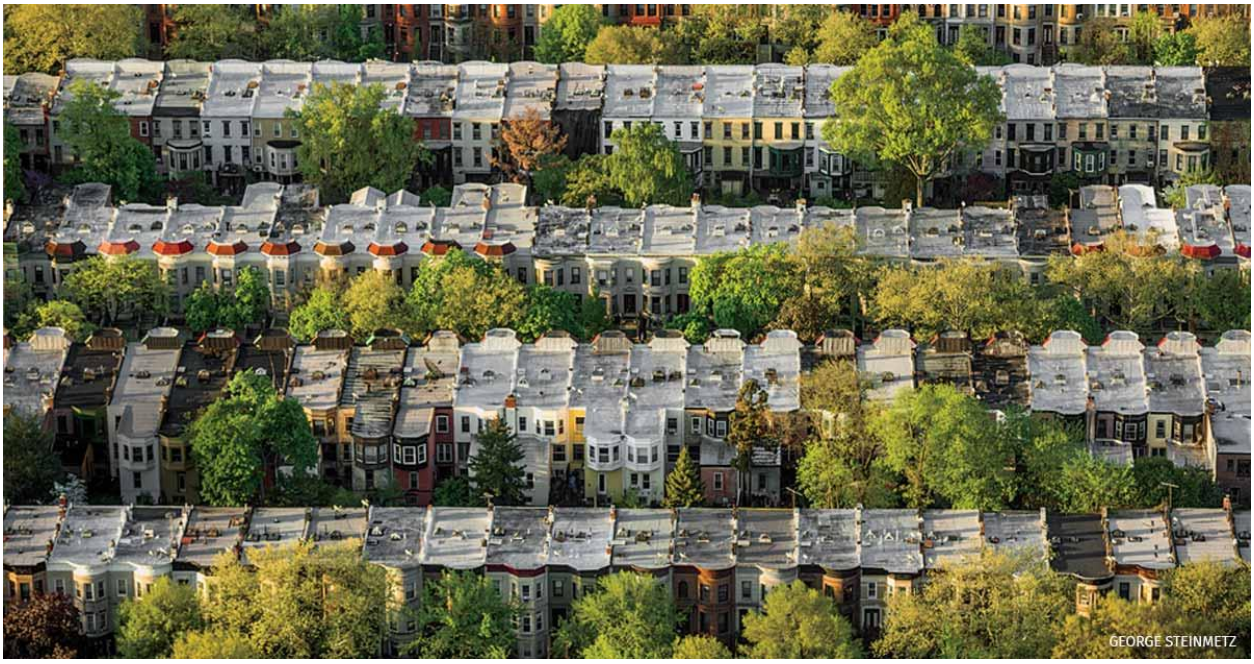
# Analyzing Urban Forestry Practices and Management Plans across Cities in the Western US with Plan-It Geo

Using Canopy Surveys and GIS to Improve Urban Forest Management Practices




**Proposal Authors**
Lizzy Schattle | 2021 MESM Candidate | (214) 693-5499 | schattle@ucsb.edu
AJ Zekanoski | 2021 MESM Candidate | (408) 710-6433 | azekanoski@ucsb.edu
**Proposal Collaborators**
Rachel Conway | 2021 MESM Candidate | (818) 667-5756 | rconway@ucsb.edu
Jon Hart | 2021 MESM Candidate | (925) 519-6782 | jonathanhart@ucsb.edu

**Client**
Ian Hanou | CEO and Founder of Plan-It Geo | ianhanou@planitgeo.com | 303.503.4846
Maegan Blansett | GIS and Natural Resources Specialist at Plan-It Geo | maeganblansett@planitgeo.com

## Objectives

The primary goal of this project is to assist the client, Plan-It Geo, evaluate their previous canopy assessments and local urban forestry management plans for effectiveness. Specific objectives include:

1. Review current urban forest management plans in order to:
    - Determine how equitably trees are distributed across the urban landscape.
    - Determine the resilience of management plans to future conditions regarding climate change, water availability, population growth, and economic uncertainty.
    - Determine how urban forestry programs and municipal sustainability and climate action plans are incorporating greenhouse gas reduction goals in California.
2. Provide recommendations for the client to help cities looking to improve urban forest management plans to account for equity and future conditions.

## Significance

In the United States, overall trends in land-use are shifting away from forested areas in favor of urbanized or agricultural spaces. A 2018 U.S. Forest Service study projects that urban land in the lower 48 states will more than double between 2010 and 2060[1]. Urbanized areas tend to be much warmer due to urban heat island effects and experience increased rates of pollution. Urban forestry is a discipline that aims to attenuate some of the negative impacts that occur with increased urbanization by establishing more green spaces within cities. The increasing rate of land conversion from forests to urban centers will result in a commensurate rise in the importance of urban forests in relation to environmental quality and human well-being.

