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Site Proposal for New Public Libraries in Los Angeles County

1. Introduction

Public libraries play crucial roles in their communities. They provide diverse programs for children and adults, free database access, free space for community activities, and cultural events. According to a survey conducted by the Pew Research Center (2016), almost two-thirds of adult Americans responded that their local libraries have positive effects on their communities. Specifically, Americans value access to books and media; having a safe, quiet place to read, study, or spend time; and having librarians to help them search for information in their libraries. Many Americans, regardless of age and gender, use the library. According to the Pew Research Center (2016), 48 percent of adults have visited public libraries in the past 12 months and 70 percent of children have visited public libraries or bookmobile in the past 12 months. Furthermore, public libraries fundamentally play an important role, especially for children, elderly, disabled, users with limited Internet access at home, and unemployed people.

In terms of accessibility, libraries that are located near residential areas offer easy and comfortable access, allowing local residents to visit the library more frequently. Kinikin (2004) and Park (2011) argued that distance is a crucial factor in terms of accessibility to public libraries. However, although many libraries are available in Los Angeles County, many citizens have difficulty accessing public libraries due to long travel distance to the nearest library. According to

Donnelly (2017), 25% of residents in the West Metropolitan areas of the United States are located more than 2 miles from the nearest public libraries.

In this regard, this project identifies areas where residents have difficulty accessing public libraries in Los Angeles County due to their absence. Furthermore, this project explores different factors that need to be considered when finding a new site for new public library and accordingly suggests appropriate sites for new public libraries in Los Angeles County.

2. Factors Determining the Site for New Public Library and Data Sources

When deciding on a site for a new public library, several factors should be considered. In this project, four factors that determine the site for new public library are studied: (i) physical accessibility, (ii) population density, (iii) percent of household without vehicles, and (iv) percent of population in poverty.

2.1. Physical Accessibility

Tobler (1970) argued that distance is one of the crucial factors associated with access to libraries. This project proposes that if the distance to the library is greater than 1.7 miles, public library users' access to library is limited. According to Donnelly (2015), mean distance to the nearest public library in Metropolitan areas of the United States is 1.7 miles. It would take a person approximately 66 minutes to walk to and from to the public library, considering that average walking speed is about 3.1 miles per hour (Aspelin, 2005). Hence, distance of 1.7 miles to library can be considered the maximum distance at which locals can use the library conveniently without using the car ((Yang, Y., & Diez-Roux, A. V., 2012). To analyze physical accessibility of public libraries, this project used shapefile of cities of LA County and Excel file of addresses of public libraries in LA county, which was retrieved from California Library Website, as shown in Table 1.

Table 1. Data Sources for Physical Accessibility

Type	Data	Source
Excel File	Addresses of public libraries in LA County	California Library Website (www.californialibrarystatistics.com)
shapefile	Cities of LA County	www.barrywaite.org/gis.htm

2.2. Population Density

Many Americans visit public library regardless of age and gender. According to the United States Census Bureau, population density typically indicates the number of people per square mile of land area. Fundamentally, high population density within 1.7 miles of the new public library likely indicates high demand for public library. In this regard, other factors being equal, a site for new public library should be located in a region with high population density. To analyze population density, this project used shapefile of population density, which was exported from SimplyAnalytics, as shown in Table 2.

Table 2. Data Sources for Population Density

Type	Data	Source
shapefile	Population density	SimplyAnalytics (app.simplyanalytics.com.libproxy1.usc.edu/login.html)

2.3. Percent of Household without Vehicles

Residents who own cars may perceive the public library that is located far from their houses as accessible for them (Penchansky and Thomas, 1981). On the other hand, local residents without vehicles are substantially limited in their access to the public library. Therefore, other factors being equal, a site for new public library should be located in a region with a high percent of household without vehicles. To analyze the percent of household without vehicles, shapefile of percent of household without vehicles was exported from SimplyAnalytics, as shown in Table 3.

Table 3. Data Sources for Percent of Household without Vehicles

Type	Data	Source
shapefile	Percent of Household without Vehicles	SimplyAnalytics (app.simplyanalytics.com.libproxy1.usc.edu/login.html)

2.4. Percent of Population in Poverty

Public libraries play crucial roles in reducing the socio-economic gap in education and providing community activities in areas with high poverty rates. Specifically, Krashen and Shin (2004) argued that public libraries help improve reading abilities of children living in poverty. Jue and colleagues (1999) claimed that public libraries provide free database access for individuals in poverty. Specifically, public libraries provide free books, free internet access, and free spaces for study and community activities so that individuals in poverty can overcome barriers to information resources. Other factors being equal, a site for new public library should be located in areas with high percent of population in poverty. To analyze the percent of population in poverty, this project used shapefile of percent of population in poverty, which was exported from SimplyAnalytics, as shown in Table 4.

