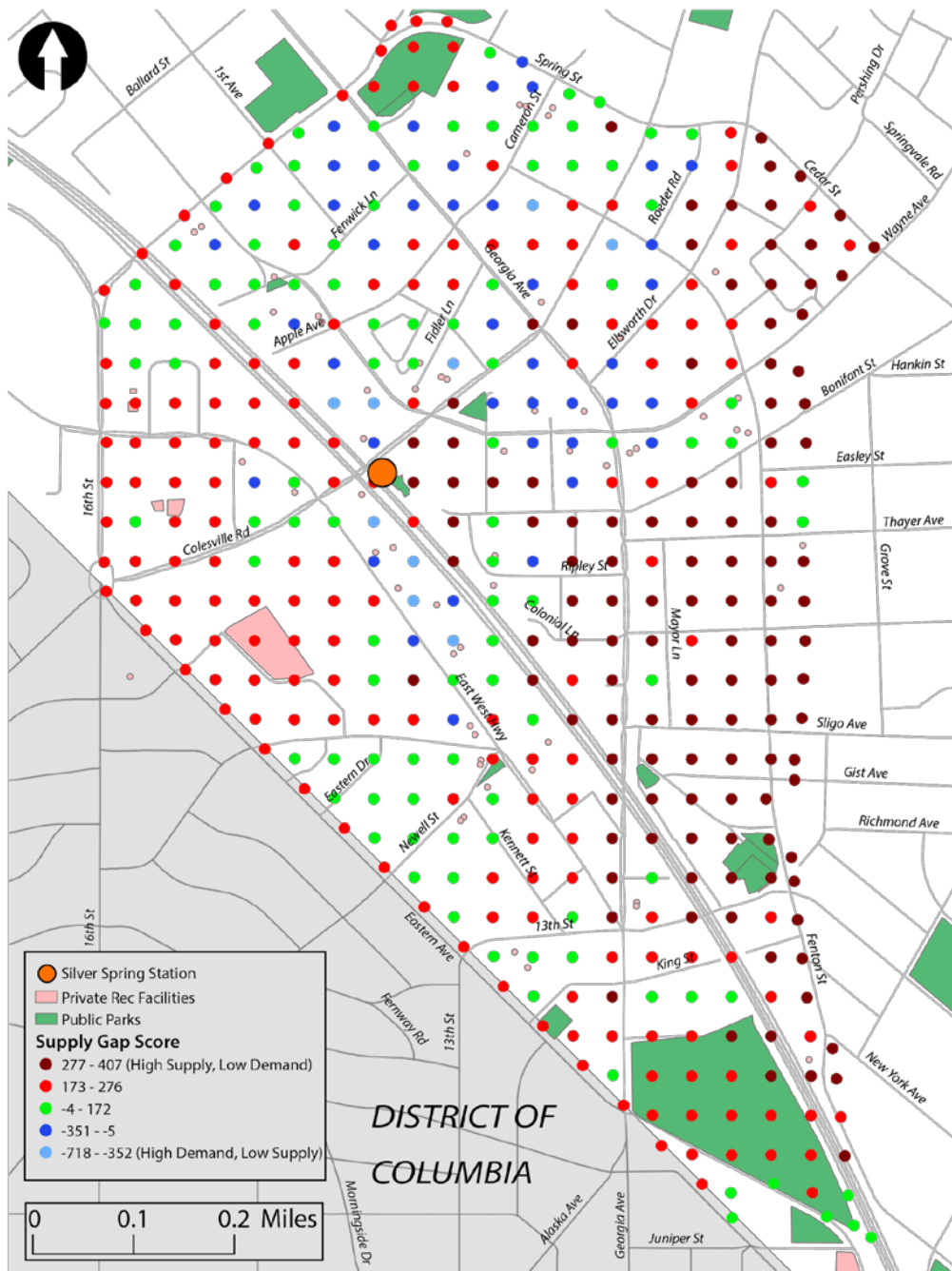


Figure 1: Downtown Silver Spring Park Supply and Demand Gaps

This suggests that there may be very few residents and workers in the immediate vicinity.

