FROM CANOPY TO POLICY

How To Turn Tree Canopy Data Into Effective Tree Policy

PlanIT Geo
developers of TreePlotter

Trees Are Part of the Solution

The trees that line our streets, shade our parks, and add character to our neighborhoods, collectively known as the urban forest, are a key piece of the puzzle for addressing some of the top challenges facing cities today. Research shows urban tree canopy is **correlated with residential housing segregation** and historic redlining practices across the United States, exacerbating the impacts of climate change and public health issues in disadvantaged communities. The release of American Forests' **Tree Equity Score** maps in 2021 helped to further illustrate this point, showing that marginalized communities across the country suffer from a lack of trees today.

With proper planning, urban trees can play a role in helping to mitigate both the causes and impacts of climate change. They also improve public health, both physically and mentally, and have the potential to address major health disparities in our communities. One method for studying urban trees, known as urban tree canopy (UTC) assessments, has experienced major innovations over the last few years, making canopy data more accessible than ever before. Now that canopy data is abundant, how can we translate that information into inclusive and effective policies for equitable urban forests?

What Is An Urban Tree Canopy Assessment?

A UTC assessment uses satellite or aerial imagery and LiDAR to map out the distribution of trees within a geographic area. It provides urban foresters and city planners a big picture view of the quantity and location of their existing trees and helps guide where new trees should be planted. Historically, UTC assessments and data were mostly used by big-budgeted, major cities, but thanks to technological advancements, communities of all sizes can now obtain regularly updated tree canopy data.

WE DEVELOPED THIS GUIDE TO EXPLAIN:

WHY Urban Tree Canopy Is Important to Planners

2007 marked the first time in history that more people lived in cities than rural areas, globally. The trend towards urbanization has only increased since. In order to track urban growth and patterns of land cover change, UTC assessments often incorporate mapping of other land cover types to illustrate the ratio of tree canopy cover to impervious surfaces, other vegetation, soil, water, and more (more on this in the next section). As population growth continues, one of our greatest challenges in city planning is to cultivate urban environments that harmonize with natural systems and benefit residents equitably for generations to come.

Frequently, trees and landscaping are treated more as an afterthought rather than an essential asset to the urban fabric. Urban trees offer a multitude of social, economic, and environmental services, such as mitigating stormwater, cooling air temperatures, reducing stress, increasing property values, and improving air quality. The sum of all of these services is an intentionally more livable community. We've gotten much better at valuing these services too. The 5.5 billion trees in U.S. urban areas provide an estimated $18.3 billion in value to their communities.

Urban Heat Island Reduction

Cooler cities are not just more comfortable, they save lives. Heat is the leading cause of weather-related deaths in the United States, and one study of 97 urban areas estimated tree cover can reduce up to 346 deaths annually.

A Public Mental Health Resource

The pandemic-triggered lockdowns led to a global rise in park visitation, as people were drawn to green spaces for diversion and decompression. Nearby green space has been shown to reduce anxiety, depression, and aggression.

We know trees improve our urban areas, both for the people living there and the natural environment, but in the face of development pressures and impacts from climate change (such as disease, pests, storms, and fire), urban forests require strong policies to persist and thrive.

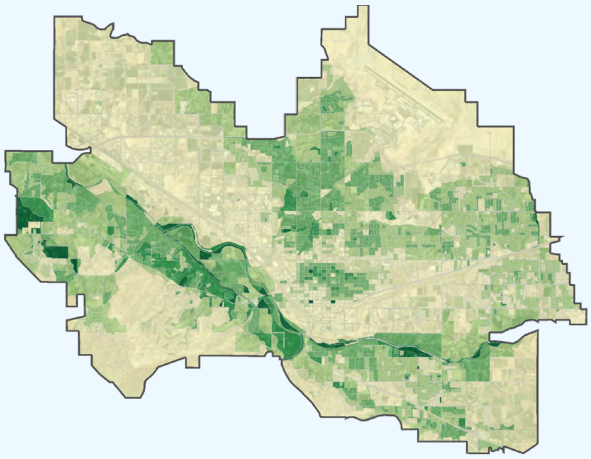
New tree growth can push back against these destructive forces when the right policies are in place, but urban forest losses have long overpowered new growth in the United States. The U.S. is losing urban tree canopy at a pace of 36 million trees and $96 million in tree benefits every year. To reverse this course and enact effective tree policies, the best first step is to measure and track what currently exists with an urban tree canopy assessment.