Table 4. Data Sources for Percent of Population in Poverty

Type	Data	Source
shapefile	Percent of Population in Poverty	SimplyAnalytics (app.simplyanalytics.com.libproxy1.usc.edu/login.html)

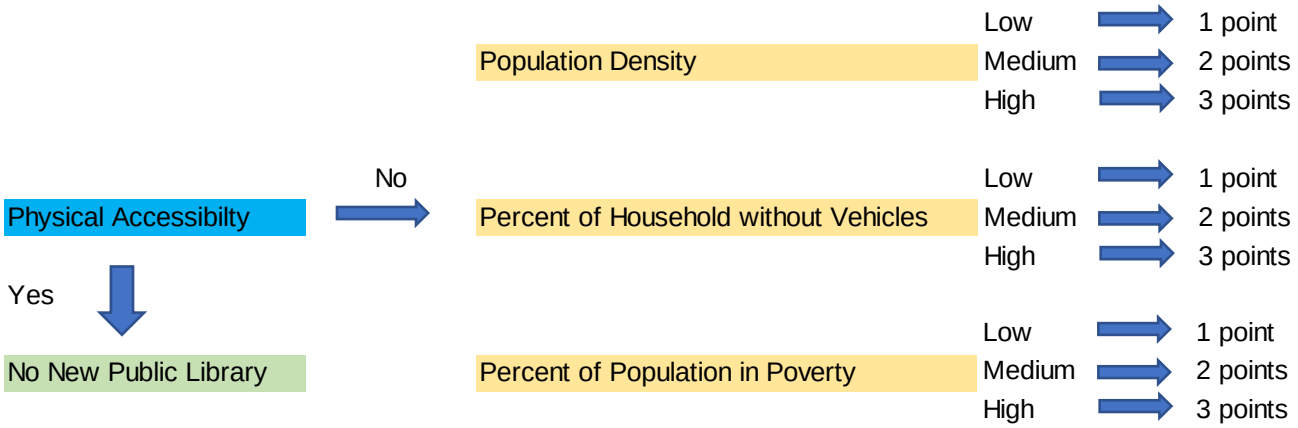
3. Geographical Analysis Method

Fundamentally, GIS is an appropriate tool for this project because it can provide diverse and accurate analysis on geographical accessibility to public libraries, as described below.

First, this project selects regions with poor access to the nearest public libraries in Los Angeles County, that is, their distance from a library is greater than 1.7 miles.

Second, this project set priorities for building new public libraries in regions with poor physical access. The selected regions were prioritized based on population density, percent of household without vehicles, and percent of population in poverty.

Figure 1. Geographical Analysis Method



The study identifies population density in regions selected in the first stage. To compare population density in these areas, three points are assigned to regions with relatively high population density, two points to areas with medium population density, and one point to areas with low population density.

The percent of household without vehicles is used to determine accessibility of libraries to local residents. To compare the percent of household without vehicles, three points are assigned to regions with relatively high percent of household without vehicles, two points to regions with medium percent of household without vehicles, and one point to regions with low percent of household without vehicles.

Considering socioeconomic effects of public library on the poor, this project measures the percent of population in poverty for each region. To compare the percent of population in poverty, three points are assigned to regions with relatively high percent of population in poverty, two points to regions with medium percent of population in poverty, and one point to regions with low percent of population in poverty.