Blue areas, on the other hand, suggest that there are more workers and residents than parks that can serve them.

Overall, the results indicate several areas with a low supply of parks and high number of residents and workers. In particular, there are several nodes of need immediately to the south, northwest, and east of the Metro station; as well as an area near the corner of Roeder Road and Cedar Street in the northeast sector of Downtown. It is worth noting that there are several areas adjacent to parks with blue parcels; this may be due to the model suggesting that population density in these spaces is too high to be adequately served by local parks. When evaluating areas to add additional parks, these spaces should be second in priority to nodes with no park access.

Figures 2 and 3 pair the supply and demand gap map with block group-level 2012-2016 American Community Survey (ACS) demographic data. It is worth noting that while block group data may provide insight on various districts within Downtown Silver Spring, it does not match the gap map's highly-detailed scale. That being said, the demographics of a specific square acre may not reflect the general demographics of the block group in which it is located.

Figure 2 pairs supply and demand gap data with median household income data. Downtown Silver Spring's average household income is relatively high (\$73,501); there are certain block groups with both low incomes and high supply deficits. In particular, the average income of households in the block group between Apple Avenue and Fenwick Lane is \$36,825. Aside from a small park at the northwest corner of this block group, there is relatively little recreational space in the immediate area.

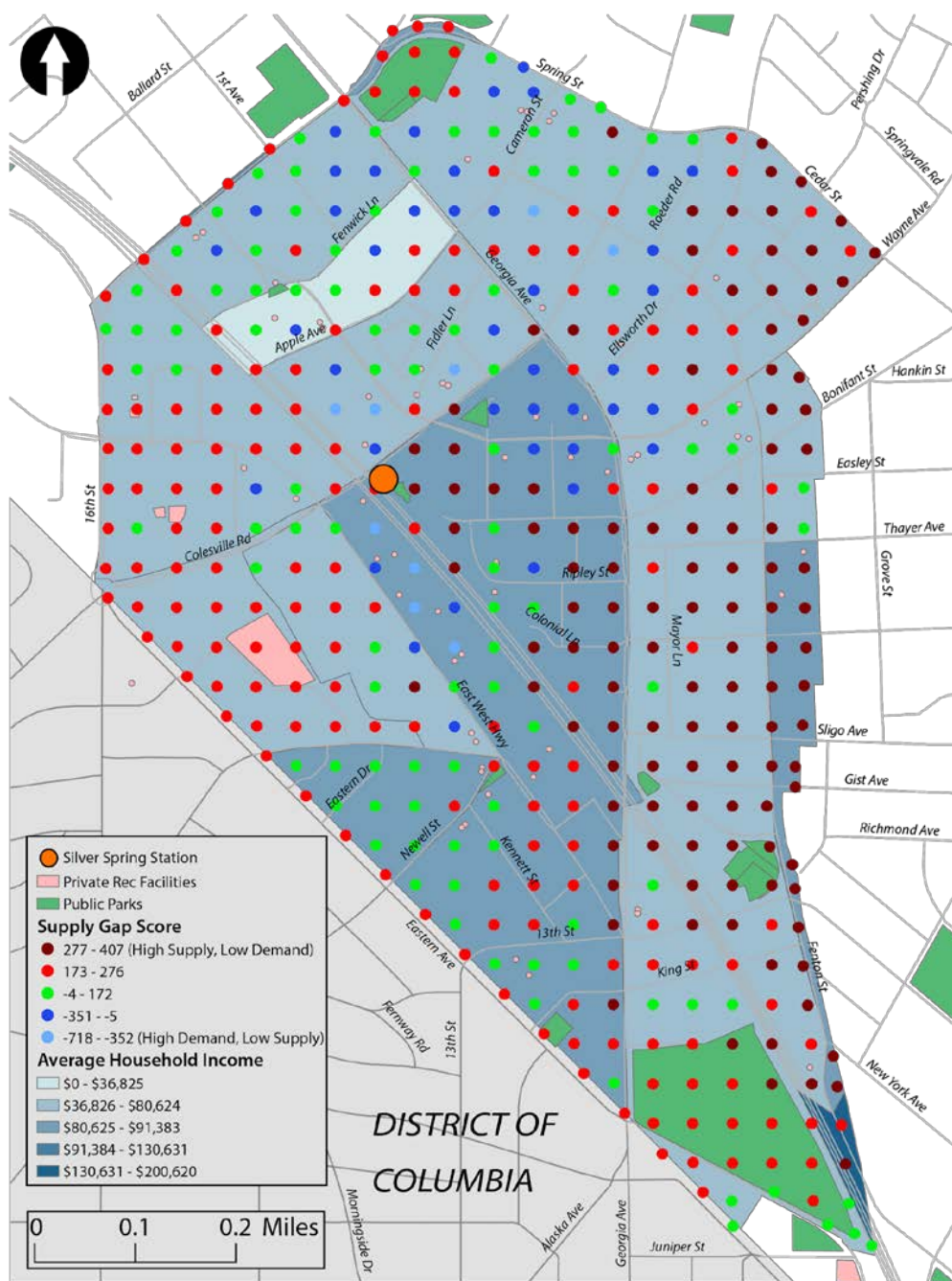


Figure 2: Park Supply and Demand Gap Scores and Average Household Incomes

Figure 3 features supply and demand gap scores with concentrations of individuals under the age of 18. While young people comprise only 12.2 percent of Downtown Silver Spring's population, there is both a relatively high concentration of young people (17.0 percent) southwest of the Metro station without convenient park access. Shown in Figure 4, Silver Spring houses approximately 24,000 workers, with a high concentration southwest of the Metro station. Given this high concentration of both young people and workers, planners seeking to attract a "24-hour population" to future parks should consider the area southwest of the Metro station.

