Assessing Equitable Tree Canopy Coverage

A Resilient Communities Project–Metropolitan Council Guide

METROPOLITAN COUNCIL

Resilient Communities Project
University of Minnesota
Building community-university partnerships for sustainability

The project on which this report is based was completed in collaboration with the Metropolitan Council and City of Woodbury as part of a 2020–2021 Resilient Communities Project (RCP) partnership. RCP is a program at the University of Minnesota's Center for Urban and Regional Affairs (CURA) that connects University faculty and students with Minnesota communities to address strategic projects that advance local resilience, equity, and sustainability. Funding for this report was provided by the Metropolitan Council.

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Resilient Communities Project
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Building Community-University Partnerships for Resilience

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FOREWORD

This resource is adapted from a student project and report originally created for the City of Woodbury, Minnesota, as part of a year-long partnership with the University of Minnesota's Resilient Communities Project (RCP), with financial support and technical assistance from the Metropolitan Council. The goal of the project was to assess the City's existing tree canopy, in support of an urban tree canopy plan update.

The toolkit was developed by University of Minnesota Department of Forest Resources students Daniel Gjertson, Jamie Kennedy, Megan Murphy, and Derell Scott in spring of 2021, in partial fulfillment of the requirements for the course "Urban Forest Management: Managing Greenspaces for People." The project was completed under the supervision of course instructor Dr. Eric North, in collaboration with Woodbury's Environmental Resources Specialist Kristin Seaman.

The original student project report is archived in the University of Minnesota's Digital Conservancy at https://conservancy.umn.edu/handle/11299/220179.

INTRODUCTION

The urban tree canopy provides numerous ecosystem services, as well as economic and health benefits for humans (Raciti et al., 2006). According to Coder (2011), urban forests decrease the volume of pollutants and nutrients entering water systems through stormwater runoff, reduce air pollution, reduce the local intensity of the urban heat island effect, perform carbon sequestration, enhance property values, provide habitat for local wildlife, and increase the overall beauty, desirability, and livability of a community.

An important element of a sustainable urban forest management approach is establishing a goal for canopy cover, which creates an agreed-upon target that can inform budgeting and planning (Urban Forestry Commission, n.d.). A canopy cover goal should consider where in the community expansion of the canopy can reasonably occur, the budget available for such investments (including both tree installation and long-term maintenance for trees planted on public land), and the anticipated time frame for expanding the canopy (Wisconsin DNR, n.d.; Raciti et al., 2006).

Common tree canopy cover goals for suburban communities are between 20 and 40% overall, but there may be different canopy goals for each land-use type in the community—for example, greater coverage in residential areas, and less coverage in commercial or industrial areas (Leahy, 2017; Rogers & Handley, 2017, City of Fridley, 2016).

For a city's canopy to be sustainable, action must be taken both to preserve (and, when mature trees die, replace) existing canopy cover and to identify areas for expansion of canopy cover (Mincey et al., 2013). Sustainability also includes ensuring an equitable distribution of urban forest resources with respect to characteristics among the population such as race and wealth, a primary goal of the environmental justice community (Berland et al., 2015).

This resource describes a replicable method used in the City of Woodbury to assess current tree canopy cover, as well as identify potential areas for additional investment to increase tree canopy cover in a way that is both equitable and sustainable.

METHODS

Site Description

The City of Woodbury is located in Washington County, in the eastern part of the Minneapolis–Saint Paul metropolitan area. Development patterns in Woodbury encompass nearly the entire range of suburban density, from quasi-grids of small lots and townhomes in the older, western parts of the city to greenfield conversion of former agricultural land into single-family estate lots on the southern and western sides of the city. Lakes, wetlands, and greenways are spread throughout the city, providing considerable preserved open space and natural areas. About 12.5% of the land area in Woodbury is dedicated park space.

Research Methods

Current canopy cover and green space conditions were assessed using three spatial analysis methods.