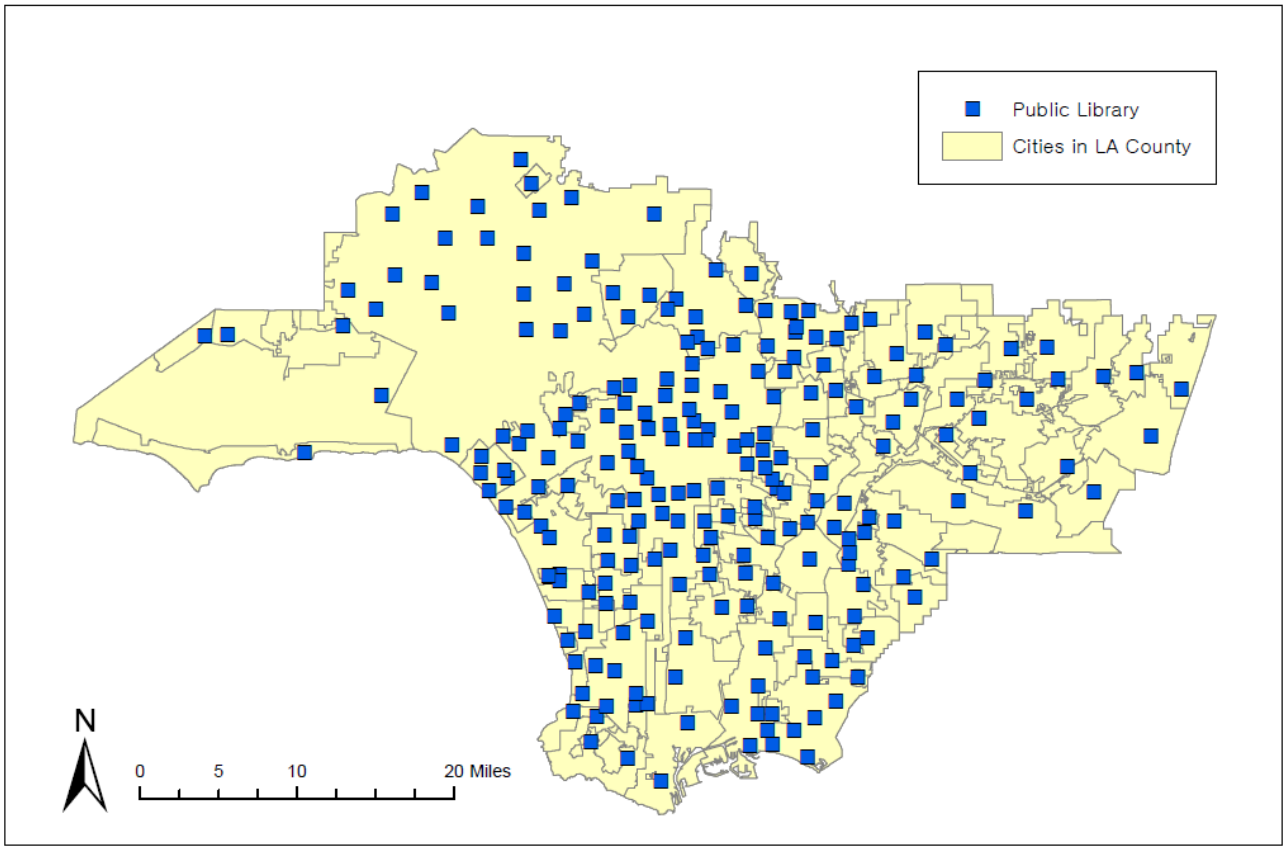
Finally, the regions in need of a new library are prioritized by summing points of three determining factors. A region with the highest total points have the highest priority of new public library.

4. Results of Analysis

4.1. The First Stage

255 public libraries including their branches are available in Los Angeles County. This project focused on public libraries including their branches located in the southern part of Los Angeles County. Figure 2 shows public libraries that are included in this project. As shown in the map, public libraries are clustered around the Central LA, the South LA, the Verdugos, the South bay, and the Westside of Los Angeles County.

