



The Cleveland Tree Plan

Together, We're Making Cleveland the Forest City Once Again

October 2015

Prepared for:

The Cleveland Forest Coalition:

- City of Cleveland
- Cleveland Neighborhood Progress
- Holden Arboretum
- LAND Studio
- Western Reserve Land Conservancy

Prepared by:

Davey Resource Group



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Executive Summary

Cleveland is in the midst of city-wide neighborhood revitalization to improve the quality of life for all citizens, as well as to address the future challenges that come with redevelopment, a new economy, and climate change. Trees are an important component of all these efforts, yet the city is losing significant tree canopy every year. Immediate action is needed to correct this trend of loss. The Cleveland Tree Plan assesses Cleveland’s current urban forest and lays out a roadmap to rebuild.

In the late 1800s and early 1900s, Cleveland was nicknamed *The Forest City*. However, Cleveland has lost significant canopy over the last 70 years, dropping from 220,000 street trees in the 1940s to 120,000 street trees in the city today. Tree canopy cover is now only 19% (only one quarter of what has been deemed possible).

And the loss continues. Each year an estimated 97 acres of tree canopy is lost. At this rate, canopy will drop to 14% by 2040, as shown in Figure 1 and detailed in Appendix D. A comparison to other cities (Table 1) shows the range of canopy levels, along with goals set for increasing canopy in each city.

It is time to rebuild Cleveland’s urban forest and reclaim *The Forest City* identity.

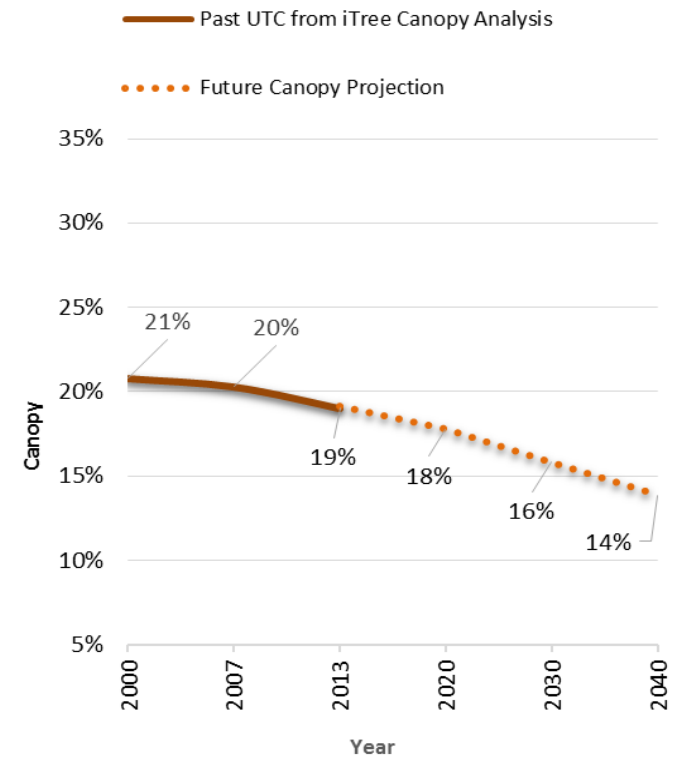
Table 1. Cleveland’s Urban Tree Canopy (UTC) Compared to Other Cities

Location	UTC	Year	UTC Goal	Goal Target Date
Pittsburgh, PA	40%	2011	60%	20-year plan (2031)
Cincinnati, OH	38%	2011	Increase	Ongoing
Louisville, KY	37%	2013	40%	Ongoing
Washington, DC	35%	2009	40%	20-year plan (2029)
Boston, MA	29%	2006	49%	10-year plan (2016)
Lexington, KY	25%	2013	30%	ongoing
New York, NY	24%	2006	30%	2036
Cleveland, OH	19%	2013	-	-
Chicago, IL	17%	2007	25%	Ongoing
Indianapolis, IN	14%	2008	19%	10-year plan (2018)

What is an urban forest?
All trees within a municipality or community (on private and public lands) comprise the urban forest.

What is tree canopy?
All land covered by trees (with leaves on) when viewed from above.

Figure 1. Cleveland tree canopy projection if no action is taken.



The Cleveland Tree Plan is unique in that it is not a city plan, but rather a *community-wide collaboration* to rebuild the urban forest through partnership. The city is just one member of a team of five organizations who banded together to initiate and fund this project. The team consists of: the City of Cleveland, Cleveland Neighborhood Progress, Holden Arboretum, LAND Studio, and Western Reserve Land Conservancy. During the planning process, *the team reached out to over 50 additional stakeholders* to assess today’s urban forest, determine a unified vision for the future, and develop a way forward together.

Why are trees important? The current canopy, even at its low level, provides Clevelanders with *over \$28 million in services every year*. Benefit data were derived using U.S. Forest Service’s i-Tree modeling and EPA’s Environmental Benefits Mapping and Analysis Program (BenMAP). Cleveland’s canopy today:

- Intercepts 1.8 billion gallons of rainwater every year (value: \$11 million).
- Removes just under 830,000 lbs. of air pollution every year (value: \$1.8 million).
- Saves residents and business owners \$3.5 million in energy costs each year.
- Reduces stress from high heat days, which has significant impacts on human health and energy needs.
- Removes 42,000 tons of carbon dioxide from the atmosphere each year (value: \$800,000). Additionally, across the lifetime of the canopy, Cleveland’s trees store another 1.3 million tons of carbon, valued at over \$25 million.
- Improves public health by preventing approximately 1,200 incidents of health problems across a range of issues, including asthma, obesity, diabetes, and mental health (value: \$6.9 million).
- Increases property values by an estimated \$4.5 million. This in turn increases city revenues.
- Improves business districts by attracting consumers that shop longer and spend more.
- Helps maintain habitat for wildlife, both aquatic and forest, which is critical to wildlife conservation.
- Prevents erosion and high sediment levels in waterways and shipping channels.
- Builds stronger communities and revitalizes neighborhoods.
- Creates safer spaces for the public by slowing traffic speeds, lowering stress, and providing buffers for pedestrians.
- Blocks noise and pollution by almost 50% for those living near highways.

The predicted future canopy loss will have significant negative impacts on the city and its inhabitants because as canopy continues to decrease, so too do the benefits it provides. And because canopy is not equally distributed across city neighborhoods (ranges from 4%–39%), lower canopy neighborhoods will feel those impacts first.

Resources and expertise are required to grow and maintain trees in communities at a level where they are considered assets, not liabilities. However, trees *can* be a good investment. A five-city study by the EPA found that cities, on a per-tree basis, accrued benefits ranging from about \$1.50–\$3.00 for every dollar invested in trees (EPA 2015). And unlike man-made infrastructure that depreciates in value over time, trees actually appreciate and provide exponentially greater benefits as they mature over time. Now is the time to make trees a priority.

Plan Development Team

City of Cleveland
Cleveland Neighborhood Progress
Holden Arboretum
LAND Studio
Western Reserve Land Conservancy

The State of the Urban Forest Today

Cleveland was assessed on 25 indicators of a sustainable urban forest, categorized into three groups: the trees, the players, and the management approach. Each indicator was given a Low, Moderate, or Good performance rating. Cleveland was found to rate in the Low performance level in more than 18 (70%) of the indicators, shown in Table 2.

The Trees: Low Performance Level. There is a lack of accurate data on the public trees in Cleveland, which creates difficulties in management, budgeting, and most importantly, ensuring public safety. The City Urban Forestry Division inspects 8,000–9,000 trees annually, but the lack of comprehensive information makes data-driven decision making very difficult. There is, however, an accurate assessment of overall canopy cover rates from a 2013 Cuyahoga County urban tree canopy assessment.

The Players: Low-Moderate Performance Level. A number of non-profit organizations and volunteers are eager for involvement, and some tree planting, stewardship, and other short-term funding and programs are in place. However, most have been working independently and without a unified vision, thus inefficiently in terms of making significant progress city-wide. The city has multiple departments working within the urban forest, but coordination efforts are minimal and goals for each department differ. City budgets are stretched thin and trees are not a priority. The public often views trees as a nuisance because of the perception that they cause significant damage. While players are in place, the unified vision and common goals are lacking.

The Management Approach: Low-Moderate Performance Level. The lack of a comprehensive and fully updated tree inventory affects almost every indicator in this category, causing low performance ratings. Although efforts have been made in recent years to revise and improve preservation and installation practices, revisions have not been incorporated into the relevant city code and development specifications. Tree protection policies and installation guidelines are outdated and without enforcement penalties. The city has a significant backlog in tree maintenance, lacks adequate funding to catch up, and is operating in a reactive manner only. Planting is relatively ad hoc and is not planned around equitable distribution of trees across the city.



Table 2. Cleveland Performance Ratings in the 25 Indicators of a Sustainable Urban Forest

Indicators of a Sustainable Urban Forest		Assessed Performance Level (green)		
		Low	Mod.	Good
The Trees	Tree Canopy			
	Size/Age Distribution			
	Condition of Public Trees - Streets, Parks			
	Condition of Public Trees - Natural Areas			
	Species Diversity			
	Species Suitability			
The Players	Neighborhood Action			
	Large Private Landholder Involvement			
	Green Industry Involvement			
	City Department/Agency Cooperation			
	Funder Engagement			
	Utility Engagement			
	Public Awareness			
	Regional Collaboration			
The Management Approach	Tree Inventory			
	Canopy Assessment			
	Equitable Distribution			
	Management Plan			
	Risk Management Program			
	Maintenance Program - Streets, Parks			
	Maintenance Program - Natural Areas			
	Planting Program			
	Tree Protection Policy			
	City Staffing & Equipment			
	Funding			

The Way Forward: A Roadmap for Success

Rebuilding Cleveland's urban forest requires a collaborative effort and partnerships, a unified vision, and a roadmap for moving forward.