Calculating Current and Potential Future Tree Canopy Coverage. Land cover maps were evaluated to determine the proportion of forested areas, potential future forested areas, and developed areas that cannot support additional canopy cover. These land cover classifications were disaggregated by Woodbury's land use classes to determine which land areas contained the most potential for future tree canopy expansion.

Land cover maps, derived from 2015 NAIP imagery at one-meter resolution, were obtained from the Minnesota Geospatial Commons (Knight et al. 2017) and reclassified according to the potential of the land cover to host tree canopy. Deciduous forest, coniferous forest, and forested/shrub wetland were classified as existing tree canopy. Grass/shrub, agriculture, bare soil, and emergent wetland were classified as potential tree canopy—that is, areas that are not currently forested, but could feasibly host tree canopy in the future. Buildings, roads and paved surfaces, and extraction (mining) were classified as tree-free areas because the current land uses exclude the possibility of establishing tree cover for the immediate future. Rivers and lakes were excluded from reclassification, as they are not available for development or canopy expansion.

The amount of each reclassified land cover (current canopy, potential canopy, no possible canopy) was calculated city-wide and within aggregated land use classes. Land use layers were obtained from the Minnesota Geospatial Commons and aggregated into single-family housing, multifamily housing (dense residential), commercial, industrial, institutional, and parks and open space land uses.

Assessing Equitable Distribution of Tree Canopy Resources. The geographic distribution of the current tree canopy was compared with key demographic characteristics of those geographic areas to determine the degree to which tree canopy resources were equitably distributed across the city. Current tree canopy coverage in Woodbury was disaggregated by U.S. Census tract to analyze the relationship between the amount of existing tree canopy coverage in a given Census tract and the demographics of each tract.

The ArcGIS land-cover–derived tree canopy layer was disaggregated by Woodbury's 11 U.S. Census tracts, as was an additional layer showing trees identified by the City's latest public tree inventory. For purposes of this analysis, trees under management of City departments were selected from the inventory and identified as public trees.

Measures of total public trees and public trees per capita were calculated city-wide and within each Census tract. The land-cover-derived canopy layer was used to analyze all tree canopy coverage in Woodbury, as a measure of total canopy resources available to residents in each tract. The city tree inventory data were used to analyze canopy coverage from public trees within the city, as a measure of canopy resources located on public land.

Disaggregation by Census tract was also used to analyze existing canopy across different demographic dimensions of Woodbury's population to address the question of equitable distribution. Three demographic metrics for these tracts were selected from American Community Survey (ACS) data: percentage of residents who identify as people of color (POC), median household income, and homeownership rate.

A regression analysis of the degree of access to green space in each Census tract and the three equity metrics was conducted to analyze correlations between race, wealth, homeownership, and canopy cover. Using the coefficients and y-intercept of each graph, a linear regression equation was created to show the overall relationship between each variable.

Measuring Access to Parks and Green Spaces. Geographic accessibility to public parks and recreation areas was assessed by creating a half-mile walkshed around each park or nature preserve in Woodbury to identify how much of the city has access to public green space resources. According to the National Recreation and Park Association, a 0.5 mile service radius is a commonly used measure of access to parks and green spaces (Oh & Jeong, 2007).