Urban forestry has several marked benefits throughout various sectors, including environmental, social, and economic benefits. The environmental benefits of urban forestry go beyond the obvious increase in trees and green space, with increased carbon sequestration and improved air quality due to overall increases in rates of photosynthesis and capture of airborne particles. A single tree is capable of absorbing 120-240 pounds of particulate pollution such as dirt and soot annually[2]. Additionally, urban forestry results in increased wildlife habitats throughout urban spaces. In terms of social benefits of urban forestry, an increase in trees and green spaces can result in an overall bolstered sense of community and an increase in communal spaces. This increase in communal outdoor spaces can lead to an increase in physical activity, reduced stress levels, and has the potential to aid in the reduction of crime rates within a city. Evaluating the equal distribution of urban forests will enable cities to better devote limited resources to communities that need the social and environmental benefits and combat environmental injustice. Additionally, urban forestry has several economic benefits, thereby providing an incentive for local governments to support urban forestry projects within their cities. For example, planting more trees within a city results in increased natural shading, which in turn reduces the need for cooling of buildings in warmer months. Urban forestry also serves as a natural solution for several infrastructural aspects in urban areas including storm-water mitigation[3]. Full-grown trees can absorb hundreds of gallons of water daily, and in urban areas where water catchment or storm-water drainage is inefficient, urban forests can aid in absorbing excess water runoff during storms.

For all of the benefits that the urban forest provides residents, none are guaranteed in an altered climate future. Urban areas years from now will have to contend with a growing urban heat island effect, increased likelihood of severe drought, increased likelihood of dangerous storm events, and likely other as of yet unknown threats related to climate change[4,5,6]. Because the threats associated with climate change are best predicted at the regional scale, it's important that urban forest management plans incorporate resilience into their objectives. There is ample data on how climate change will affect areas of the country locally and cities must take it upon themselves to use that data to make the best decisions about not only what's best for the urban forest today, but what will last in perpetuity[7].

Plan-It Geo projects include helping cities update urban forestry management plans. Our research will focus on evaluating the equity of the spatial distribution and overall resilience of urban forests to climate change, which will benefit Plan-It Geo by providing more information to help improve their recommendations for urban forest management plans. This research will in turn benefit local community members by improving air quality and contributing to global trends in forestation.

## Background

Urban forestry encompasses street trees, residential trees, park trees and greenbelt vegetation. In some cities, trees are purposely planted and carefully managed by residents or the city, while in other cities, the trees are the unfortunate result of land-use changes, economics, and neglect[8]. Despite efforts of local groups and a national trend in better local forest management practices, overall there is an unequal distribution of urban forests across the United States. Plan-It Geo hopes to bring awareness to this problem in addition to guiding future forest management practices via informing local groups where urban forests would best serve their communities and residents. This can be achieved by using Plan-It Geo's TreePlotter™ software suite in conjunction with several other geographic mapping and spatial analysis software. In analyzing current trends and assessing potential locations of urban forests, Plan-It Geo also hopes to take into account various future scenarios associated with the varying levels of resilience and susceptibility in different cities throughout the United States.

Our project will look into cities that have worked with Plan-It Geo in the past that have tree canopy analyses and urban forest management plans already in place. We will look at tree canopy assessments, urban forest management plans, and climate data for each city and will compare said data across several metrics and among other cities with similar data collected.

Equitable urban forestry is a practice that is gaining in popularity and support throughout the United States with small non-profit organizations popping up in various cities. Therefore, a great deal of local work in individual cities is being completed, but more broad-scale and comparative work must be done to better assess national success in urban forestry and re-establishment of national canopy layers.

## Equity

Urban tree canopy cover has been shown to improve the wellbeing of urban populations in many ways, but it is clear that urban canopy cover is not equitably distributed. Low-income, underserved, communities of color often have fewer greenspaces, parks, and trees in general[9]. Chronic health conditions occur at higher rates within these impoverished neighborhoods and citizens frequently do not have sufficient access to proper health care. Due to the lack of shade and evaporative cooling from less canopy cover, these neighborhoods suffer from hotter temperatures which can exacerbate chronic conditions and increase demand for emergency medical services[10]. Studies have shown that planting trees in high-density population centers that have increased levels of air pollution would have the greatest overall impact on public health[11]. Our analysis of urban forestry practices will include how cities are addressing the inequity of tree distribution in the city and provide recommendations on how to improve equity in urban tree distribution.