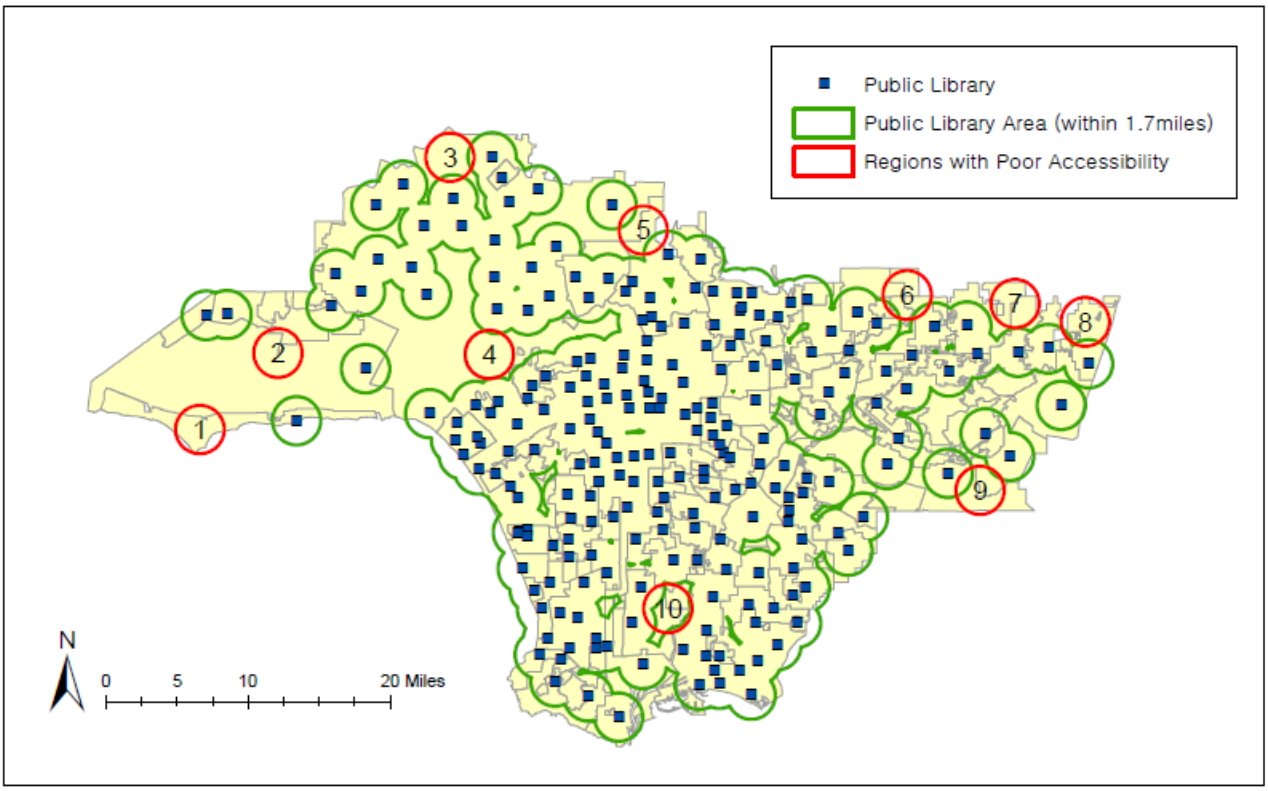
Figure 2. Public libraries in Los Angeles County



ArcMap Processing
• Geocoding public libraries in LA County using Esri's address locator

Figure 3 shows analysis on physical accessibility to public libraries. There are 10 regions, which have poor accessibility to public libraries as followings: Western part of Malibu (region 1), Sothern part of Calabasas (region 2), Granada Hills of North (region 3), Bel Air (region 4), Northern part of Glendale (region 5), Duarte (region 6), Eastern part of Glendora (region 7), Claremont (region 8), Southern part of Diamond Bar (region 9), and Eastern part of Carson (region 10).

Figure 3. Physical Accessibility to Public libraries and Regions with Poor Accessibility