A Unified Vision

Through partnership, Cleveland will once again be known as the Forest City. Residents from every neighborhood will equally experience the many benefits of our urban forest that increase resilience, health, prosperity, and overall quality of life. Cleveland will achieve this vision by:

- Collaborating amongst a variety of stakeholders
- Prioritizing trees in government, nonprofit, and the business sectors
- Implementing best practices in urban forestry
- Increasing tree canopy and the benefits it provides
- Ensuring that tree benefits are equitably distributed
- Leveraging the economic advantages of urban trees
- Engaging people to revitalize neighborhoods through community forestry

Three Goals

Three goals were defined that, once achieved, will pave the way for real progress in rebuilding a sustainable urban forest:

- Goal #1: A shift in thinking about trees, acknowledging them as critical community infrastructure
- Goal #2: A reversal in the trend of canopy loss
- Goal #3: Assuming full stewardship for the tree infrastructure

A Roadmap for Rebuilding in Nine Actions

With these goals in mind, a forward-thinking strategy has been mapped out in the form of nine actions, each of which contains a lead organization, key partners, executable steps, and progress benchmarks. These actions provide a roadmap for rebuilding Cleveland's urban forest through partnership, and helping Cleveland reclaim its identity as The Forest City.

- Action #1: Establish a unified voice, formalize partnerships
- Action #2: Develop and implement an outreach and education strategy
- Action #3: Develop and implement a funding plan
- Action #4: Complete a comprehensive tree inventory
- Action #5: Develop and implement a management plan for city-owned trees
- Action #6: Undergo an operational review
- Action #7: Establish a canopy goal and plan for canopy updates
- Action #8: Institute policy changes supportive of urban forestry
- Action #9: Plant with a purpose: trees for neighborhood equity.

An Action Sheet has been developed for each one, detailing the tasks involved and assigning a lead partner organization. Additionally, each task has been compiled into an achievement schedule, categorized into short term (2015-2017), midterm (2018-2020) and long term (2021-2040) work. Progress should be re-evaluated every 5 years by reassessing performance levels in all *25 indicators of a sustainable urban forest*, as well as using the achievement schedule to gauge Tree Plan implementation progress.

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Introduction

Cleveland's urban forest is quickly disappearing and is in a state of disrepair, which has many negative effects on Cleveland residents and businesses. The good news is that there *is* a way to rebuild in today's fiscal, political, and social environment. It is possible to balance tree canopy preservation with development, to share in the costs and workload, and to harness the will and drive of the community to work together in this effort. This plan lays out the roadmap to rebuild Cleveland's urban forest through partnership.

Consider the following realities:

- Cleveland is losing tree canopy.
- Cleveland is heating up, both from urban heat island effects and climate change, which is causing extreme weather and public health problems, and negatively affecting water quality (combined sewer overflow, drop in lake level, flooding).
- Cleveland's city budget is stretched thin.
- Cleveland is reinventing itself by revitalizing neighborhoods across the city.
- Support for a vibrant urban forest is on the rise. Cleveland recognizes that attracting people means having amenities like public transit, trails, bike paths, parks, and tree-lined streets.
- The City of Cleveland and key regional stakeholders are focused on health, equity, and sustainability, all of which are improved by a properly maintained urban forest.

As is the case with most environmental resources, an urban forest spans across many political and regional boundaries, and beyond one agency or organization. In fact, 75–80% of Cleveland's tree canopy is privately owned. Therefore, despite the fact that a master tree plan was called for both in the city's 2013 Climate

Action Plan and Cleveland 2020 plan, this is not only a *city government plan*. It is also a *community plan* to rebuild the urban forest through stakeholder partnership. The plan envisions the community at large (government, nonprofits, businesses, and residents) prioritizing and stewarding their respective roles in rebuilding our urban forest.

Cleveland's vision for a healthy urban forest today and in the future requires:

- Effective collaboration amongst a variety of stakeholders
- Prioritization of trees by government, nonprofit, and the business sectors
- Implementation of best practices in urban forestry
- An increase in tree canopy and the benefits it provides
- Equitable distribution of the tree benefits
- Leveraging the economic advantages of urban trees
- Community engagement to revitalize neighborhoods through community forestry

What is an urban forest?

All trees within a municipality or community (on private and public lands) comprise the urban forest.

What is tree canopy?

All land covered by trees (with leaves on) when viewed from above.

This plan highlights the importance of Cleveland’s trees. The plan also illustrates some of the larger issues affecting the health of our urban forest, particularly with respect to priorities and responsibilities, along with how the city’s trees are cared for and commonly perceived. In assessing the state of the urban forest, several challenges were identified as fundamental obstacles to improvement.

This plan has three goals:

- Cultivate a shift in thinking about trees—specifically recognizing trees as critical community infrastructure (versus being perceived as merely aesthetic).
- Reverse the current trend of canopy loss.
- Assume full stewardship of tree infrastructure.

A forward-thinking strategy is then mapped out in the form of nine actions, each of which contains an action sheet that includes a lead organization, key partners, executable steps, and progress benchmarks.

About Cleveland

To fully understand Cleveland’s current political, social, and fiscal environment, it is important to provide a brief snapshot of the city and some of its history.

Situated on the Lake Erie coastline in northeast Ohio, Cleveland is a city of 36 distinct urban neighborhoods in the midst of revitalization. Though today’s population (approximately 390,000) is less than half of what it was in its heyday of the 1950s (just under 1 million), Cleveland is earning a reputation as a comeback city. After decades of decline and disinvestment, new growth is happening in downtown and nearby neighborhoods, which has earned the city terms like “rust belt chic” and the “green city on a blue lake”. Many people are “returning from the suburbs, drawn by the renewed vibrancy of city living” (Cleveland 2020

Building Assets). These new generations of urban residents are attracted by amenities that enhance quality of life: bike paths, walkability, parks, water access, greenspace, and public transit.

However, the citywide population decline over the past 50 years means that city budgets are stretched thin working to maintain infrastructure built for a population of 1 million with revenues from a population of only 390,000. The current city budget has remained unchanged since 2005.

Cleveland has a rich history of urban forestry. In the early 1800s, Cleveland was nicknamed *The Forest City*, thanks in large part to the efforts of the Case family. Leonard Case, president of the Cleveland village council in the 1820s, was responsible for large tree plantings and enacting an ordinance that requires shade trees along village streets. Later, his son William Case, who became mayor in the 1850s, again promoted and organized another mass tree planting in 1852.

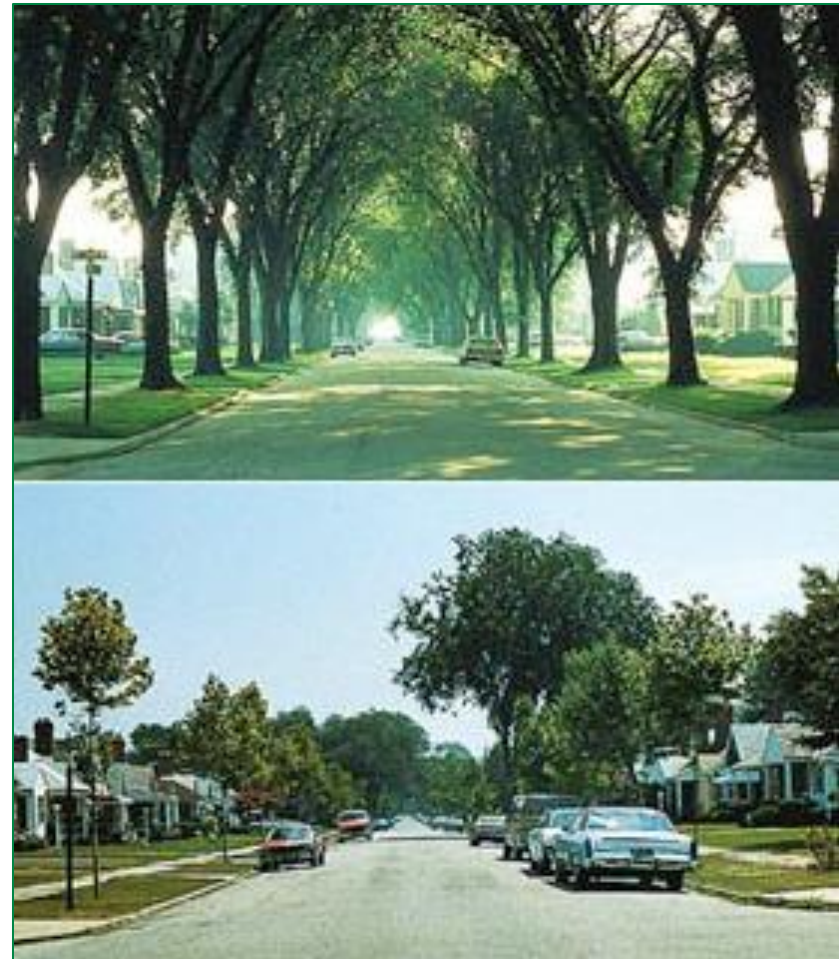
The City of Cleveland officially launched a city forestry department in 1897 as part of an effort to maintain and preserve these mature public trees (ECH 1997).

Another 13,000 trees were planted in city parks in the 1930s. A 1940 city tree count reported 220,000 street trees, with another 100,000 in city parks (ECH 1997, FC). In the 1990s, 10,000 trees were planted as part of Cleveland’s 200th birthday celebration in the “Trees for Tomorrow” project, using funds raised by the Cleveland Bicentennial Commission (EHC 1999) (Roberts 2015). Despite these planting efforts throughout the 1900s, Cleveland’s public tree count (excluding parks) is now estimated at 120,000—approximately *half* of what was reported 70 years prior.

Cleveland’s urban forest has faced a number of setbacks, including the loss of American chestnut, one of Ohio’s most prevalent trees. These trees were lost to chestnut blight disease in the early 1900s. Oftentimes, elms were planted in their place, only to be wiped out by Dutch elm disease, which was unknowingly carried from France in infected wood materials belonging to a Cleveland furniture company in the early 1930s (Hammond 2006). Sadly, many of the dying elms were replaced with ash, which are now facing elimination from the pest emerald ash borer (Dutch Elm 2015).