With a UTC assessment, you can lay out exactly where your urban tree canopy exists today, and by analyzing imagery from past years, you can show how canopy is growing and shrinking over time. This is invaluable feedback on the impact of past policies, and it can serve as guidance for investments in your urban forest. Most importantly, it allows you to make a reasonable, data-backed case to government leadership for changes to your local policies and ordinances that will improve tree equity and canopy coverage.

WHY GRAND JUNCTION GOT A UTC ASSESSMENT

"Leadership within community forestry programs will always struggle to get outside agencies to buy into the value of trees without having canopy assessment data. It is too easy to be viewed as the "tree hugger" who is complaining about a few tree losses without data backing up the discussion. Having visual information, as well as data, documenting key aspects of how tree cover is changing in a community, and the services the resource is providing moves the conversation into a discussion of reality versus feelings."
-Rob Davis, City Forester, Grand Junction, Colorado

With 62,000 residents, Grand Junction is the largest city on the western slope of Colorado, and in 2021 the city was able to complete its first UTC assessment thanks to the improved accessibility of tree canopy data. The analysis showed Grand Junction's tree canopy had grown from 7% in 2011 to 11% in 2019 and provided $30 million in annual cost savings. Rob Davis, Grand Junction City Forester, is now using the canopy data to justify changes in the municipal code, influence development code, and better integrate urban forestry goals into future comprehensive plans. Check out our Grand Junction case study to learn more.



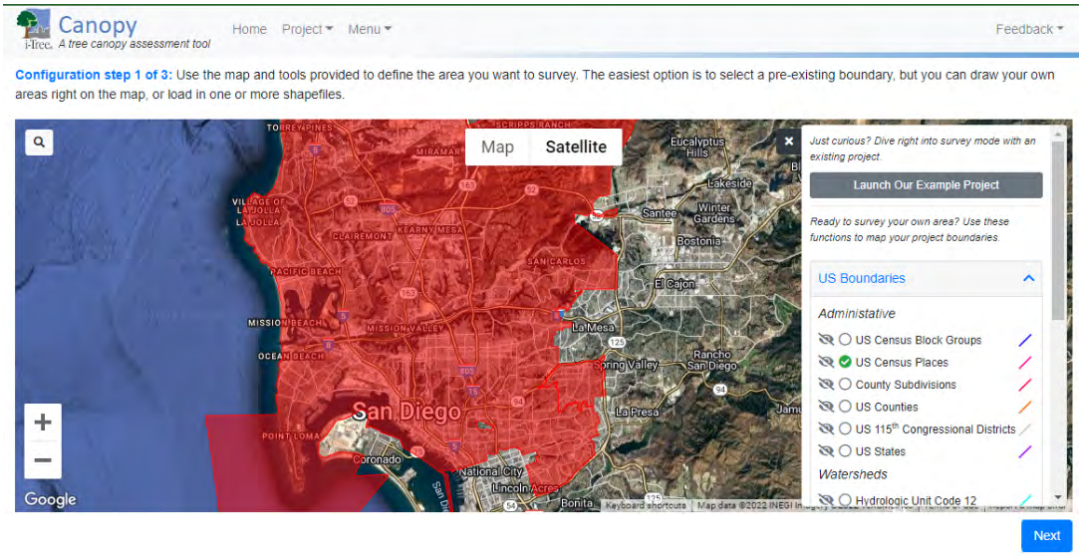
Urban tree canopy by census block in Grand Junction.

HOW Communities Can Get Canopy Data

There are two approaches for quantifying your urban forest: bottom up or top down. A tree inventory works from the bottom up, as personnel work on the ground to map the location and record the condition of individual trees in a defined area (typically only on public property). The top down approach analyzes where tree canopy exists using remote sensing sources, such as aerial and satellite imagery and LiDAR elevation data, and is called an urban tree canopy (UTC) assessment.