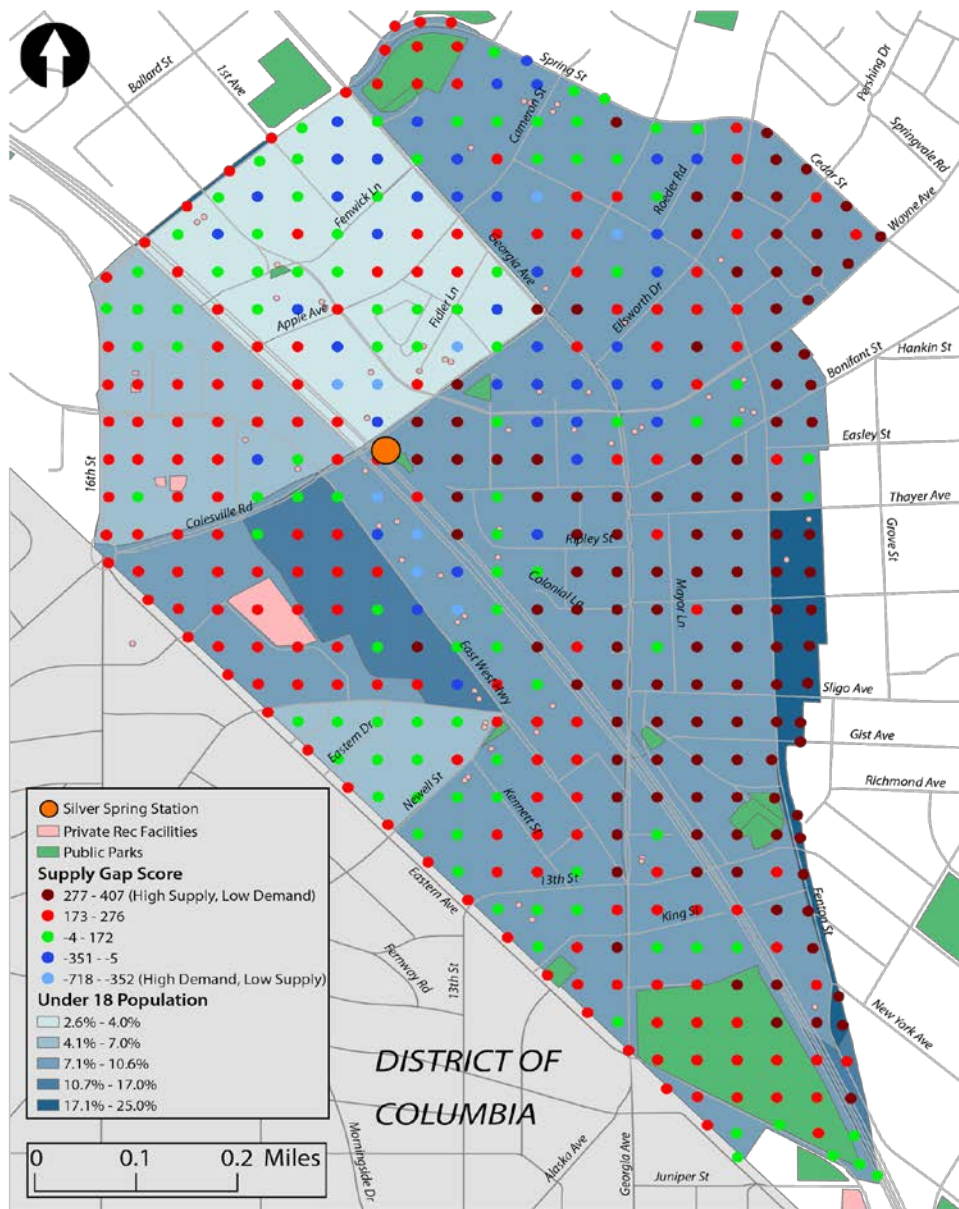


Figure 3: Park Supply and Demand Gap Scores and Under-18 Populations

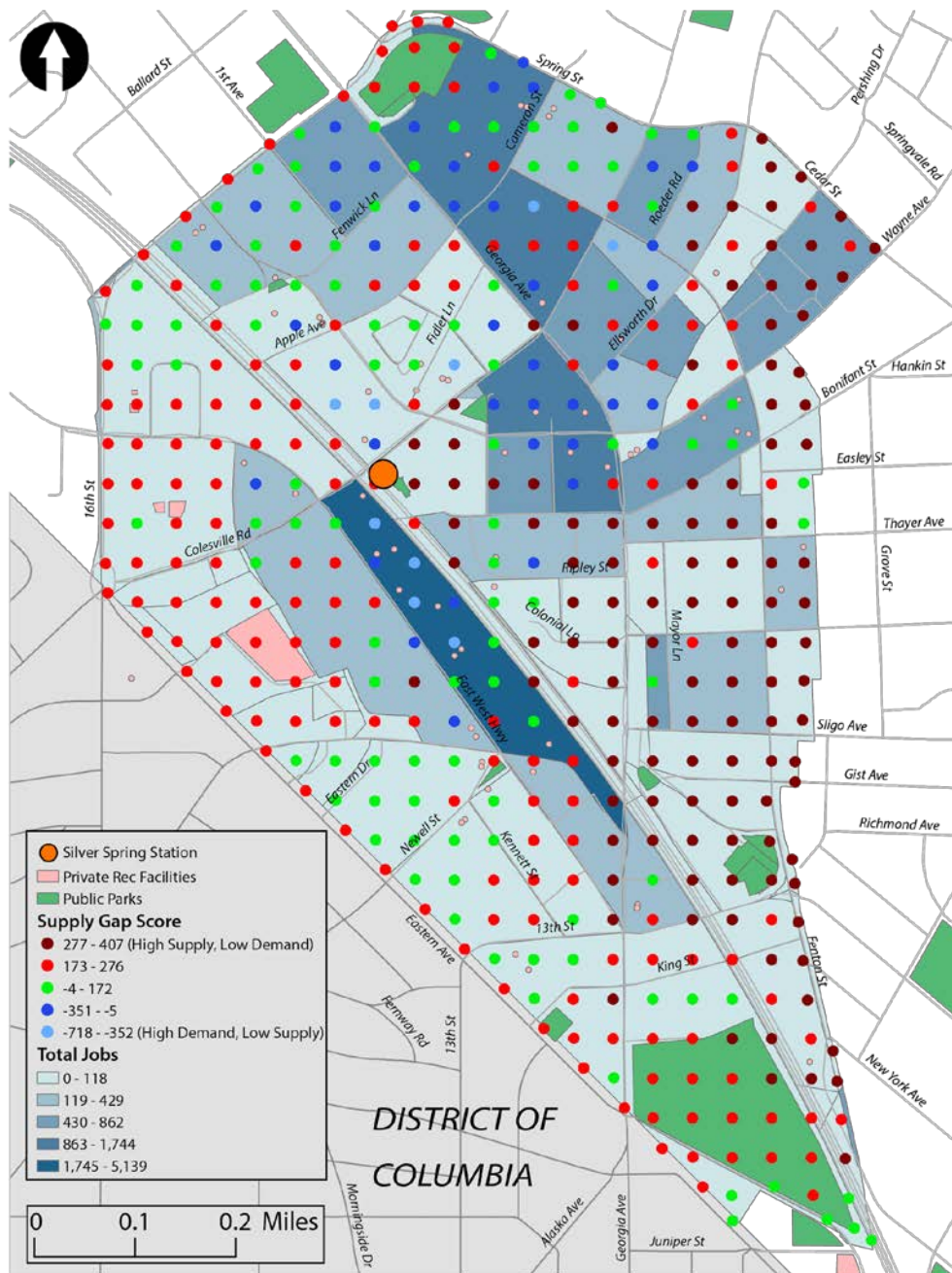


Figure 4: Park Supply and Demand Gap Scores and Total Jobs

To better serve Silver Spring’s nonwhite populations, we also constructed maps that overlaid supply and demand scores on concentrations of black, Hispanic, and Asian populations.

As seen in Figure 5, approximately 35 percent of Downtown Silver Spring's population identifies as black; large concentrations of African-Americans can be found throughout Downtown Silver Spring. In particular, there are both large concentrations of African-Americans and high demand levels in the northeast corner of Downtown Silver Spring. Only 11 percent of Silver Spring's population identifies as Hispanic and 7 percent identifies as Asian. As shown in Figure 6, the largest concentration of Asians is located in the block groups directly surrounding the Metro station, a location with a lack of robust of park supply. As shown in Figure 7, Downtown Silver Spring's northwest corner is home to a large Hispanic population. While there are two parks located to the east and north of this area, the high population density may indicate a need for additional park space.