Cleveland is losing an estimated 97 acres of tree canopy per year. If this rate of loss holds, another 2,600 acres of canopy will be lost by 2040. Methodology and canopy calculations details can be found in Appendix D. This loss is happening just as climate change emerges as a serious threat to Cleveland. The 2013 Cleveland Climate Action Plan identified high heat days and stormwater management as two of the region’s biggest climate impacts—trees help address both of these issues.

Trees need to serve as a vital piece of Cleveland’s revitalization.



Before and After Photos of the Effect of Dutch Elm Disease in Detroit (Above 1971, Below 1984) Photos: Jack Barger, U.S. Forest Service

The Process

One of the unique aspects of this plan is that it was developed and funded by multiple stakeholders in Cleveland across many disciplines, including the City of Cleveland. Five organizations partnered to fund this plan and representatives from 28 organizations participated in interviews and stakeholder meetings.

Coordinated through the Mayor’s Office of Sustainability and led by urban forestry consultants at Davey Resource Group, the stakeholder team utilized two planning processes: first, a general adaptive management approach commonly used in resource management; and second, a system of indicators used to assess the sustainability of an urban forest (Clark et al. 1997) (Kenney et al. 2011).

The adaptive management approach is a systematic approach used in many types of resource management. It incorporates learning outcomes to improve management processes by asking a cycle of questions (Figure 2) (Miller 1988).

- What do we have?
- What do we want?
- How do we get there?
- How are we doing?

To assess the sustainability of urban forest issues, 25 *Indicators of a Sustainable Urban Forest* were separated into three categories—the trees, the players, and the management approach.

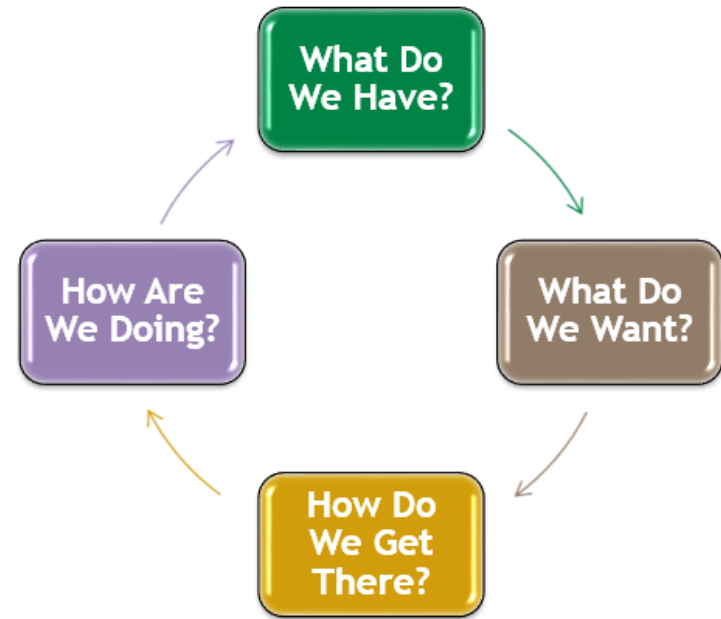


Figure 2. Adaptive management approach.

These indicators are used to identify areas for improvement and evaluate performance levels across multiple levels of urban forest management. They serve as a framework to establish the current state of the urban forest, but also serve as ways to gauge future progress.

Three stakeholder meetings were held during the planning process to review, assess, and brainstorm ideas on each group of indicators. Representatives from 28 local entities attended. With over 30 individual interviews conducted, GIS data analysis of the recent countywide urban tree canopy assessment, and incorporation of the *Cleveland 2020* and the *Cleveland Climate Action Plan*, the *Cleveland Tree Plan* was developed.



Figure 3. Indicators of a sustainable urban forest (adapted for Cleveland).

Why Trees?

The city’s most pressing needs and issues inevitably compete for resources. This plan sheds light on why Cleveland’s trees should be one of the city’s top priorities.

First, trees provide significant benefits such as stormwater management, urban heat island effects, climate adaptation, and air quality. These services have economic, social, and/or environmental value, some of which are easily quantifiable, while others more qualitative in nature. *Tree canopy in Cleveland currently provides over \$28 million in quantifiable annual services to residents each year*, as shown in Table 3. Additionally, Cleveland’s trees provide *another \$25 million* in carbon storage services over their lifetime (not an annual quantity).

Table 3. Annual Tree Benefits

Benefit	Quantity	Unit	Value
STORMWATER: Reduction of Runoff	1,792,333,232	gals.	\$10,753,999
ENERGY: Savings from Avoided Cooling	31,677,030	kWhs	\$3,484,473
PROPERTY: Increases in Property Values	-	\$	\$4,469,333
HEALTH: Less Incidents of Adverse Health	1,204	incidents	\$6,871,291
AIR: Carbon Monoxide (CO) Removed	12,740	lbs.	\$8,471
AIR: Nitrogen Dioxide (NO ₂) Removed	116,690	lbs.	\$34,684
AIR: Ozone (O ₃) Removed	493,640	lbs.	\$1,247,940
AIR: Sulfur Dioxide (SO ₂) Removed	54,640	lbs.	\$7,616
AIR: Dust, Soot, Other Particles Removed (Particulate Matter, PM ₁₀)	150,900	lbs.	\$471,292
Carbon Sequestered	41,683	tons	\$807,130
Total Annual Benefits			\$28,156,229
Carbon Storage Over Canopy's Lifetime (not an annual benefit)	1,292,522	tons	\$25,027,531
Total Benefits Overall			\$53,183,760

Twelve of the more prominent tree benefits are listed below and detailed throughout this section:

1. Flooding and water pollution reduction
2. Erosion prevention
3. Energy savings
4. Lessening the impact of high heat days
5. Carbon reduction
6. Cleaner air
7. Better health
8. Higher property values
9. More successful business districts
10. Habitat for wildlife
11. Stronger, more vibrant communities
12. Safer streets
13. Buffers for noise and pollution

Benefits data were analyzed citywide and on a neighborhood scale from multiple i-Tree models as well as the EPA’s Environmental Benefits Mapping and Analysis Program (BenMAP). i-Tree is a suite of modeling software developed by the U.S. Forest Service in partnership with The Davey Tree Expert Company, National Arbor Day Foundation, Society of Municipal Arborists, Casey Trees, and the International Society of Arboriculture. BenMAP is a software that uses ambient pollution exposure data to calculate health impacts to residents. Detailed benefits methodology and tables can be found in Appendix D.

Second, trees are valuable community infrastructure and need to be actively managed. In fact, they are the only urban infrastructure that actually increases in value over time. As trees mature, the benefits they provide exponentially increase, while more traditional city infrastructure like roads and bridges tend to deteriorate with age.

Third, tree canopy provides benefits to nearby residents, though those benefits are not equally available to all residents because canopy levels vary from neighborhood to neighborhood. It is important to examine tree canopy levels to ensure that Cleveland residents are receiving equal benefits across all neighborhoods. Six neighborhoods were identified as having the highest need for canopy: Central, Clark-Fulton, Cudell, Fairfax, Stockyards, and West Boulevard. This plan is focused on communitywide equitable distribution of tree canopy. Strategies to reduce the disparities across neighborhoods are detailed in *Appendix B: Planting with a Purpose: Trees for Neighborhood Equity*.

Lastly, trees are a good investment and have been shown to provide positive returns. A five-city study by the U.S. Environmental Protection Agency found that cities, on a per-tree basis, accrued benefits ranging from about \$1.50–\$3.00 for every one dollar invested in trees (EPA 2015). In addition, services provided by trees are often cheaper than man-made infrastructure built to address urban challenges. Once a comprehensive inventory is available in Cleveland, return on investment can be measured by comparing benefits from the urban forest to the costs of management.

Trees can mitigate this problem by reducing the amount of stormwater that enters sewer systems. They act as mini-reservoirs by slowing and reducing the amount of rainwater that enters storm drains, which is especially important in highly developed urban areas like Cleveland. In fact, roughly 100 mature trees can intercept 100,000 gallons of rainfall per year (USFS 2003). Trees also trap contaminants (oils, solvents, pesticides, and fertilizers) that often mix with rainwater as it flows across parking lots or lawns, thus reducing pollutants entering waterways.

Cleveland’s urban forest intercepts an impressive 1.8 billion gallons of rainwater every year, a service valued at just under \$11 million. These photographs on page 8 show polluted stormwater runoff in Cleveland. This service helps reduce instances of harmful algae blooms that occur in Lake Erie, and results in dead zones and dangerous drinking water situations that can cause human health issues (Abbey-Lambertz 2014).

If canopy in Cleveland continues to decline at its current rate (an average of 97 acres each year) and development continues, the quantity of stormwater handled by local sewer systems will greatly increase. This places additional stress on the aging and deteriorating sewer infrastructure within the city - some sewers are already upwards of 100 years old (Scharver 2015). Additionally, water quality will continue to deteriorate. Clean waterways are essential for health, economic development, wildlife, and outdoor recreation in Cleveland. Trees are a major part of the solution to this urban challenge, especially as they mature and benefits increase exponentially.

Erosion Prevention

Urban Trees Reduce Erosion Problems

Trees, especially roots, help stabilize hillsides and stream banks. They also aerate the soil, which reduces rainwater runoff by enabling the ground to absorb more rainwater.

In Cleveland, erosion is creating critical issues for the economy and health of local waterways. As sediment erodes into local waterways due to a lack of vegetated buffers (trees) along the creeks, more and more sediment must be dredged each year in the Cuyahoga shipping channels. As the need for more frequent dredging and disposal of material continues to increase, taxpayers will end up absorbing millions of dollars of added expenses every year. A navigable river is critical to Cleveland’s economy, which relies on shipping lanes through the Great Lakes (Eaton 2014). High sediment levels in waterways also degrade fish habitat through poor water quality (discussed further in Wildlife Habitat section). If canopy continues to decrease, silt loads in waterways will continue to increase, creating habitat degradation and added expenses for residents.