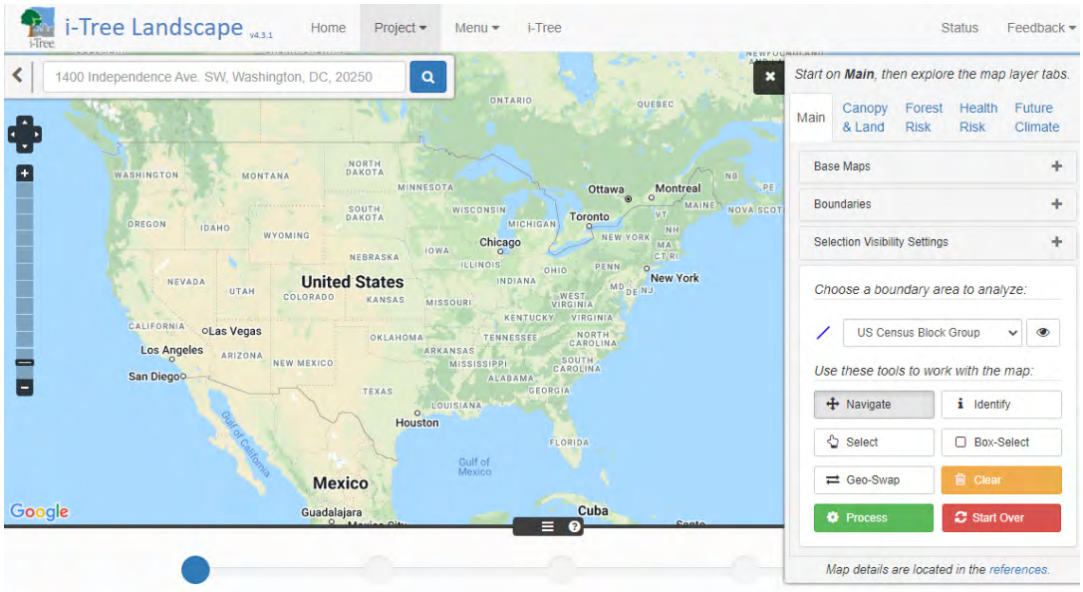
Unlike a tree inventory, a tree canopy assessment looks at all trees in the city, both public and private, so it is excellent for tracking large scale trends, setting canopy goals, measuring the effectiveness of urban forest management programs over time, and as we'll discuss below, informing effective policy updates. There are multiple methods for completing a UTC assessment that vary in scope, cost, and data output. Some of these options can be done in-house, while others require an outside consultant.

UTC ASSESSMENT METHODS



Point Sampling

This is the simplest method and can be completed using the i-Tree Canopy tool. Random points are generated within an area and manually assigned a value of "tree" or "non-tree" until a 1-2% standard error is reached. By dividing the number of "tree" points by the total number of points, you can quickly get an estimate of the percent canopy cover or any other land cover type.



i-Tree Landscape

Another way to measure tree canopy is through the i-Tree Landscape tool. This tool uses land cover data from the National Land Cover Database and sometimes incorporates high-resolution data from a UTC assessment. Once a location is selected, an estimate of the amount of tree canopy is provided. You can also explore location data (census data, forest risk, future climate, etc.), see tree benefits, prioritize tree plantings, and generate reports. The resolution for the land cover information in i-Tree Landscape is typically 30 meters, so many trees in the urban environment are not captured and the information provided may not represent real-world conditions.

High-Resolution Land Cover Mapping

The third method uses remote sensing technology and high-resolution imagery (aerial or satellite) and elevation (LiDAR) datasets to create detailed land cover data. These data are used to categorize a given landscape into specific classes, such as tree canopy, other vegetation, impervious surfaces, bare soil, or water. This method provides the highest level of detail, with an image resolution of 60 centimeters to 1 meter.

Artificial Intelligence-Driven Assessments

This is a new innovation in canopy and land cover assessment technology available through PlanIT Geo™. The results are similar to high-resolution land cover mapping, but the process is partially automated using the power of artificial intelligence and machine learning. What this means is the delivery time for UTC assessments can be days instead of months and results can be updated as a subscription every two years, instead of repeating the entire process every five to ten years.