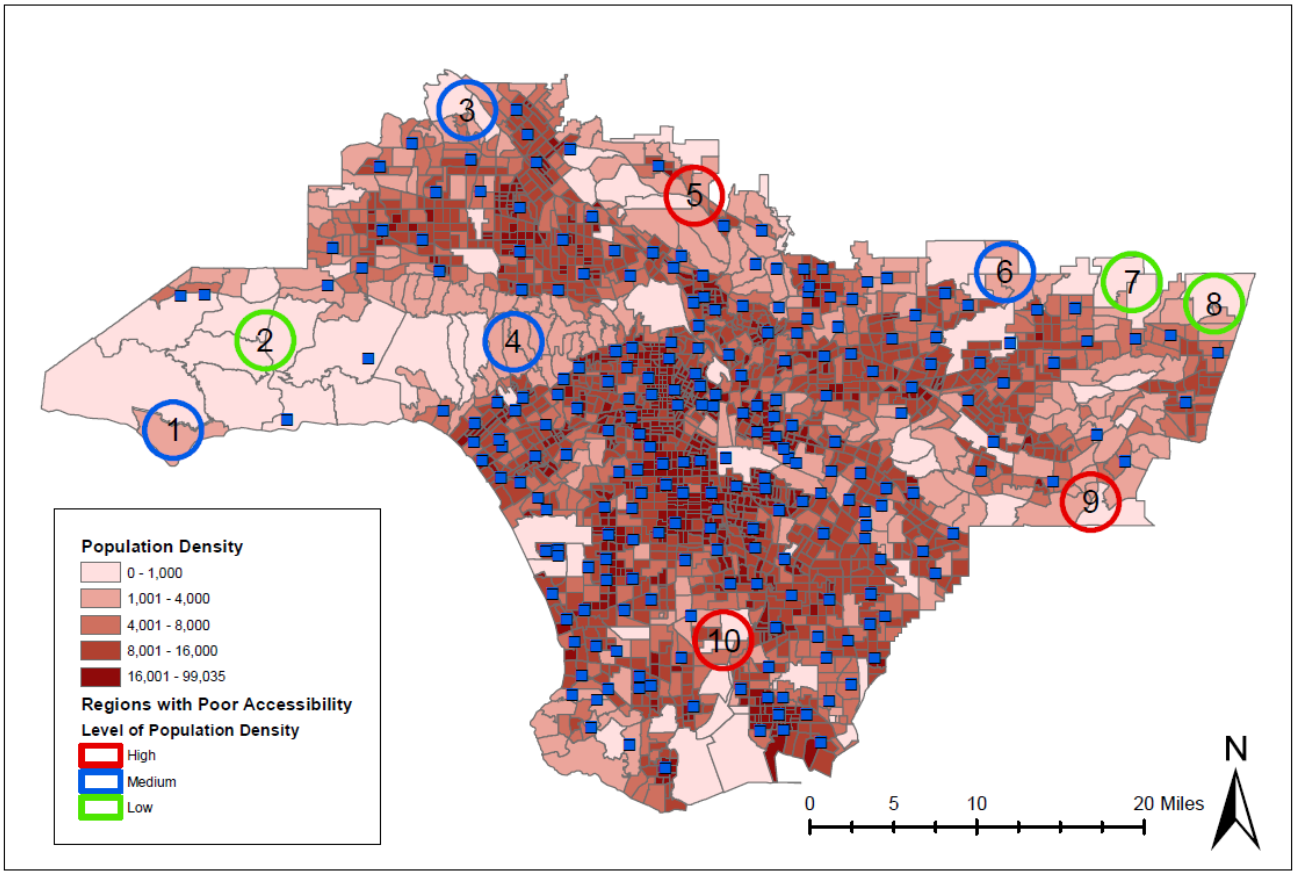


ArcMap Processing
• Buffering the public library points with 1.7 mile's distance • Creating point features for 10 regions that are not included in the buffer area of public libraries • Buffering those 10 points with 1.7 mile's distance • Opening attributes table of shapefile of regions with poor accessibility and creating a field for number of regions • Entering number of each region in attributes window • Turning on label to show number of regions in the map

4.2. The Second Stage

First, this paper assesses the level of population density in these regions selected in the first stage. As shown in Figure 4, regions 5, 9, and 10 have relatively high population density whereas regions 2, 7, and 8 have relatively low population density. The other regions (regions 1, 3, 4, and 6) have relatively medium population density.

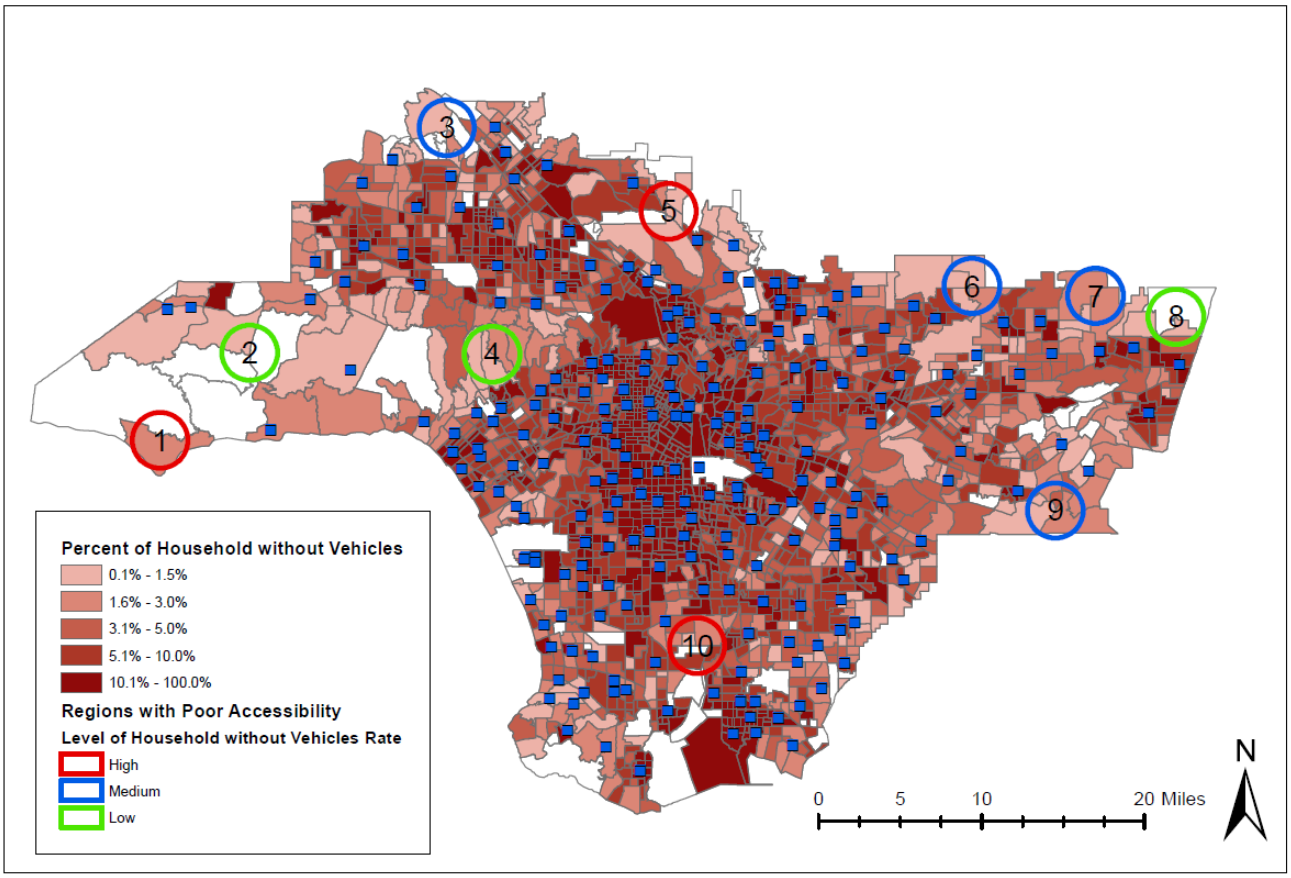
Figure 4. Population Density in Regions with Poor Accessibility