Energy Savings

Urban Trees Reduce Energy Consumption and Production

Trees provide energy savings through reduced cooling and heating requirements. The cooling effect of a healthy tree is equivalent to 10 room-sized air conditioners operating 20 hours a day (NC State 2012). However, trees don't just cool the environment through their shade; ambient (surrounding) temperatures are also lower due to the moisture trees emit. Winter heating costs can also be reduced by as much as 25% when trees are properly placed around buildings as windbreaks (Heisler 1986). Additionally, lower energy consumption reduces the amount of energy produced, thus lowering pollution emissions at the source of energy production.

Trees in Cleveland save residents and businesses \$3.5 million in energy costs each year (32 million kilowatt-hours of energy), though these savings are not equally distributed across the city, as seen in Figure 5. Neighborhoods with less canopy (primarily located in the urban core), including Central, Cuyahoga Valley, Downtown, Goodrich-Kirtland Park, and University are seeing less energy savings per acre than other neighborhoods. As Cleveland's canopy continues to decrease, energy consumption, costs, and related emissions will increase.

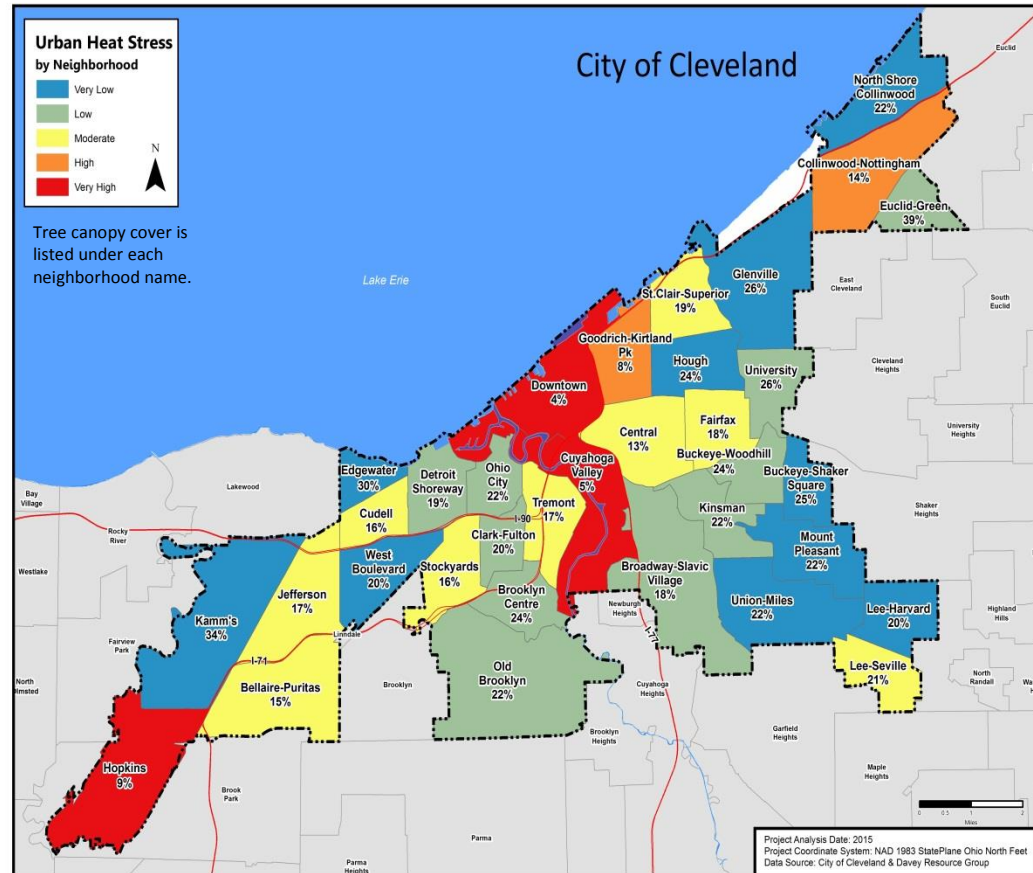


Figure 5. Urban heat stress by neighborhood.

Lessening the Impact of High Heat Days

Urban Trees Reduce Urban Heat Island and Vulnerability to Climate Change

Urban heat islands can produce temperatures that are 15–25 degrees higher in nearby, less paved, and developed areas. Tree canopy can lower ambient temperatures by 20 to 45 degrees Fahrenheit (EPA 2015). Heat stress causes public health problems for vulnerable residents (both the aging and very young) and worsens air pollution because of higher ground-level ozone. Urban trees are one of the most cost-effective, long-term solutions to reducing the effects of urban heat islands.

The hottest areas in Cleveland (calculated from a ratio of hard surface areas to canopy cover) are in the urban core, along Cuyahoga Valley and at the airport, as shown in Figure 6. The number of days per year with temperatures over 100 degrees F continues to increase. Figure 7 shows future projections for days with temperatures over 100 degrees.

Because canopy can greatly lessen heat island effects, any decrease in canopy will exponentially increase the detrimental effects of heat stress on Cleveland residents. Climate change can exacerbate the urban heat island effect even further. By providing shade and ambient temperature cooling effects, trees reduce a community’s vulnerability to climate change (Jennings 2015). Cleveland’s 2013 Climate Action Plan clearly called for trees as an effective tool for both mitigation of and adaption to climate change. High need, low canopy neighborhoods like Collinwood-Nottingham, Cuyahoga Valley, Downtown, and Goodrich-Kirtland Park experience more heat stress than other communities.

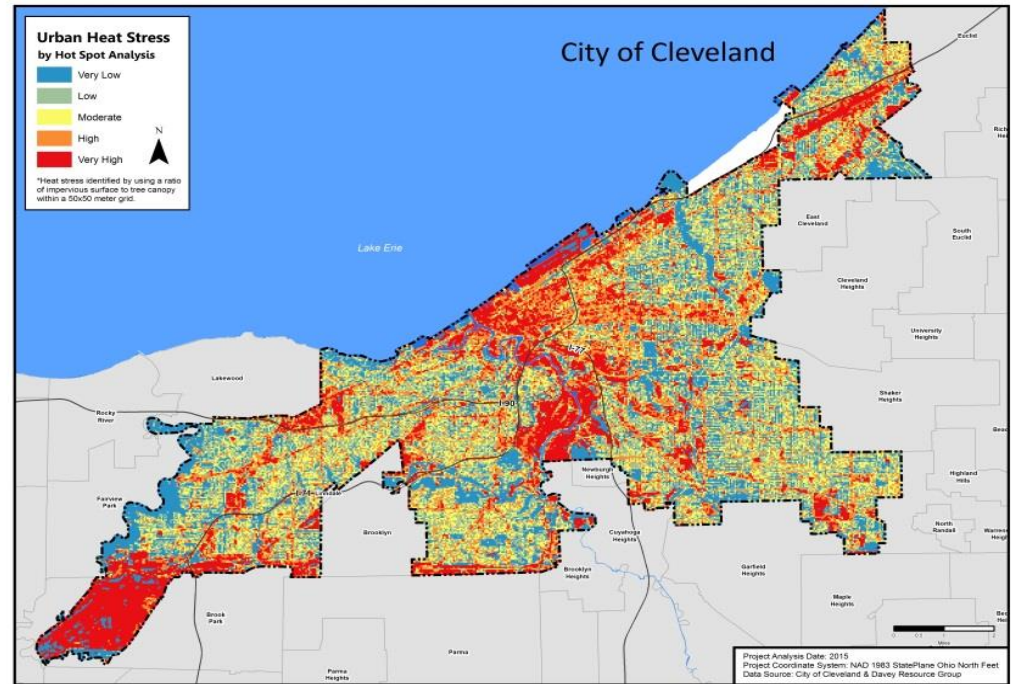


Figure 6. Urban heat stress by hot spot analysis.

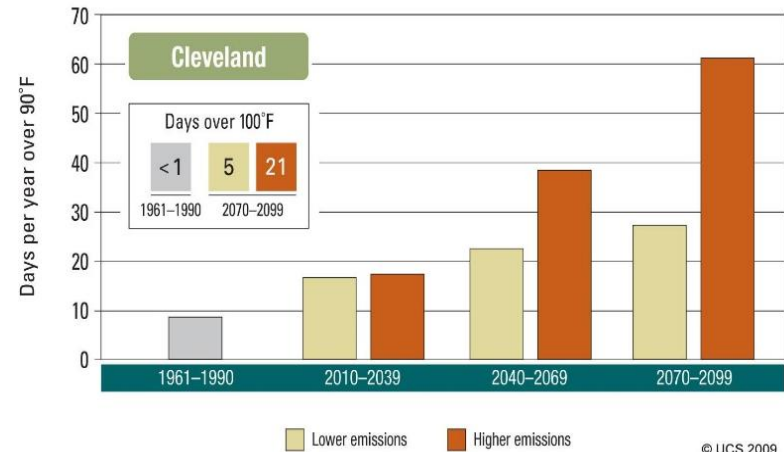


Figure 7. Projected extreme heat days, charted by Union of Concerned Scientists.

Carbon Reduction

Urban Trees Remove Carbon Dioxide from the Atmosphere

The total carbon reduction benefit provided by trees can be measured in two categories. The first is the amount of carbon dioxide absorbed by tree leaves annually (or “sequestered”), which has been calculated at just under **42,000 tons of carbon in Cleveland, valued at \$800,000**. Figure 8 shows how these benefits are distributed across Cleveland’s neighborhoods. The second is the amount of carbon stored in woody tissue of living trees over their lifetime, calculated at almost **1.3 million tons, valued at just over \$25 million**.

Geographically larger neighborhoods may have more carbon benefits though their tree canopy is lower because as a total area there is more trees.

These two carbon removal avenues represent an important benefit to Cleveland residents, as it mitigates atypical climate patterns believed to be influenced by excess atmospheric carbon.