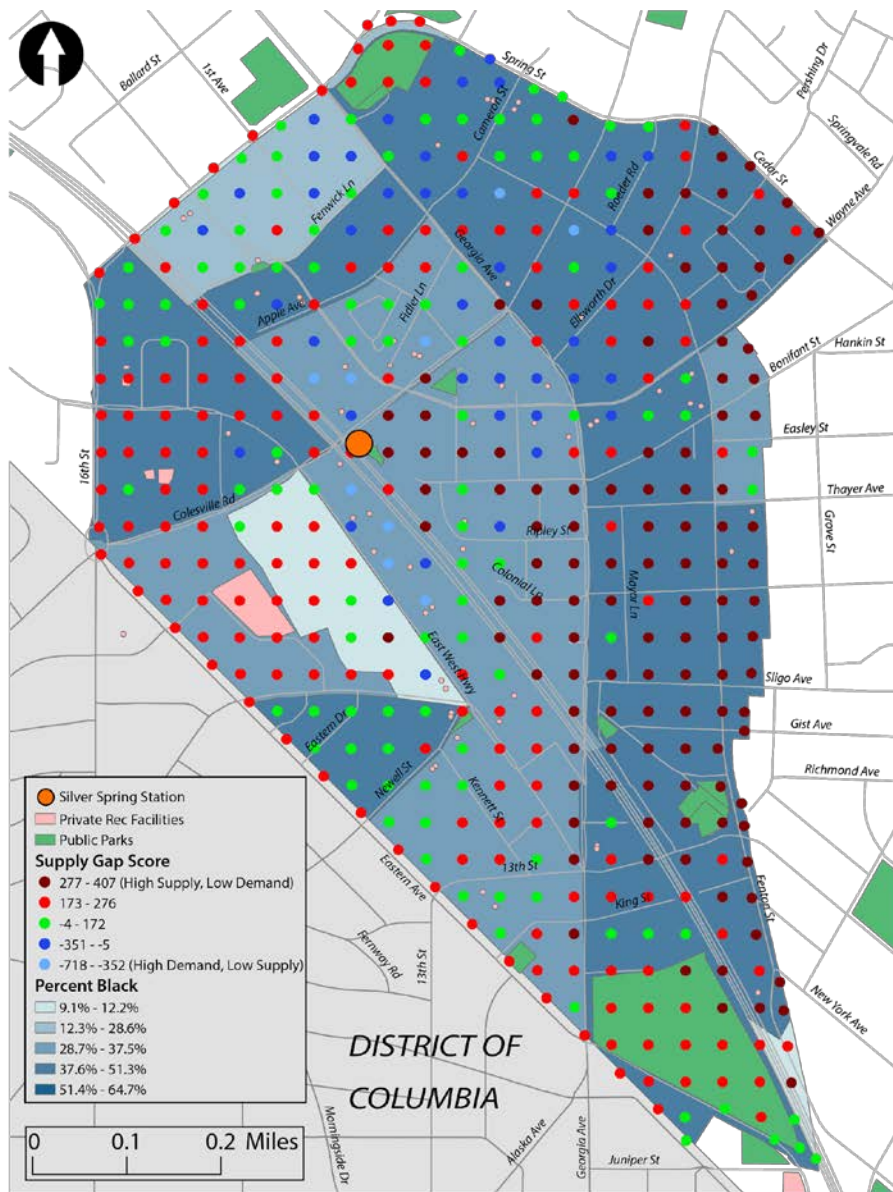


Figure 5: Park supply and demand gap scores and black populations.