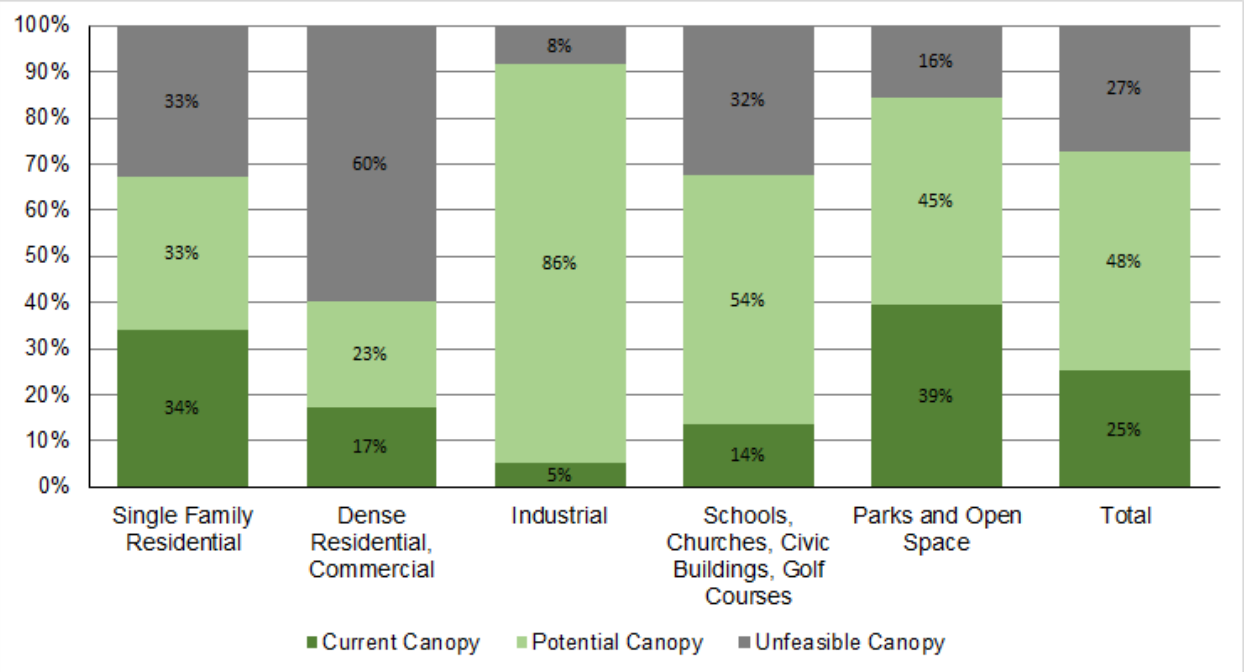
A GIS layer of public parks in Woodbury was obtained from the Minnesota Geospatial Commons. A buffer of 0.5 miles was applied to all of the public parks in the city.

SAMPLE FINDINGS: CITY OF WOODBURY

Analysis of Current and Potential Future Tree Canopy Coverage

As shown in Figure 1, tree canopy currently covers about 25% of the land in Woodbury. Another 27% of Woodbury's land is covered by existing buildings, pavement, or other impervious surface. This leaves about half the city's land as areas where canopy does not exist currently, but is theoretically appropriate for tree habitat. Public land (a combination of civic buildings, parks, and open space) has approximately 30% canopy coverage.

Figure 1: Land uses in Woodbury classified by potential for tree canopy. *Note: Land use data acquired 2016. Land cover data acquired 2015. Source: MN Geospatial Commons.*



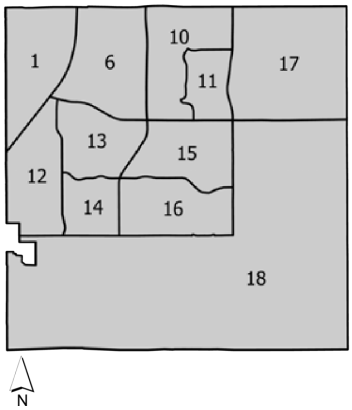
The greatest potential for future canopy development exists on public land or quasi-public open space. Industrial land use constitutes a very small proportion of the city's land area, so despite its proportionally large opportunity for potential canopy area, it is not a good candidate for targeting future canopy expansion.

Residential and commercial land uses appear to be nearing their full potential for tree canopy coverage. However, as former agricultural land is developed into housing and commercial space, the potential for canopy expansion in those areas will likely increase.