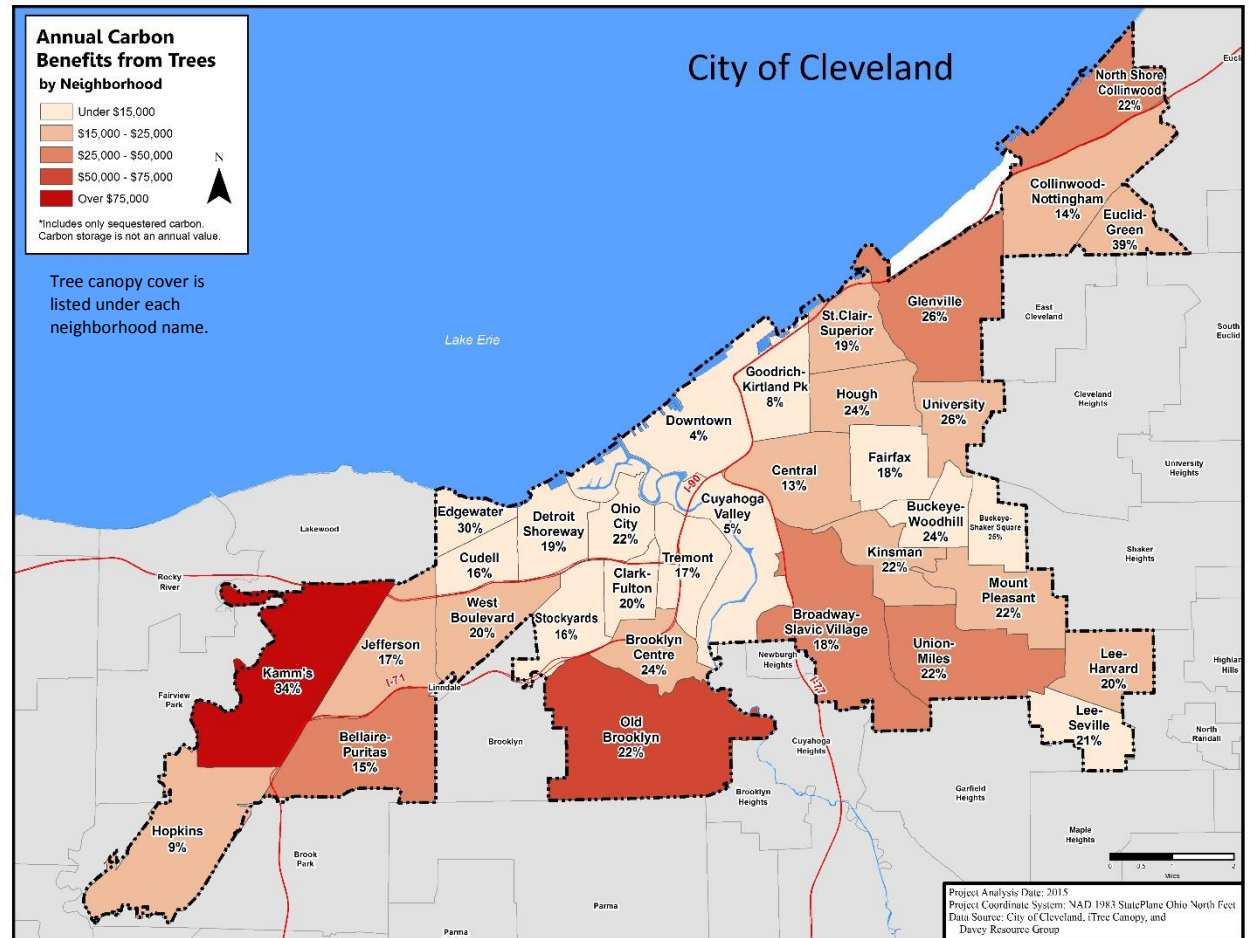


Figure 8. Annual atmospheric carbon dioxide removal from trees.

Cleaner Air

Urban Trees Reduce Air Pollution Levels

Trees can remove up to 60% of street-level air pollution, including carbon dioxide, ozone, nitrogen dioxide, sulfuric dioxide, and small particulate matter (dust, ash, dirt, pollen, and smoke) (Coder 1996).

Cleveland’s urban forest removes just under 830,000 lbs. of air pollutants every year, a service valued at \$1.8 million. Figure 9 shows how these benefits are distributed across Cleveland’s neighborhoods. This is an extremely important public health service, especially as the metro area was recently identified in the American Lung Association’s *State of the Air 2015* report as the 10th worst city for air quality out of 220 cities in the U.S. (ALA 2015).

By 2040, if canopy drops to 14% as predicted, air quality services provided by trees will decrease by an estimated 260,000 lbs. of pollutants. Health issues will continue to increase if the canopy loss issue is not resolved.

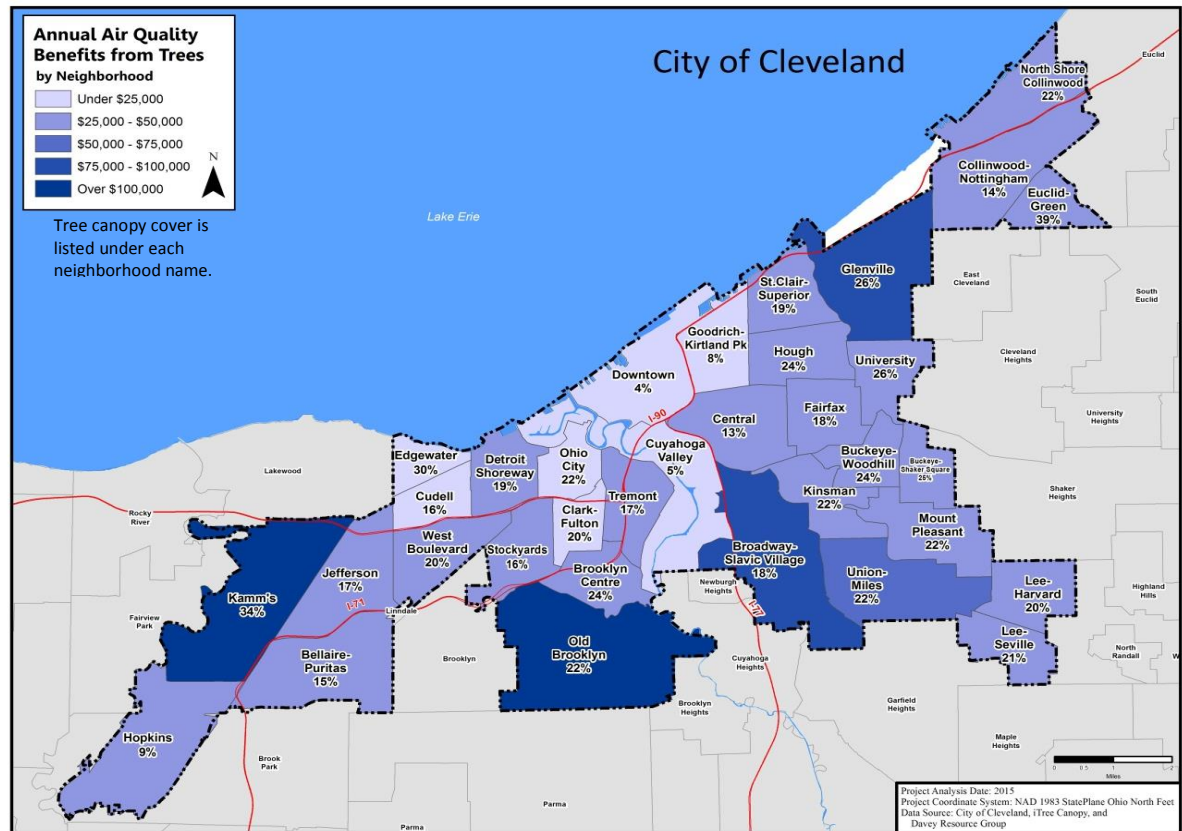


Figure 9. Annual air quality benefits from trees.

Better Health

Urban Trees Improve Public Health

By improving air quality and reducing heat island effects, trees are known to create a healthy environment for people. Studies have also shown that individuals with views of, or access to, greenspace also tend to be healthier; employees experience 23% less sick time and greater job satisfaction, and hospital patients recover faster with fewer drugs (Ulrich 1984). Trees also have a calming and healing effect on ADHD adults and teens (Burden 2008). After New York City increased its tree canopy by installing over 300 trees for each square kilometer, a study found that asthma in young children decreased by 29% (Lovasi 2008).

In Cleveland, it has been estimated that Cleveland’s current tree canopy accounts for 1,200 *less* incidents of adverse health effects like respiratory issues and hospital visits each year, valued at just under **\$6.9 million** (Table 4).

Table 4. Annual Incidents of Health Issues Avoided by Existing Tree Canopy in Cleveland
(Source: EPA BenMap)

Adverse Health Effect Avoided	Incidents/Year	Value
Respiratory Symptoms	532	\$45,640
Bronchitis (acute & chronic)	0.4	\$35,521
Acute Myocardial Infection (heart attack)	0.1	\$11,762
Hospital Visits (emergency room/ hospital)	3.4	\$62,257
Asthma Exacerbation	495	\$40,995
Mortality	0.86	\$6,656,299
School Loss Days	146	\$14,358
Work Loss Days	26	\$4,460
Total	1,204	\$6,871,292

Between 2005 and 2009, asthma rates in Cleveland increased from 11% to 14% and one person in eight reported experiencing respiratory stress in the past year. The prevalence of asthma in Cleveland is higher than the national, state, and county rate, and higher than the neighboring city of Akron and similar-sized cities like Pittsburgh and Detroit (Prevention Research Center for Healthy Neighborhoods 2015). Higher canopy cover has been associated with lower asthma rates, as seen in Figure 10.