ArcMap Processing
• Adding data of shapefile of population density and ruling out northern part of LA County • Calculating weighted average of population density in the 10 regions by selecting all census tracts within each region and weighting the area of each census tract • Opening attributes table of shapefile of regions with poor accessibility and creating a field for level of population density • Entering the weighted average of population density of each region in attributes window • Categorizing these 10 regions into high, medium, and low groups based on weighted average population density • Applying different outline color for each group

Second, as shown in Figure 5, analysis of the percent of household without vehicles indicates that regions 1, 5 and 10 have relatively high percent of household without vehicles whereas regions 2, 4 and 8 relatively have low percent of household without vehicles. The other regions (regions 3, 6, 7, and 9) have relatively medium percent of household without vehicles.

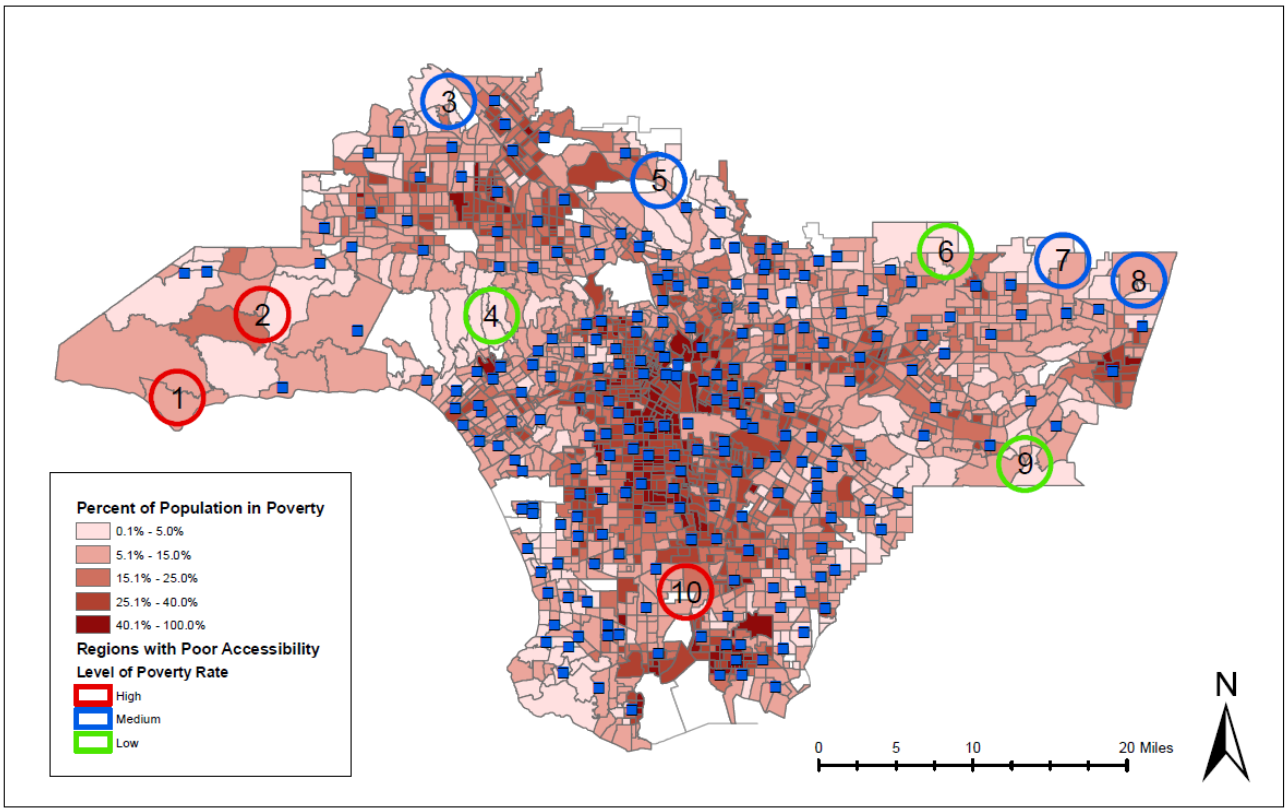
Figure 5. Percent of Household without Vehicles in Regions with Poor Accessibility