Analyzing Equitable Distribution of Tree Canopy Resources

There are currently 11 Census tracts in Woodbury. Nearly one-quarter of residents live in the largest, tract 18 (Table 1), which includes a sizeable area in the southwest part of the city. This large tract, along with its neighbor, tract 16, are areas of concentrated affluence (Figure 2), meaning the median income is at least four times the national poverty line. Tracts 17 and 18, on the eastern edge of the city, are the most recently developed areas of Woodbury, and contain the lowest percentage of tree canopy. The tracts with the highest canopy cover are 13, 11, 6, and 1. Three of these are located in the northwest part of the city, which has the longest history of development.

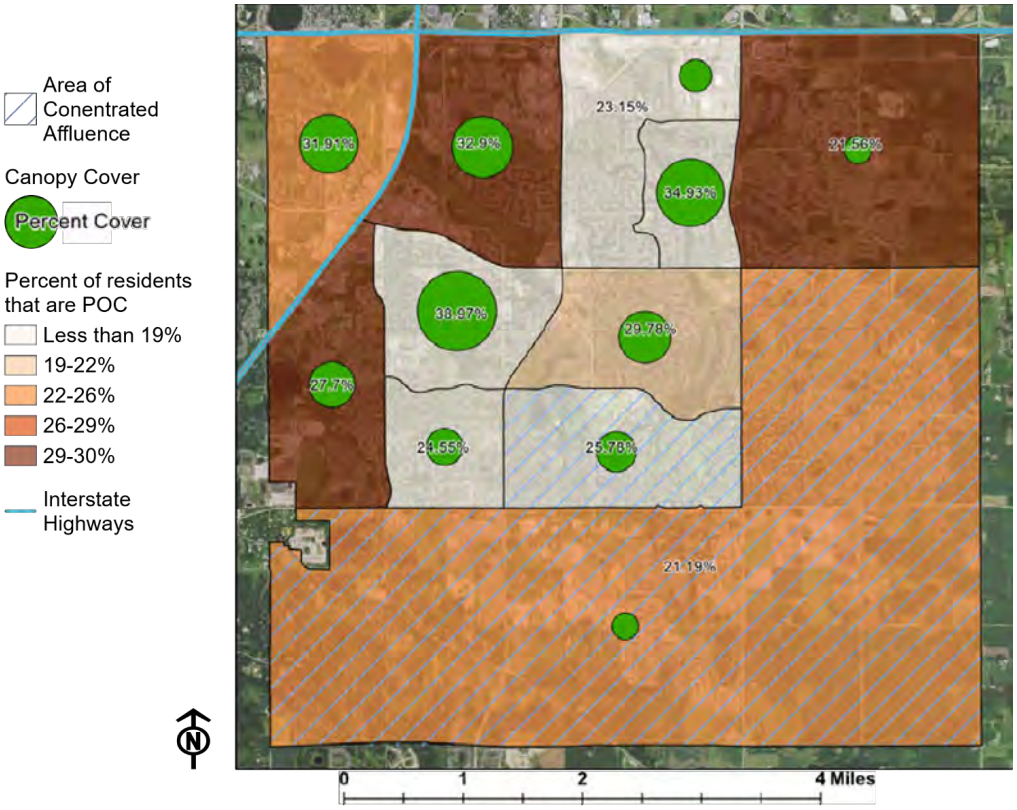
Table 1: Race, Median Income, and Canopy Cover and City-Managed Trees per capita in Woodbury, by U.S. Census Tract. *Census tracts are displayed from greatest to least percentage of tree canopy cover. Green cells indicate the top three tracts with respect to factors typically associated with greater canopy cover (i.e., tracts with the highest median incomes are green). Orange cells indicate the bottom three tracts with respect to each of those factors (i.e., tracts with the lowest home ownership rate are orange). Source: American Community Survey; Metropolitan Council.*