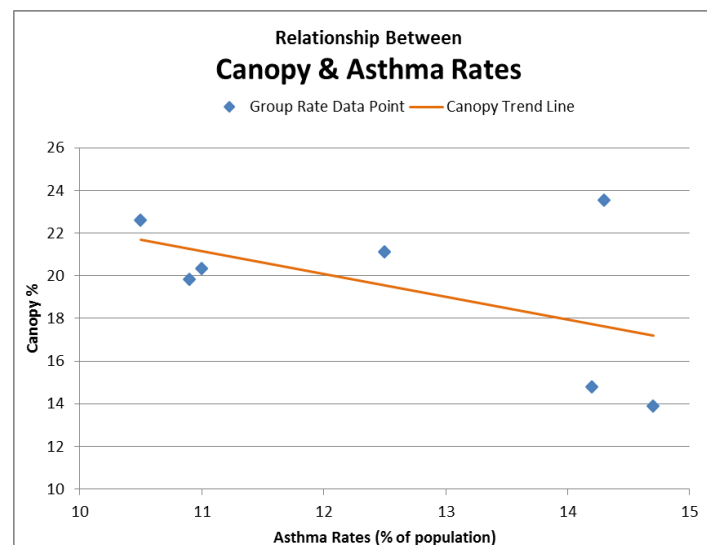


Figure 10. Trend line indicating the areas with higher asthma rates have lower canopy cover in Cleveland.

Figures 11 and 12 compare the air quality benefits from trees with the prevalence of asthma in Cleveland neighborhoods. Diabetes and obesity can also be correlated to tree canopy cover, as shown in Figure 13. Diabetes among adults is higher in neighborhoods with lower canopy. The relationship of tree canopy and obesity, however, is more indirect and, therefore, less dramatic.

Because canopy is not equitably distributed, an unnecessary health burden is placed on neighborhoods with lower canopy cover. If canopy continues to decrease, health issues are likely to increase and so will the equity gap.

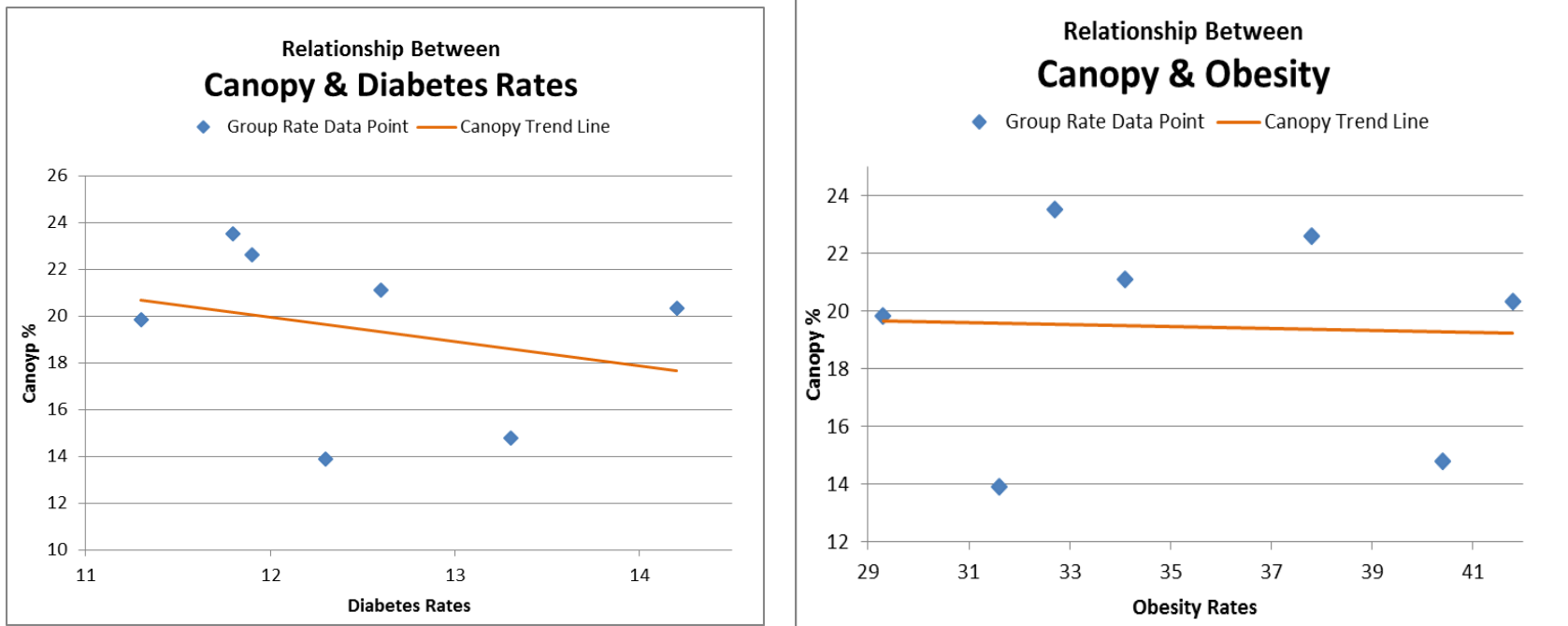


Figure 13. Trend lines indicating that areas with higher diabetes and obesity rates have lower canopy cover in Cleveland. Health Data Source: Cleveland Neighborhood Data Briefs, Prevention Research Center at Case Western University

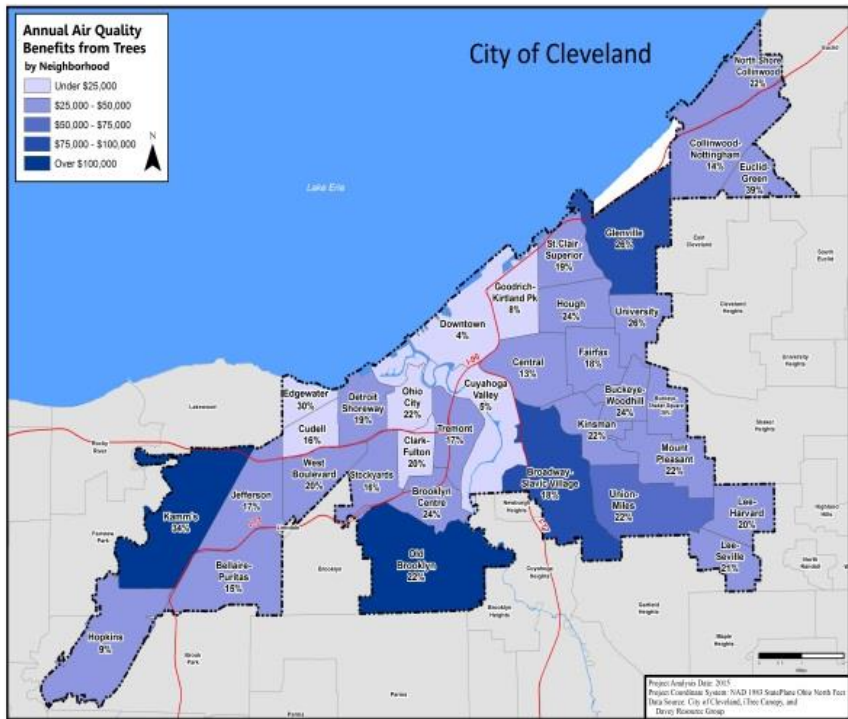


Figure 11. Annual air quality benefits from trees by neighborhood.

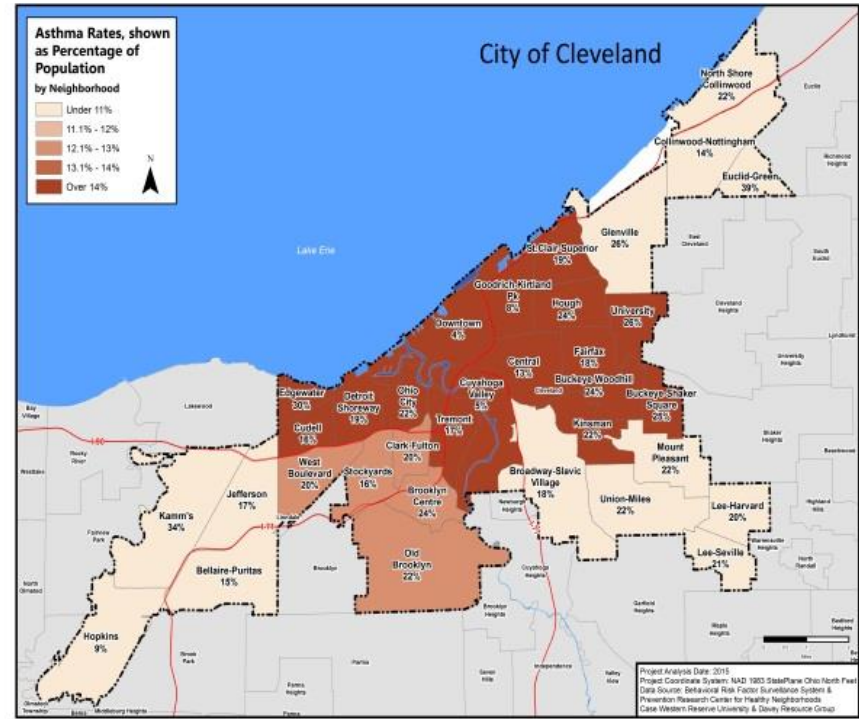


Figure 12. Asthma rates shown as percentages of population by neighborhood.

Higher Property Values

Urban Trees Increase Real Estate Values

Trees increase residential property and commercial rental values by an average of 7% (Wolf 2007). This not only impacts a property owner's bottom line, but also translates to higher city tax revenues. The impact of the urban forest on a property purchase is somewhat intuitive but difficult to quantify. Consider the following two residential streets.

The urban forest canopy increases Cleveland property values by an estimated \$4.5 million. Figure 14 shows how these benefits are distributed across Cleveland's neighborhoods. As the canopy continues to decrease, so too will property values and tax revenues.

More Successful Business Districts

Urban Trees Increase the Time and Money Spent in Shopping Districts

Commercial shopping districts also benefit from tree canopy. Studies have shown that consumers pay an average of 11% more for goods and shop for a longer period of time in shaded and landscaped business districts (Wolf 1998b, 1999, and 2003). Consumers also feel that the quality of products is better in business districts that are surrounded by trees (Wolf 1998a). Despite these findings, many business owners don't want trees in front of their stores because they are concerned about trees hiding signage.

In Cleveland, commercial land use has an average canopy of just 9%, with a potential for 29% tree canopy cover. Local business districts with low tree canopy levels may lose business to higher canopied shopping districts. Imagine the impact to local business when canopy potential is realized.