## Available Data

Plan-It Geo has a range of forest canopy data available for cities across the western US. This includes the following datasets:

- Tree canopy assessments for cities across the United States using the TreePlotter™ software suite, GIS, LiDAR (Light Detecting and Ranging), and i-Tree studies
- Climate and remote sensing data through Climate Engine database
- Publicly available demographic data

- Urban forest management plans on what basis to plant and remove trees for several cities in WA, IA, CO, NJ, MO and MN
- Tools for comparison and analysis of management plans across cities, including the Municipal Tree Care and Management census and Community Assessment & Goal-Setting Tool, and using San Jose State University's Comparative Study of Urban Forest Management Programs for Three Major Cities in Santa Clara County as a reference
- The Adaption Workbook will allow for the auditing of urban forest management plans for future resilience to climate change
- The CUFR Tree Carbon Calculator can be used to assess how urban forestry programs are incorporating greenhouse gas reduction goals

## Possible Approaches

**Analysis of spatial distribution of urban forests.** This task will involve using ArcMap GIS software to overlay tree canopy analyses provided by Plan-it Geo with fine-scale demographic data that is publicly available. By doing this, our team will be able to determine if these public goods are concentrated in certain areas of the cities we are analyzing. For cities whose management plans are made available to us, we can visualize where future plantings and developments are planned to see how the distribution of urban forest benefits are likely to change on a temporal scale.

**Analysis of urban forest resilience to future conditions.** This task will involve evaluating urban forest management plans in the context of the cities they are written for. Some of the variables we will need to consider include microclimate (and how it's likely to change), water availability, land use priorities, pathogens and pests, species suitability, and natural disaster likelihood. Plans that include site specific tree planting information can be thoroughly evaluated for climate change resilience by their expected success when considering the above factors. Where site specific information is unavailable, plans can be evaluated on their indirect contributors to resilience. These include policy/ordinance improvements, available funding, staffing, and community engagement. Individual assessments will need to be done for each city as these variables will differ across them.

## Deliverables

For deliverables, the project would include the following components:

1. **Guidance document** detailing the resilience of urban forests to likely future conditions in several cities, including city green infrastructure maps.
2. **Recommendations** for an approach to improve urban forest management plans to account for both equity of marginalized communities within cities as well as resilience to future climate conditions.
3. **Website** detailing our findings and providing a framework for other cities to utilize
4. **Client presentation** at the end of the project to highlight our finding on how Plan-It Geo can improve their products across client cities.

**Internship**

Plan-It Geo is offering one summer internship in their Denver metro area office. The intern will focus on assisting in geospatial processes and data analysis, reporting, software development or other tasks as determined by the project direction and student interests.

## Supporting Materials

## Citations:


1. David J Nowak, Eric J Greenfield. US Urban Forest Statistics, Values, and Projections. *Journal of Forestry*, 2018; 116 (2): 164 DOI: 0.1093/jofore/fvx0041

2. Wolf, Kathy. *Urban Forest Values: Economic Benefits of Trees in Cities.* University of Washington, College of Forest Resources, Nov. 1998, https://www.naturewithin.info/Policy/EconBens-FS3.pdf.

3. Elmqvist, T, et al. (2015). Benefits of Restoring Ecosystem Services in Urban Areas. *Current Opinion in Environmental Sustainability*, Elsevier, www.sciencedirect.com/science/article/pii/S1877343515000433.

4. Hanak, E., J. Mount, C. Chappelle, J. Lund, J. Medellín-Azuara, P. Myoyle, and N. E. Seavy, 2015: What If California's Drought Continues? Public Policy Institute of California, San Francisco, CA, 20 pp. URL.

5. Hibbard, K. A., F. M. Hoffman, D. Huntzinger, and T. O. West, 2017: Changes in Land Cover and Terrestrial Biogeochemistry. *Climate Science Special Report: Fourth National Climate Assessment, Volume I*.

6. USGCRP, 2017: Climate Science Special Report: Fourth National Climate Assessment, Volume I. Wuebbles, D. J., D. W. Fahey, K. A. Hibbard, D. J. Dokken, B. C. Stewart, and T. K. Maycock, Eds. U.S. Global Change Research Program, Washington, DC, USA, 470 pp. doi:10.7930/J0J964J6.

7. Cutter, S. L., W. Solecki, N. Bragado, J. Carmin, M. Fragkias, M. Ruth, and T. Wilbanks, 2014: Ch. 11: Urban Systems, Infrastructure, and Vulnerability. *Climate Change Impacts in the United States: The Third National Climate Assessment*. Melillo, J. M., T. (T. C. Richmond, and G. W. Yohe, Eds., U.S. Global Change Research Program, Washington, DC, 282–296. doi:10.7930/J0F769GR.