ArcMap Processing
• Adding data of shapefile of percent of household without vehicles and ruling out northern part of LA County • Calculating average percent of household without vehicles in the 10 regions by selecting all census tracts within each region • Opening attributes table of shapefile of regions with poor accessibility and creating a field for level of household without vehicles rate • Entering average percent of household without vehicles of each region in attributes window • Categorizing these 10 regions into high, medium, and low groups based on percent of household without vehicles • Applying different outline color for each group

Third, the analysis of percent of population in poverty indicates that regions 1, 2 and 10 have relatively high percent of population in poverty whereas regions 4, 6, and 9 have relatively low percent of population in poverty, as shown in Figure 6. The other regions (regions 3, 5, 7 and 8) have relatively medium percent of population in poverty.

Figure 6. Percent of Population in Poverty in Regions with Poor Accessibility



ArcMap Processing
• Adding data of shapefile of percent of population in poverty and ruling out northern part of LA County • Calculating average percent of population in poverty without vehicles in the 10 regions by selecting all census tracts within each region • Opening attributes table of shapefile of regions with poor accessibility and creating a field for level of poverty rate • Entering average percent of population in poverty of each region in attributes window • Categorizing these 10 regions into high, medium, and low groups based on percent of population in poverty • Applying different outline color for each group

5. Conclusion

As shown in Figure 7 and Table 5, the total scores for each region are calculated by summing up scores of the three determining factors. Fundamentally, the highest the total scores, the highest the priority of new library in Los Angeles County. Overall, eastern part of Carson receives 9 points, which is the highest score among 10 regions. Therefore, eastern part of Carson is the region with the greatest need to build a new public library in Los Angeles County, since eastern part of Carson has relatively high population density, high percent of household without vehicles, and high percent of population in poverty. Western part of Malibu and Northern part of Glendale are regions with the second highest total scores, indicating the second highest priority of new public library for the two regions. Specifically, western part of Malibu has relatively high percent of household without vehicles and high percent of population in poverty even though it has medium population density. Northern part of Glendale has high population density and high percent of household without vehicles, although it has medium percent of population in poverty.

Figure 7. Total Points of the 10 Regions with Poor Accessibility to Public Libraries