The dataset baseline is 2011, so communities can get a change analysis to see the trends of their urban forest from 2011 up to current day. Canopy growth does not happen very quickly in most climates, but canopy loss sure can. Having a more frequent change analysis leads to more targeted policies, as you can hone in on trends faster, such as certain zoning districts suddenly making up the majority of canopy losses.

This method represents a major shift in the traditional UTC assessment process, as technological advancements and plentiful data sources have made tree canopy analysis accessible for any size community. The story of Grand Junction, highlighted at the end of the previous chapter, exemplifies the importance of this shift. The tight operating budget of Grand Junction's forestry department had dissuaded any previous attempts to complete a traditional canopy assessment. PlanIT Geo's subscription model for tree canopy and land cover data made the price point manageable and for first time Grand Junction can support their management actions and advocate for policy changes with canopy data.

Geographic Scales

UTC assessments can be calculated using a variety of spatial scales. For example, PlanIT Geo analyzed nine distinct geographic boundaries for a UTC Assessment of Colorado Springs, Colorado, including council districts, watersheds, land use types, and census blocks. Each scale offers unique insights, such as identifying which land use types are seeing the greatest canopy losses, which may point to needed policy changes.

You can't just look at the tree canopy alone. The benefit of looking at the scale of census blocks and block groups is they can be easily cross referenced with other socioeconomic data. This helps develop maps highlighting where disadvantaged populations are most lacking in tree canopy. You can even analyze how supportive the natural elements in your city are for public health using new datasets developed by PlanIT Geo partner, NatureQuant.

WHAT Policies Can Be Created From Canopy Data

Now that we've covered how and why tree canopy data is valuable to city planning efforts, let's explore what type of urban forestry policies can be pursued as a result. A tree canopy assessment can lay the groundwork for canopy goal-setting, preservation of the existing urban forest, and implementation of proactive tree care.

Comprehensive plans, municipal codes of ordinances, and master plans are all tools city planners use to shape and guide development, preservation, and everything in between. Many city departments are typically involved with the day-to-day operations for trees, which can result in confusion over responsibility, authority, and maintenance. A UTC assessment helps you orient your city departments and set the stage for citywide urban tree canopy goals and a proactive tree maintenance plan.

PLANNING AND UTC GOALS

As is the case with all citywide planning goals, it takes specific regulations to build toward a canopy cover goal over time. After completing a UTC assessment and understanding your baseline data, you can set a goal for how much canopy is appropriate to strive for in your city.

While 40% was once referenced as an ideal citywide canopy goal, the urban forestry industry now recognizes there is no "one size fits all" recommendation for cities due to the vast array of climatic, land use, and population density conditions. As such, we strongly encourage you to set canopy goals with input from city staff, local experts, community members, and elected officials to ensure community buy-in and an integrated approach. You can read more on setting canopy goals in our blog: How To Set Effective, Evidence-Based Urban Tree Canopy Goals.

When a UTC goal is decided upon, your city's comprehensive plan or an urban forest management plan are both appropriate places to house this overarching goal. The supporting actions that build toward this canopy goal should be included in your municipal code of ordinances and standard operating procedures. For example, Fremont, California completed a UTC assessment in 2020 as part of a larger Urban Forest Management Plan that includes canopy goals and equity-based prioritization for future canopy investments. The City then incorporated references to their canopy coverage within the municipal code chapters for Streets, Sidewalks, and Public Property, as well as Planning and Zoning.

ORDINANCES FOR PUBLIC TREES VS. PRIVATE TREES

It's important to understand how much of the UTC is owned and maintained by the city versus privately owned. When UTC data is aggregated by parks, streets and rights-of-way, and city-owned properties, your city can discover areas of strength or opportunity within your domain. In many urbanized areas, it is often the tree canopy on private property that outweighs the amount on publicly owned land.

Urban forestry management plans and public tree ordinances are common avenues for your city to provide structure for your municipal urban forestry program, set goals and implementation strategies, and designate public tree maintenance responsibilities, authority, and processes. Whether your municipality handles street tree maintenance or the adjacent property owner does, policies need to be clear and concise for setting the trees up for a long, healthy life that will continue to grow the canopy.