Tract ID	Percent of Non-White Residents	Median Household Income	Percent Homeowners	Percent Canopy Cover	Public Trees Per Capita
13	15%	$91,523	90%	39%	0.44
11	17%	$134,786	96%	35%	0.31
6	31%	$96,014	67%	33%	0.07
1	26%	$74,228	57%	32%	0.52
15	20%	$109,203	79%	30%	0.24
12	31%	$73,477	72%	28%	0.18
16	18%	$159,077	96%	26%	0.17
14	15%	$127,930	99%	25%	0.20
10	16%	$106,406	81%	23%	0.11
17	33%	$105,698	84%	22%	0.11
18	26%	$134,435	82%	21%	0.38

Generally, one might expect to find higher measures of canopy resources in areas that have a lower proportion of people of color, higher household incomes, and higher homeownership rates (Riley and Gardener 2020). In Woodbury, regression analysis of the three social equity factors (percentage residents of color, median household income, and homeownership rate) against the two measures of tree canopy indicated no statistically significant patterns across the city.

Figure 2: Canopy Cover and Concentration of People of Color in Woodbury, by Census Tract. *Tracts that are considered areas of concentrated affluence (ACA) are also identified.*



However, examining the tracts independently, there are some signs of inequities. For example, tract 6, located in the older part of town, has the second-highest proportion of residents or color, the lowest homeownership rate, the fourth-lowest median income, and the lowest public-tree per capita rate (Tract 6 also has one of the highest total canopy cover percentages, suggesting that public tree coverage lags far behind private tree coverage). Tract 11 has the second-highest income and home ownership rate and is in the top four tracts for both measures of canopy resources. Tract 17, one of the most recently developed, has the third-highest proportion of people of color, and is in the bottom three tracts for both measures of canopy resources. There are also tracts that show equitable distribution of canopy resources: tract 1 has the second

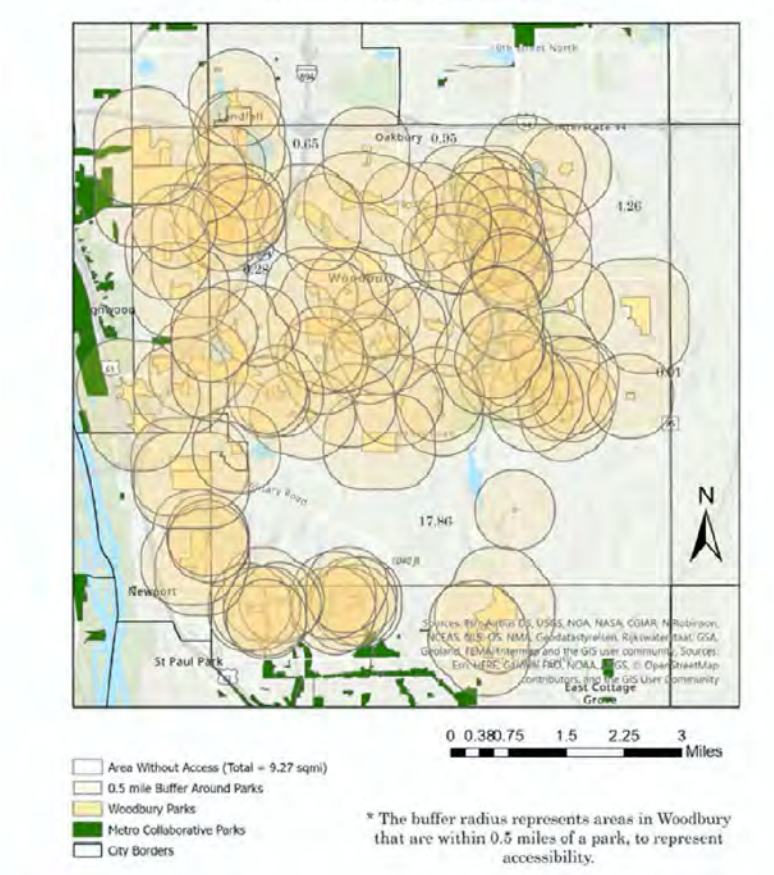
lowest income and lowest home ownership rate, but has the highest public trees per capita rate, and the fourth highest total canopy percentage.