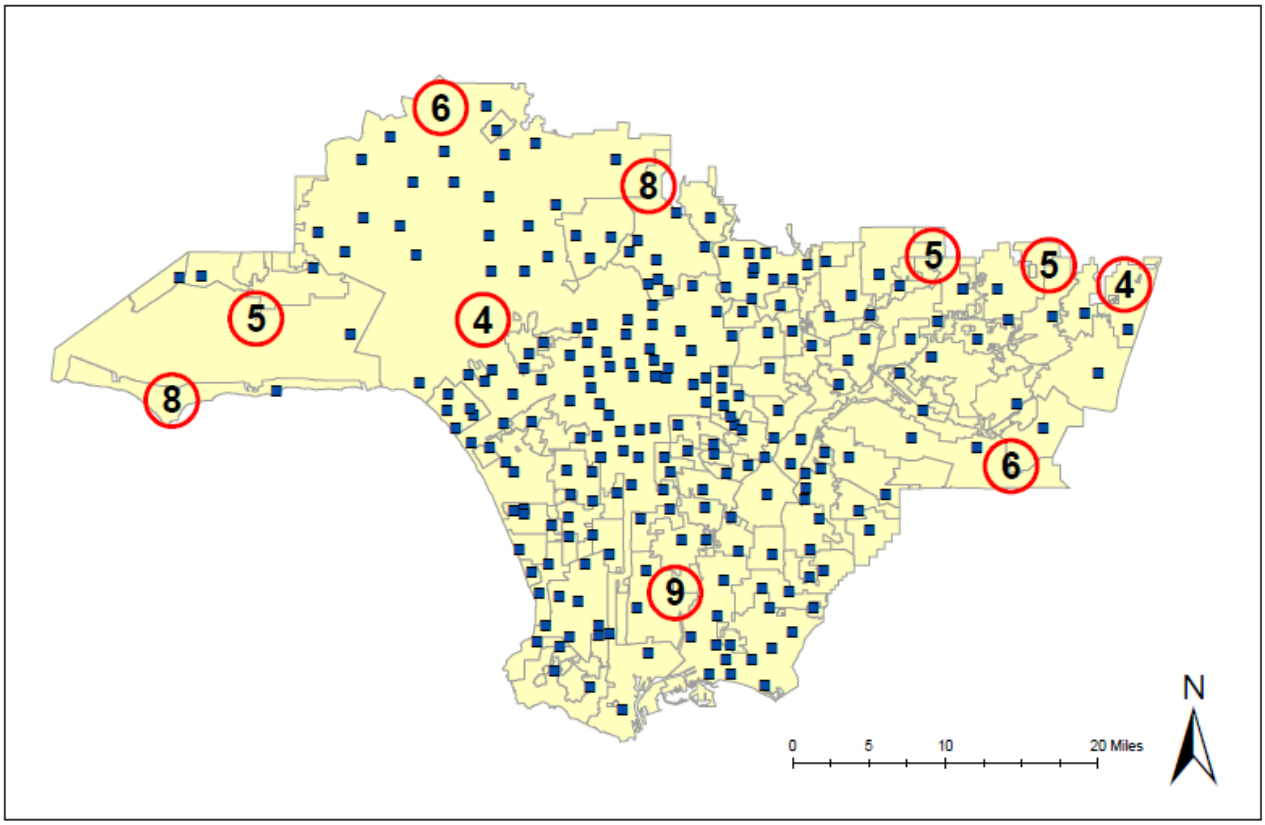


Table 5. Total Points of Each Region

Region	Population Density	Percent of Household without Vehicles	Percent of Population in Poverty	Total
1. Western part of Malibu	2	3	3	8
2. Sothern part of Calabasas	1	1	3	5
3. Granada Hills of North	2	2	2	6
4. Bel Air	2	1	1	4
5. Northern part of Glendale	3	3	2	8
6. Duarte	2	2	1	5
7. Eastern part of Glendora	1	2	2	5
8. Claremont	1	1	2	4
9. Southern part of Diamond Bar	3	2	1	6
10. Eastern part of Carson	3	3	3	9

On the other hand, Bel Air and Claremont obtain the lowest total scores of 4 points, indicating that these regions have the lowest priority of new public library in Los Angeles County.

In this regard, eastern part of Carson should be considered the first candidate of new public library in Los Angeles County, followed by western part of Malibu and northern part of Glendale. Building new public libraries for these regions could improve geographical accessibility of many citizens who have difficulty accessing public libraries. Furthermore, new public libraries could serve as center of education and community activities for these regions.

6. Limitation

First, when selecting regions with poor accessibility to the existing public libraries, this project considers1.7 miles in straight line from the existing public libraries to create buffering areas. However, travel distance to a public library is typically greater than the straight-line distance, considering curved roads. To measure library accessibility more accurately, it would be better to account for road networks (Park, 2011). Furthermore, the straight line does not specify the regions, which can be reached within a specific walk time or drive time. Determining the buffer areas based

on the driving time or walk time would provide a more accurate analysis of geographical accessibility (Park, 2011).

Second, as shown in Figure 5 and Figure 6, several census tracts do not have the data on the percent of household without vehicles or percent of population in poverty. Hollow color indicates those census tracts. Such lack of data affects scores assigned to each region. If this project were able to use the data for all census tracts, it would have been possible to assign scores more accurately.

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