Canopy study trends are continuously revealing that, aside from large-scale nature preserves and parks, tree canopy cover is greatest within single-family residential zoning districts. Ordinances protecting trees on private land are on the rise, particularly in cities experiencing a lot of growth, development, and redevelopment. These codes may include planting requirements, tree removal regulations, and standards for tree maintenance.

Beyond these ordinances, municipalities have a great opportunity to provide public education and stewardship training to help community members care for trees. Care for young and newly planted trees is especially important to ensure the trees contribute to the citywide canopy for generations to come. This is an area where a nonprofit partnership can be extremely effective.

EDUCATING THE PUBLIC WITH TREESCHARLOTTE

TreesCharlotte is a local nonprofit that has been an invaluable community partner for Charlotte, North Carolina's urban forestry team. The nonprofit organizes volunteer planting events all over the city (43,000 trees planted or given away so far) and educates residents on the importance of the canopy and how to preserve trees. To support these efforts the city hosts the headquarters of TreesCharlotte in their Landscape Management office and supports their operations with capital, planting plans, and technical support.

PRESERVING EXISTING URBAN FOREST VS. PROMOTING FUTURE URBAN FOREST

Depending on the preservation issues facing your community, you may have specific tree species or ecosystems in need of additional protection standards. Establishing guidelines for preserving larger trees can help to retain existing canopy.

RENTON'S PATH TO NEW TREE POLICIES

Renton, Washington is a suburb of Seattle with a population just over 100,000. Their path to updating tree ordinances started with a 2018 UTC Assessment, which found the citywide canopy cover had actually increased slightly from 2010 to 2017. However, the only land-use type with declining canopy cover over that span was single-family residential, which accounts for 73% of the city's total canopy. The city proposed several tree regulation amendments in 2022 to better encourage the retention of mature trees, including new development incentives to preserve high-value trees and ensuring tree preservation methods discourage future tree removal violations. They are supporting these changes with a new urban forest management plan which includes canopy goals and staffing recommendations so they can effectively enforce the tree regulations.