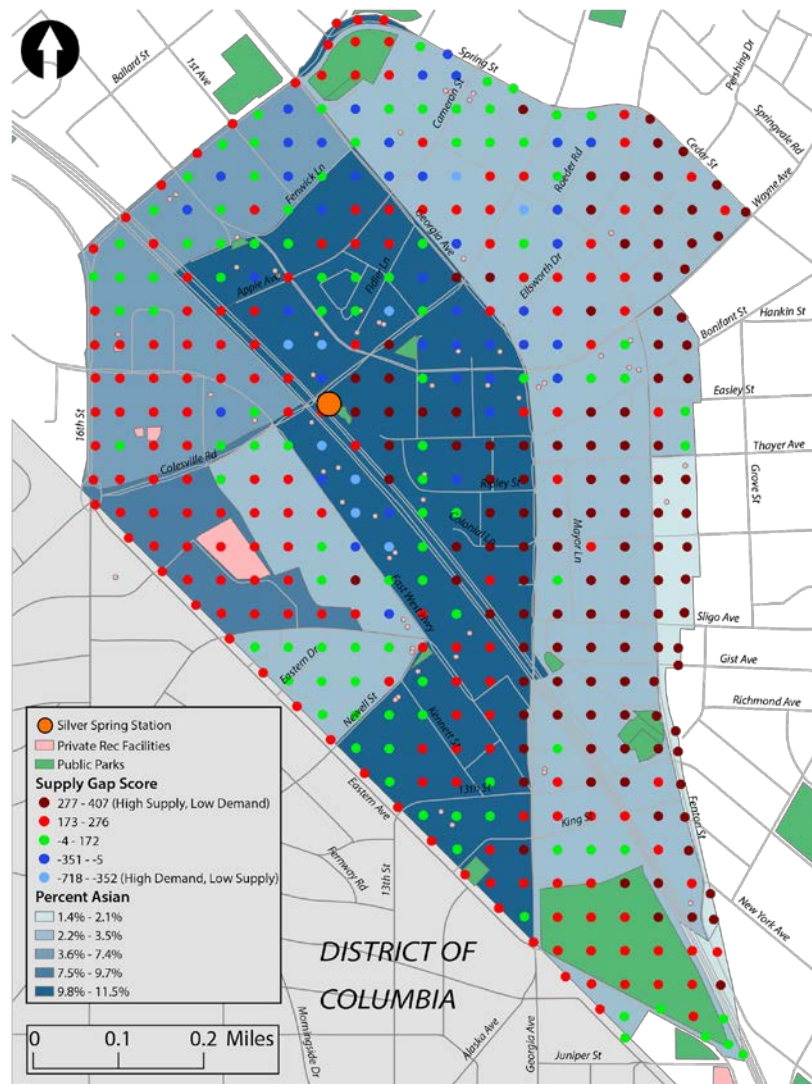


Figure 6: Park Supply and Demand Gap Scores and Asian populations

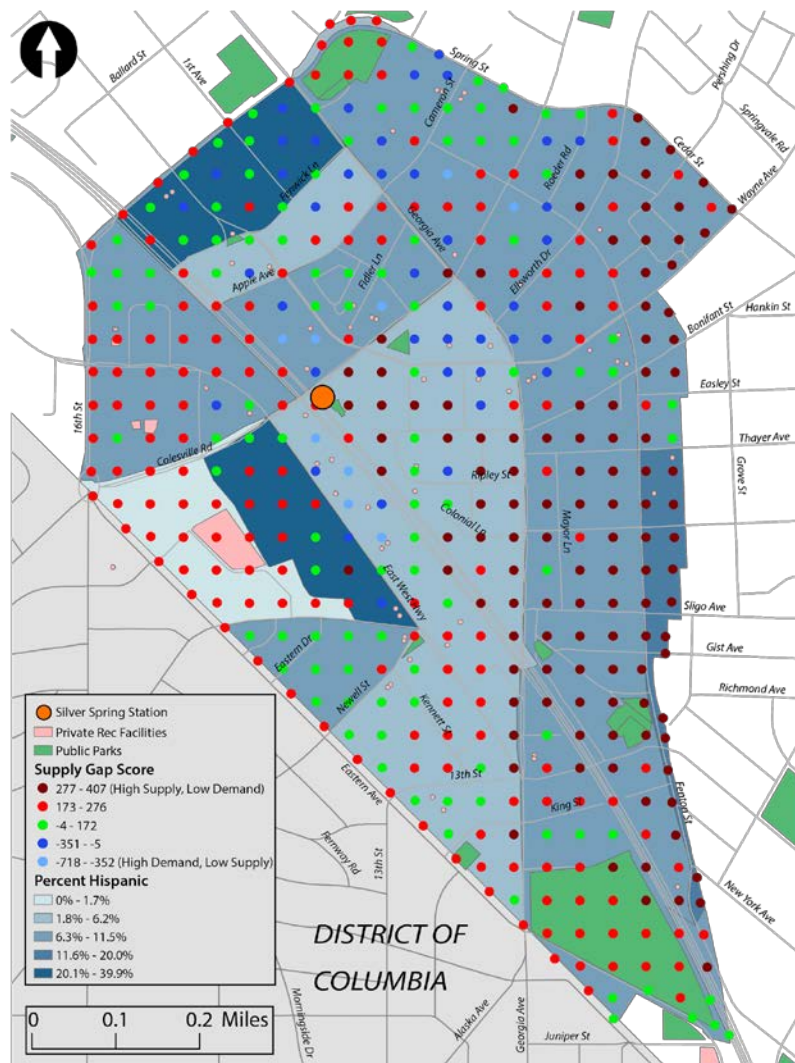


Figure 7: Park Supply and Demand Gap Scores and Hispanic Populations

Implications for Park Planning

The supply and demand gap maps indicate that several areas in Downtown Silver Spring lack enough recreational space to serve the local population. Due to development pressures and the high cost of real estate, M-NCPPC may have difficulty adequately serving areas with high demand and low supply. That being said, planners should consider prioritizing park development in areas with both high levels of demand and large concentrations of marginalized populations.

Recommendations

Based on background research, the results of the supply and demand model, and the analysis of the overlay maps, we recommend that M-NCPPC take the following actions to enhance the model and improve access to parks in Downtown Silver Spring:

Supply and Demand Model

Consider supply and demand variables and weights. While we are confident that the model provides a snapshot of the supply and demand of parks in Downtown Silver Spring, future iterations should consider which variables are included and how they are weighted. M-NCPPC should consider interviewing local stakeholders (including residents, employees, and community leaders) to better understand who is using Downtown Silver Spring's parks and what they believe to be missing from the local supply of green spaces.

Use the model to understand the impacts of additional parks. The model has a strong potential to assess the impact of proposed parks on demand and supply in Downtown Silver Spring. If M-NCPPC identifies a specific parcel for a new park, that space could be added to the model's inventory to understand how it would impact supply and demand scores.

Add trail data to better understand pedestrian access to parks. The current version of the model does not include trails in its pedestrian network, but these routes serve as important access routes to local parks. Future models should therefore consider adding M-NCPPC's trail network to its pedestrian networks.

Improving Access to Parks