Viewing the Census tract data in map form shows the pattern of gradually increasing tree canopy percentages from northwest to southeast across the city. A notable exception to this pattern occurs in two of the least racially diverse tracts, which happen to have the highest percentages of tree canopy coverage in Woodbury (Figure 2).

Analyzing Access to Parks and Green Spaces

The 0.5 mile buffer map (Figure 3) shows that 9.27 square miles of Woodbury are not within 0.5 miles of any city-owned parks. The city is 35.72 square miles, meaning that almost 26% of Woodbury has limited access to a park. Primarily this limited park access exists in the section of the city that is currently under development. Accessibility is further limited in the areas in the upper left hand corner of the map that are not within 0.5 miles of a park and have a major interstate running through them.

Figure 3: Parks in Woodbury with a 0.5-mile Buffer Applied



WORKS CITED

Berland, A., Schwarz, K., Herrmann, D. L., & Hopton, M. E. (2015). How environmental justice patterns are shaped by place: Terrain and tree canopy in Cincinnati, Ohio, USA. *Citiesand the Environment (CATE)*, *8*(1), 1. https://digitalcommons.lmu.edu/cate/vol8/iss1/1

City of Fridley. (2016). City of Fridley urban forestry study. Retrieved from: https://www.ci.fridley.mn.us/DocumentCenter/View/2427/Urban-Forestry-Study- 8_8_16?bidId=

Coder, K. D. (2011). Identified benefits of community trees and forests. Warnell School of Forestry and Natural Resources. University of Georgia.

Knight, J. F.; Rampi, L. P.; Host, T. K. (2017). 2015 Twin Cities Metropolitan Area UrbanTree Canopy Assessment. Retrieved from the Data Repository for the University of Minnesota, http://doi.org/10.13020/D6C016.

Leahy, I. (2017). Why we no longer recommend a 40 percent urban tree canopy goal. Retrieved from: https://www.americanforests.org/blog/no-longer-recommend-40-percent-urban- tree-canopy-goal/

Mincey, S. K., Schmitt-Harsh, M., & Thurau, R. (2013). Zoning, land use, and urban tree canopy cover: The importance of scale. *Urban Forestry & Urban Greening*, *12*(2), 191-199. https://doi.org/10.1016/j.ufug.2012.12.005

Oh, K., Jeong, S. (2007). Assessing the spatial distribution of urban parks using GIS.*Landscape and Urban Planning, 82*(1-2), 25-32. https://doi.org/10.1016/j.landurbplan.2007.01.014

Raciti, S., M.F. Galvin, J.M. Grove, J.P.M. O'Neil-Dunne, A. Todd, & S. Clagett. (2006). *Urban tree canopy goal setting: A guide for Chesapeake Bay communities.* USDA Forest Service. https://www.chesapeakebay.net/documents/UTC_Guide_Final.pdf