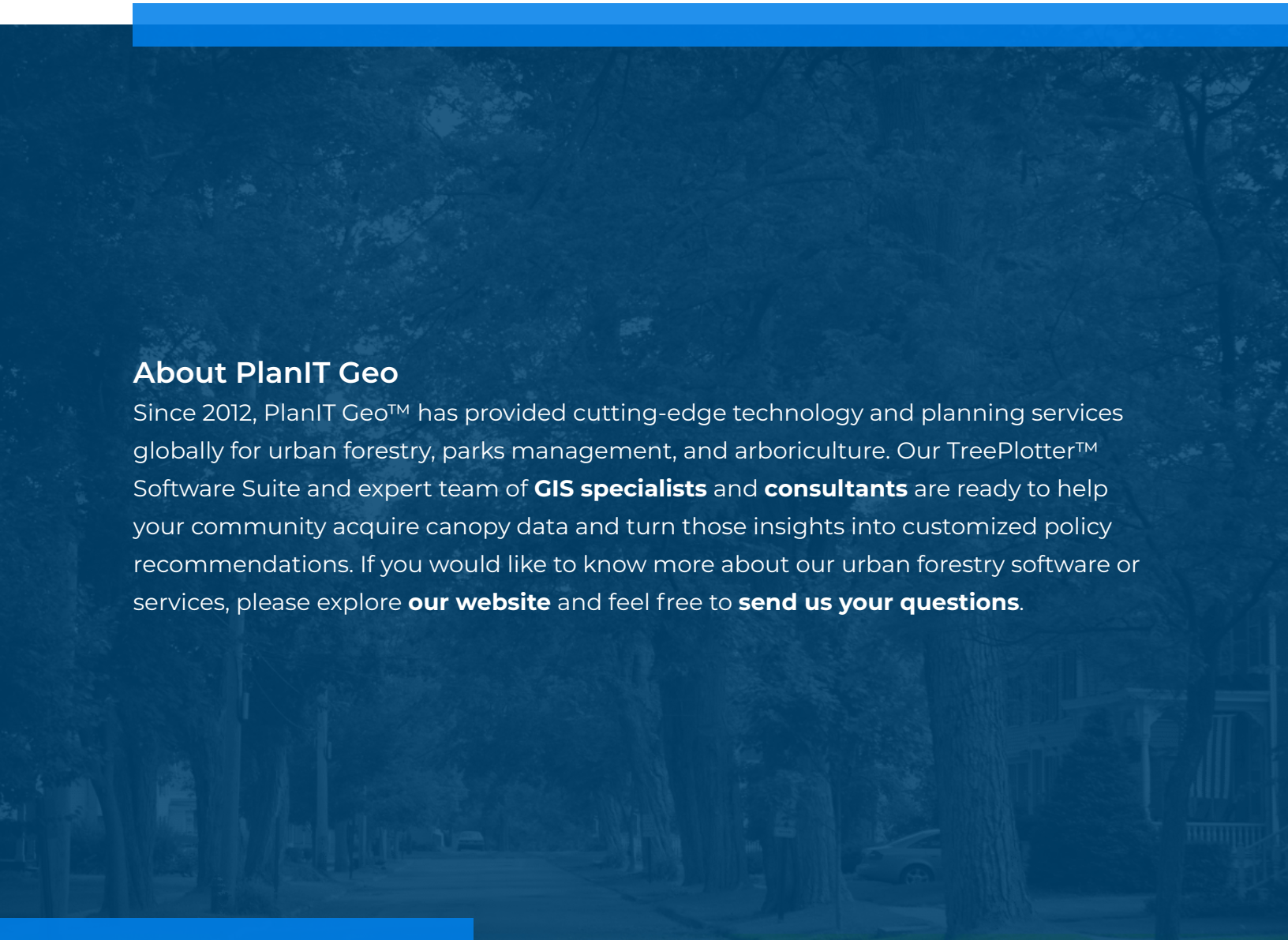
You may think preservation of existing urban forest is the main objective of local ordinances, but it's also important to consider trees that will be planted in the future. As previously explained, land classification typically includes both tree canopy, other vegetative cover, and impervious surfaces, among other land cover types. The ratio of impervious surfaces to tree canopy can be quite alarming in urbanized areas, resulting in large amounts of land throughout the city unable to support tree canopy. Policies limiting impervious surfaces can promote future possible planting areas (PPA) for your city.

In promoting your future urban forest, you can analyze UTC by land use or zoning districts to identify areas for improvement in your zoning code. Zoning districts with low UTC but high PPA are prime for investment in tree plantings. UTC goals and tree planting requirements can be set at a large scale (citywide or zoning district) or they can be site-specific. For example, a citywide goal could be 35% canopy or a maximum impervious area at 35%.

Conclusion

It's time for every program to start measuring and mitigating the unequal distribution of urban tree canopy and all associated benefits that come with it. It starts with understanding your community's baseline canopy coverage, then analyzing that data for the bigger story. Where is your urban forest disappearing? Where has canopy always been lacking? How does possible planting area correlate with rising temperatures or poor public health?

Backed by these insights, your city is ready to look towards the future and start planning policies to make sure your urban forestry program is moving in the right direction. This often starts by establishing a canopy cover goal, which helps prioritize management actions, motivate the public and officials, and inspire funding and stewardship. That goal can be the catalyst to create more tactical policy changes based on what was identified in the UTC assessment, such as the need to promote more new plantings or strengthen mature tree protections. With canopy data as your guide, your community can enact updates to codes, ordinances, and regulations ensuring decisions made today build towards beneficial outcomes for your forest in decades to come.



About PlanIT Geo

Since 2012, PlanIT Geo™ has provided cutting-edge technology and planning services globally for urban forestry, parks management, and arboriculture. Our TreePlotter™ Software Suite and expert team of **GIS specialists** and **consultants** are ready to help your community acquire canopy data and turn those insights into customized policy recommendations. If you would like to know more about our urban forestry software or services, please explore **our website** and feel free to **send us your questions**.