Improve access for people of color. The model suggests that disparities in park access exist for people of color in Downtown Silver Spring. When considering where to add parks in Downtown Silver Spring, M-NCPPC should prioritize areas with both low levels of supply and high concentrations of people of color.

Enhance pedestrian routes to parks. The model identified several residential areas near to parks with low supply levels. Initially confused by the results of the model, we eventually concluded that these areas often lacked direct pedestrian access to nearby parks. To ensure that residents can conveniently access these spaces, M-NCPPC should partner with local authorities (particularly the Montgomery County Department of Transportation) to improve pedestrian connections for locations close to parks with low supply scores.

Amenitize parks to attract the local workforce. Our results indicated that much of the demand for Downtown Silver Spring's recreational spaces is driven by the large nearby workforce. To entice local workers to Downtown Silver Spring's parks, local stakeholders should consider adding amenities or hosting events that appeal to this population. For example, the local business improvement district could consider starting a program akin to Off the Grid, a San Francisco-based initiative that hosts food trucks at parks during workday lunch hours.¹²

Opportunities for Future Research

Quantify racialized access gaps. While the results anecdotally illustrated low levels of supply in areas with high concentrations of minority residents, further research is necessary to quantify

¹² Off the Grid. Retrieved from www.offthegrid.com

the gap between supply and demand. ArcGIS' spatial regression tool could be used to correlate the relationship between supply gap scores and block group-level concentrations of minority populations.

Add qualitative data variables to the model. As it stands, demand for parks is exclusively calculated through a series of quantitative variables. That being said, our literature review suggests that access to parks on paper does not necessarily mean that certain populations feel comfortable using local amenities. Furthermore, we cannot assume that a park's amenities appeal to nearby populations. To better understand if and how local residents (particularly marginalized populations) access parks, M-NCPPC should consider interviewing community members and quantifying results into variables that could be added to the model.