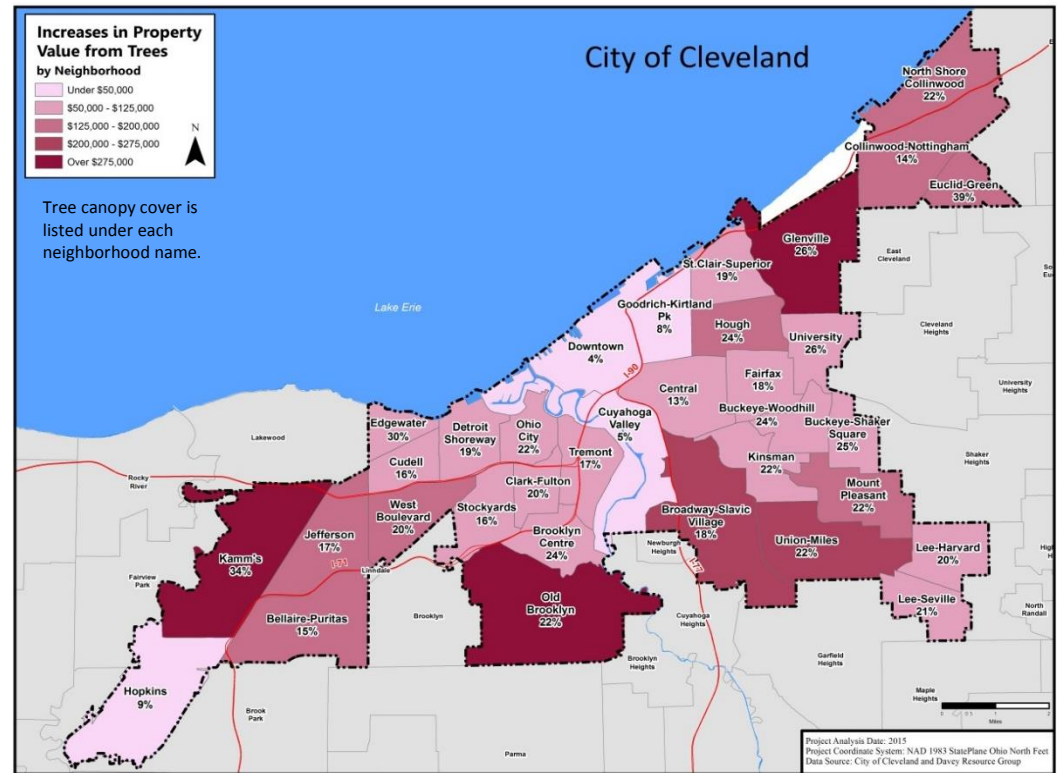


Figure 14. Increases in property value from trees by neighborhood.

Habitat for Wildlife

Urban Trees Sustain Wildlife

Trees have a significant impact on wildlife life, both on land and in waterways. Urban wildlife habitat serves as refuge for song birds and pollinators impacted by urbanization and is an important part of wildlife conservation (USFS 2015).

Forest Connectivity. The forests in urban areas are often fragmented (disconnected patches of forest) due to high levels of development. Lack of habitat, food, shelter, and water makes sustained life difficult for wildlife. When smaller forests are connected through planned or informal urban greenways, trees provide essential habitat to a range of birds and other wildlife that feed on insects (Dolan 2015). Better habitat can also reduce the impact and damage of the deer population on residential landscapes.

In Cleveland, large unfragmented forest areas (termed core and edge forest) cover only 7% of land. The remaining tree canopy is comprised of patchy forested areas or areas with no trees at all. Connecting the patches with the core forest will result in an improved network of corridors for wildlife and human enjoyment. Cuyahoga County's greenspace plan ("Greenprint") shows the location of existing parks and highlights those greenspace corridors that should be the focus of environmental management and restoration, and open space protection and reclamation. Waterways, which are often the center of the greenspace corridors, are named. It also identifies major streets that have wider rights-of-way, connect to community centers, and which should be priorities for future greening improvements.

The Greenprint also identifies the routes of existing and potential trails. The potential routes involve a variety of locations including utility easements, greenspace corridors, abandoned rail corridors, institutional properties and right-of-ways.



Some wildlife species rely on specific species of trees nesting and habitat. The Kirtland Warbler (above) depends on Jack Pine trees. Image Source: Cleveland.com



Neighbors and students helped Cuyahoga ReLeaf plant trees along Mill Creek in Kerruish Park. Source: CuyahogaRiver.org



Native Trees & Wildlife Habitat

Wildlife utilizes the shelter and food source that native trees provide. Native trees and the wildlife they support are important to the thousands of migratory birds that use Cleveland as a stop-over along a key migration route.

includes plans for a system of natural corridors to assemble trails and increase forest cover. Other projects such as Red Line Greenway and Tow Path trail can also serve as greenway connectors and provide opportunities to increase canopy in Cleveland (Cuyahoga County Planning Commission 2015).

Aquatic Life. Urban streams are often highly degraded, partly due to a lack of vegetated buffers (trees) along waterways. Trees shade the water and keep water temperatures cool. Fallen leaves in the water are a food source for fish, insects, and invertebrates. Trees also keep soil in place, which prevents high silt loads in streams that can smother aquatic life and filter contaminants from runoff to reduce water pollutants (CRR 2015).

The biodiversity of Cleveland is rooted in the native trees that have adapted to survive here. Urban environments, especially treelawns, parking lots and developed areas or areas degraded by development present unique challenges including heat island effects, salt spray, acidic soils and compacted soils. However, there are some native trees that can survive these conditions and there are some areas in city where native trees may thrive including public parks, cemeteries, residential lots, institutional campuses and business campuses.

Besides supporting birds and pollinators, trees also provide habitat for insects that support a variety of wildlife in the foodweb. A single native oak tree can provide food and shelter for 22 species of caterpillars in addition to many other pollinator and insect species.

Stronger, More Vibrant Communities

Urban Trees Contribute to the Building of Better Communities

Tree-lined streets can help attract new residents and create stronger communities. While less quantifiable, the benefit of community building is no less important than other tree benefits. Fostering the development of a vibrant public realm for all to share is a major focus in today's Cleveland. Strong neighborhoods with tree-lined streets, meeting places, parks, libraries, and public transit can make low-consumption lifestyles more affordable, convenient, and attractive.

One study showed that residents of apartment buildings surrounded by trees reported knowing their neighbors better, socializing with them more often, having stronger feelings of community, and feeling safer and better adjusted than did residents of more barren, but otherwise, identical areas (Kuo 2001b). Another study identified that areas with tall trees creating an overhead canopy were associated with lower crime levels (burglary, theft, and shootings). The study found that a 10% increase in tree canopy was associated with a 12% decrease in crime (Troy 2012). According to studies released by the Pennsylvania Horticultural Society, greening neighborhoods increase surrounding property values, reduce crime and vandalism, and encourage exercise (which in turn reduces stress). All of these improvements contribute to building a better community (PHS 2015).

Cleveland leadership, neighborhood activists, and planners cite trees as an important tool in neighborhood revitalization efforts. In a recent survey of Cleveland community development corporations (CDCs), over 70% of respondents consider tree planting a priority in their neighborhood's development; many of these respondents would commit staff time to tree planning projects (Western Reserve Land Conservancy 2015).

Newly planted trees in a neglected area can appeal to new residents and counteract the "Broken Window" theory, which posits that neglected areas encourage more neglect. Trees cultivate community pride, deter vandalism, and encourage investment. If canopy continues to decline in Cleveland, neighborhoods will be the first to feel the effects.



Mayor Jackson has cited trees as a way to:

"increase the livability of our neighborhoods and enhance the quality of life for all Clevelanders" (Climate Action Plan 2013).



Nelson Beckford, Senior Program Officer for Strong Communities at St. Luke's Foundation, also believes that trees are a real indicator of solid neighborhoods:

"Many stable Cleveland neighborhoods like West Park, Ohio City, and Old Brooklyn and municipalities like Shaker Heights and Lakewood are (rightly) associated with tree-lined streets and solid housing stock."

Safer Streets

Urban Trees Slow Traffic and Provide Safe Walkable Streets

Traffic speeds and driver stress levels are lower on tree-lined streets, contributing to a reduction in road rage and aggressive driving (Wolf 1998a, Kuo and Sullivan 2001b). According to the Federal Highway Administration, tree canopy along a street provides a narrowing speed control measure by creating a “psycho-perceptive sense of enclosure” that discourages speeding (US DO 2015). The buffers between walking areas and driving lanes created by trees also make streets safer for pedestrians and cyclists.

Many of the streets in Cleveland were designed for the bustling, high-population city of the 1950s. With today’s population being less than half of what it was 60 years ago, streets are not correctly sized for today’s usage by cars, cyclists, and pedestrians (Noles 2015). Both Cleveland and Cuyahoga County have recently adopted Complete and Green Streets policies that include trees and greenspace. Complete streets “create a walking, biking, and public transportation-friendly city, while reducing environmental impact by incorporating green infrastructure” (Sustainable Cleveland 2019). Projects like the Fleet Avenue Streetscape project in Slavic Village and the Enhance Clifton project are using trees in their complete and green street redesigns to create a safer and more right-sized environment for the public (Broadway Slavic Village 2015) (Enhance Clifton 2015).



Rendering of Fleet Avenue as a Complete and Green Street

A Buffer to Block Noise and Pollution

Urban Trees Reduce Noise and Exposure to Emissions from Highways and Rail Lines

Trees are critical buffers for those who live along busy roadways or rail lines by reducing both noise levels and exposure to pollution from vehicle emissions. A 100-foot-wide, 45’ high densely planted tree buffer can reduce highway noise by 50% (NC State 2012). Pollution can also be worse for those living along highways and rail lines. The American Lung Association found “growing evidence that vehicle emissions coming directly from those highways may be higher than in the community as a whole, increasing the risk of harm to people who live or work near busy roads” (ALA 2015).

Many of Cleveland’s neighborhoods have at least one highway cutting through the fabric of the community. Tree buffers can benefit the health and well-being of those residents by reducing noise and air pollution.