8. Miller, R. W., Hauer, R. J., & Werner, L. P. (2015). Urban forestry: planning and managing urban greenspaces.

9. Wolf, Kathleen L. (2017). Trees, jobs, health and equity in the urban forest. Tree Care Industry Magazine. 28(5): 62-64.

10. Anderson, Meg, and Sean McMinn. "As Rising Heat Bakes U.S. Cities, The Poor Often Feel It Most." *Heat and Health in American Cities*, NPR, 3 Sept. 2019, www.npr.org/2019/09/03/754044732/as-rising-heat-bakes-u-s-cities-the-poor-often-feel-it-most.

11. Daniels, M.J., Dominici, F., Samet, J.M., Zeger, S.L. (2000). Estimating particulate matter-mortality dose-response curves and threshold levels: an analysis of daily time-series for the 20 largest US cities. Am. J. Epidemiol. 152, 397–406.


## Budget:

The budget for this project is not projected to exceed the $1,300 provided by the Bren School of Environmental Science & Management. Costs will include printing expenses and conference calls.

PLANIT GEO
mapping a greener future

**Ian Hanou**
CEO and Founder
303.503.4846
IanHanou@PlanITGeo.com

**Maegan Blansett**
GIS & Natural Resources Specialist
208.921.0190
MaeganBlansett@PlanITGeo.com

January 22, 2020

**To: Bren Group Project Coordinator**
Bren School of Environmental Science and Management
2400 Bren Hall, University of California, Santa Barbara
Isla Vista, CA 93106-5131

Dear Bren Group Project Committee,

PlanIT Geo is pleased to offer our enthusiastic support of the Bren School master's group project, *Analyzing Urban Forestry Practices across Cities in the Western US: Using Canopy Surveys and GIS to Improve Urban Forest Management Practices* .

PlanIT Geo is a services and software company specializing in urban forestry, arboriculture, software development, management planning, GIS, and urban tree canopy (UTC) assessments. Additionally, we utilize assessment data to develop management and action plans for communities and agencies. We care passionately about the work that we do and rely on our own software daily for projects involving mapping, data collection, data management, reporting, and communications.

By now, it is widely acknowledged that urban forests have many proven benefits on human health and the environment. Street trees help to regulate temperatures, remove pollutants from the air, reduce runoff and improve water quality, and even provide therapeutic benefits and increase property values. However, it has also been shown that tree canopy is often not evenly or equitably distributed across communities. PlanIT Geo's arborists, urban foresters, GIS professionals, and software developers assess the urban forests in various cities, counties, and campuses every day from both the top-down and bottom-up, but our work is limited to the clients who hire us. The proposed Bren group project would provide a new and greatly valued opportunity to take a step back and provide an assessment and analysis of our own data products, combined with many other publicly available data sources.

Intended project objectives, methods, and/or outcomes include:

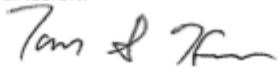
- Auditing urban forest management plans for future resilience with climate change;
- Reviewing municipal sustainability & climate action plans for the presence/absence of an urban forestry component;
- Using tree carbon calculators and other tools to evaluate how urban forestry programs are incorporating greenhouse gas reduction goals; and

- Comparing management plans across cities that have and have not worked with PlanIt Geo, aiding in the creation of a list of target cities for PlanIt Geo to work with.

With our broad urban forestry experience, including more than 250 consulting and software projects among key staff, PlanIT Geo is able to offer a wide range of spatial and tabular datasets, as well as final reports, to the master's students. Since our datasets were created locally, we do not foresee a non-disclosure agreement becoming necessary. We can also help guide students to existing tools, research, and assessment frameworks to aid in the development of the project.

If this proposal is accepted, we will be excited to offer our guidance and mentorship, available datasets, and engaged participation immediately and throughout the duration of the full project length. We anticipate being able to host one student as a summer intern in our office in the Denver metro area. The internship focus can include assisting with our geospatial processes and data analysis, reporting, software development, or other tasks as determined by the project direction and student's interests. This project presents a unique opportunity for both PlanIT Geo and the Bren master's students to gain insight and experience and to advance our shared goal of improving urban forestry practices, increasing tree canopy, and promoting environmental equity throughout communities in the western US, so we are very excited to support this proposed project and to be considered as a partner.

Sincerelv.



Ian S. Hanou
CEO and Founder
PlanIT Geo
7878 Wadsworth Blvd, Suite 340
Arvada CO, 80003