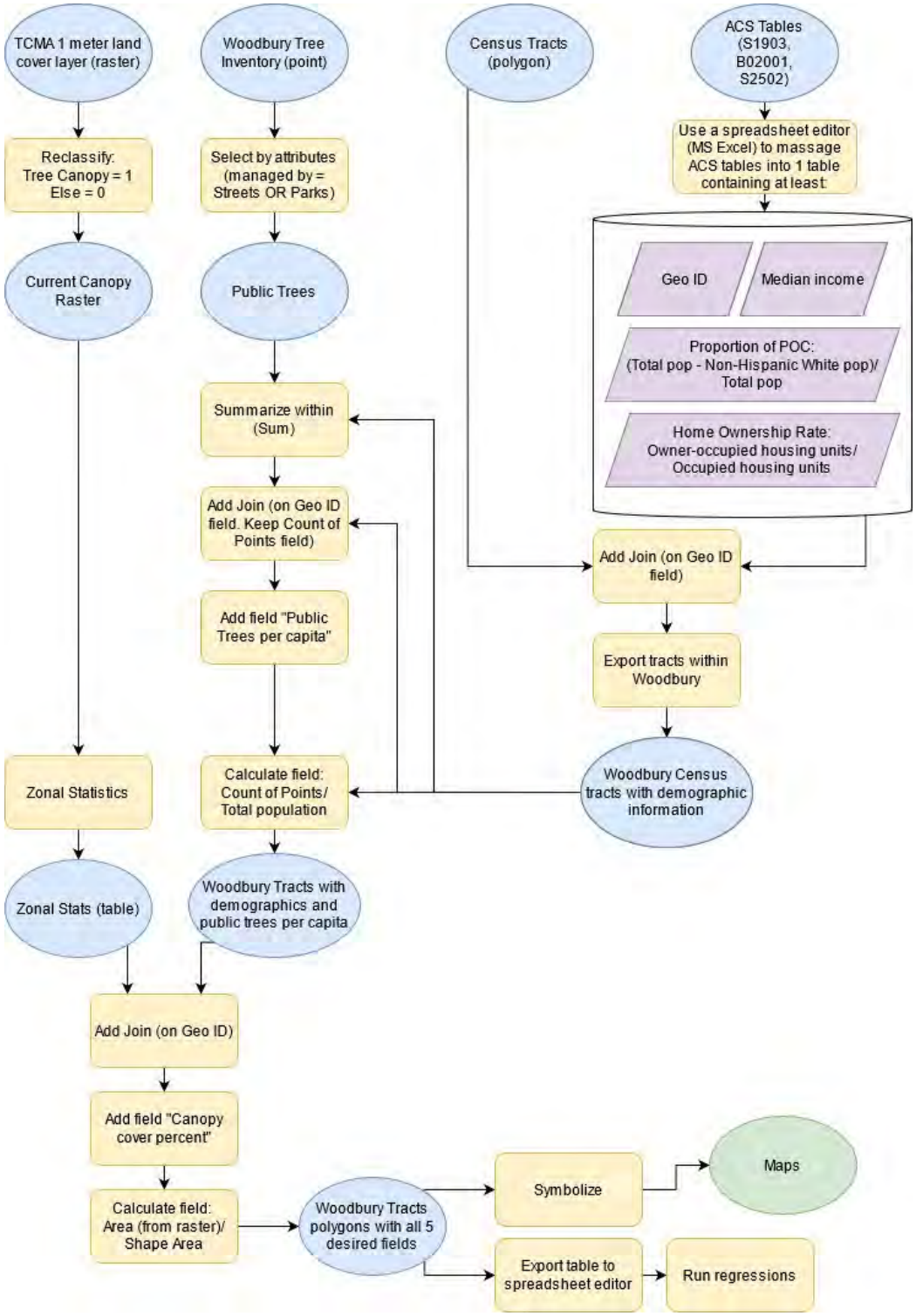
Riley, C. B., & Gardiner, M. M. (2020). Examining the distributional equity of urban tree canopy cover and ecosystem services across United States cities. *PLoS ONE*, *15*(2): e0228499. https://doi.org/10.1371/journal.pone.0230398

Rogers, K., Handley, P. (2017). Plymouth policy area: Tree canopy cover assessment. Retrieved from: https://www.plymouth.gov.uk/sites/default/files/PlymouthPolicyAreaTreeCanopyCoverAssessment.pdf

Urban Forestry Commission. (n.d.). Urban forest management plan overview. City of Seattle. https://www.seattle.gov/Documents/Departments/UrbanForestryCommission/2010/2010docs/OverviewCanopyCover.pdf

Wisconsin DNR. (n.d.). Tree canopy goals. Retrieved from: https://dnr.wisconsin.gov/topic/urbanforests/ufia/canopygoals

APPENDIX: WORKFLOW FOR TREE CANOPY EQUITY ANALYSIS



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