All Benefits Combined

The Case for Investing in Urban Trees

By adding together the quantifiable benefits from trees (stormwater management, energy savings, property value, and air quality) in Cleveland, the current canopy provides **an annual benefit of \$28 million** to the people who live, work, and play in Cleveland. Carbon storage over the canopy's lifetime adds an additional \$25 million in benefits. These totals exclude the harder to quantify, but equally compelling, benefits associated with place-making and quality of life.

Equitable distribution of benefits is a priority for Cleveland. Figure 15 shows how the benefits trees provide are distributed across the neighborhoods. In many cities, there are substantial disparities between neighborhoods due to gaps in wealth or differences in social and political status. It is important to ensure that the benefits provided by trees are provided to all residents as equally as possible.

Table 5. Summary of Quantifiable Benefits in Cleveland

Benefit	Quantity	Unit	Value
STORMWATER: Reduction of Runoff	1,792,333,232	gallons	\$10,753,999
ENERGY: Savings from Avoided Cooling	31,677,030	kWhs	\$3,484,473
PROPERTY: Increases in Property Values	-	\$	\$4,469,333
HEALTH: Less Incidents of Adverse Health	1204	incidents	\$6,871,291
AIR: Carbon Monoxide (CO) Removed	12,740	lbs.	\$8,471
AIR: Nitrogen Dioxide (NO ₂) Removed	116,690	lbs.	\$34,684
AIR: Ozone (O ₃) Removed	493,640	lbs.	\$1,247,940
AIR: Sulfur Dioxide (SO ₂) Removed	54,640	lbs.	\$7,616
AIR: Dust, Soot, Other Particles Removed (Particulate Matter, PM ₁₀)	150,900	lbs.	\$471,292
Carbon Sequestered	41,683	tons	\$807,130
<i>Total Annual Benefits</i>			\$28,156,229
Carbon Storage Over Canopy's Lifetime <i>(not an annual benefit)</i>	1,292,522	tons	\$25,027,531
<i>Total Benefits Overall</i>			\$53,183,760

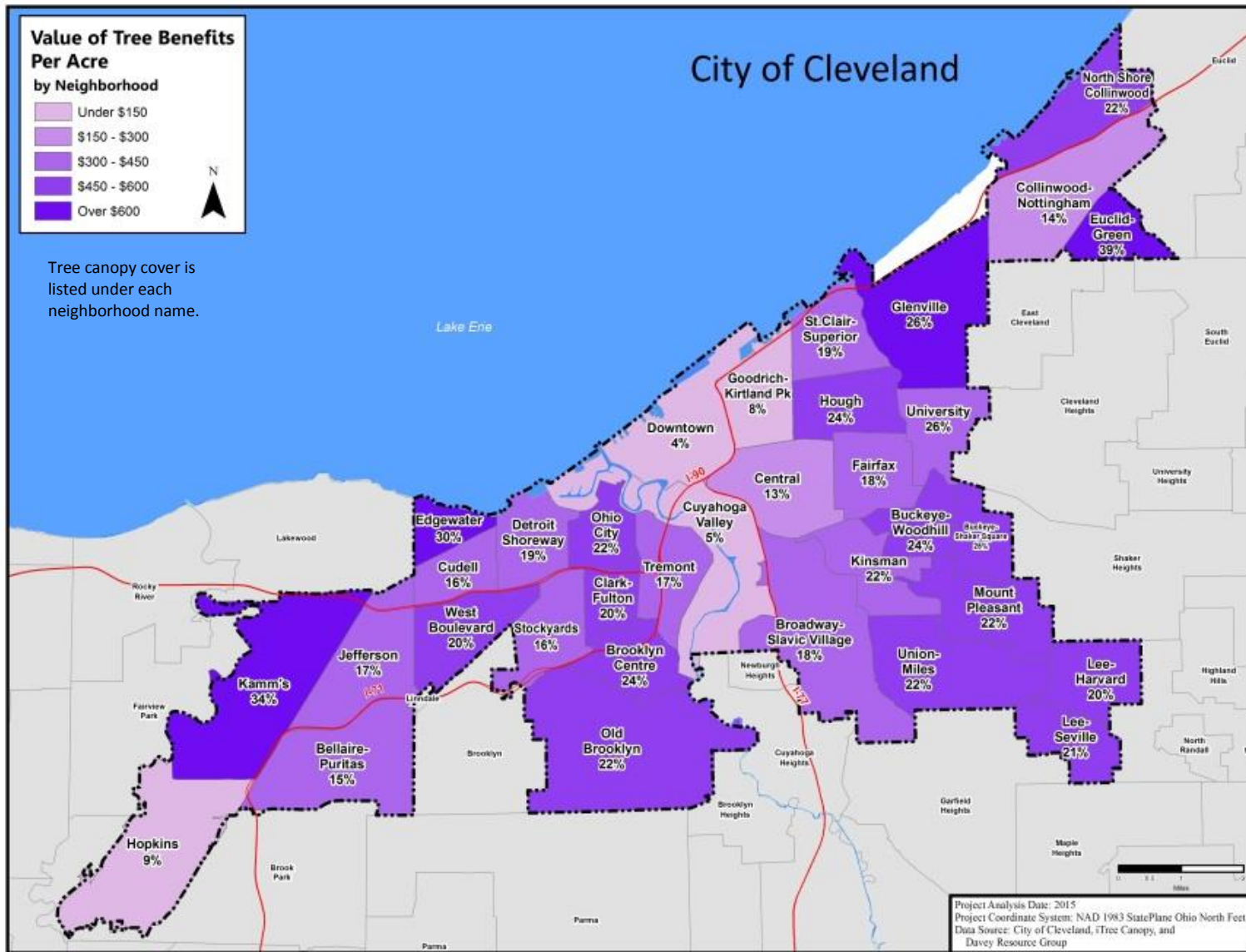


Figure 15. Value of tree benefits per acre by Cleveland neighborhood.

Table 6. Quantifiable Benefits of Cleveland’s Urban Forest by Neighborhood (Excludes Health)

Neighborhood Data			Air Pollution Avoided		Carbon Reduction		Stormwater Intercepted		Energy Savings		Property Value Increase	Total Benefits	
Name	Canopy %	Size (Acres)	Unit (lb)	Value (\$)	Unit (tons)	Value (\$)	Units (gallons)	Value (\$)	Units (kWhs)	Value (\$)	Value (\$)	Total Value	Value Per Acre
Bellaire-Puritas	15%	2,191	22,402	\$49,269	43,107	\$834,704	62,373,697	\$374,242	1,041,247	\$114,537	\$168,371	\$1,541,123	\$703
Broadway-Slavic Village	18%	2,901	36,229	\$79,590	69,637	\$1,348,401	99,783,989	\$598,704	1,870,672	\$205,774	\$252,807	\$2,485,275	\$857
Brooklyn Centre	24%	938	15,340	\$33,720	29,503	\$571,284	42,413,963	\$254,484	710,833	\$78,192	\$89,266	\$1,026,946	\$1,095
Buckeye-Shaker Square	25%	742	12,793	\$28,101	24,587	\$476,087	35,425,050	\$212,550	642,106	\$70,632	\$108,067	\$895,437	\$1,207
Buckeye-Woodhill	24%	790	12,886	\$28,333	24,790	\$480,020	35,682,216	\$214,093	421,773	\$46,395	\$96,566	\$865,407	\$1,095
Central	13%	1,501	13,182	\$28,981	25,357	\$490,994	36,407,741	\$218,446	124,392	\$13,683	\$66,759	\$818,863	\$546
Clark-Fulton	20%	611	8,150	\$17,893	15,655	\$303,142	22,570,525	\$135,423	652,762	\$71,804	\$57,919	\$586,181	\$960
Collinwood-Nottingham	14%	2,110	18,249	\$42,312	37,021	\$716,842	53,801,913	\$322,811	694,639	\$76,410	\$149,325	\$1,307,701	\$620
Cudell	16%	698	5,437	\$16,572	14,500	\$280,768	21,023,576	\$126,141	422,908	\$46,520	\$58,637	\$528,639	\$757
Cuyahoga Valley	5%	2,573	8,122	\$17,831	15,601	\$302,088	23,533,822	\$141,203	35,530	\$3,908	\$18,802	\$483,832	\$188
Detroit Shoreway	19%	974	12,226	\$26,864	23,505	\$455,129	33,999,577	\$203,997	610,515	\$67,157	\$80,934	\$834,081	\$856
Downtown	4%	1,779	4,951	\$10,891	9,529	\$184,516	13,566,182	\$81,397	3,213	\$353	\$12,613	\$289,770	\$163
Edgewater	30%	533	10,657	\$23,429	20,499	\$396,938	29,666,495	\$177,999	397,711	\$43,748	\$76,371	\$718,486	\$1,348
Euclid-Green	39%	733	19,262	\$42,556	37,234	\$720,975	53,900,334	\$323,402	685,502	\$75,405	\$197,542	\$1,359,880	\$1,855
Fairfax	18%	1,031	12,364	\$27,195	23,794	\$460,736	34,279,936	\$205,680	384,612	\$42,307	\$95,162	\$831,080	\$806
Glenville	26%	2,454	42,928	\$94,394	82,590	\$1,599,217	118,555,572	\$711,333	2,942,436	\$323,668	\$321,309	\$3,049,922	\$1,243
Goodrich-Kirtland Pk	8%	1,071	6,239	\$13,696	11,983	\$232,030	17,081,311	\$102,488	83,851	\$9,224	\$25,930	\$383,368	\$358
Hopkins (Airport)	9%	2,642	15,407	\$33,850	29,617	\$573,491	42,793,849	\$256,763	97,283	\$10,701	\$39,735	\$914,541	\$346
Hough	24%	1,089	17,749	\$39,018	34,138	\$661,031	49,497,136	\$296,983	883,353	\$97,169	\$157,976	\$1,252,176	\$1,150
Jefferson	17%	1,655	19,408	\$42,664	37,329	\$722,814	53,855,121	\$323,131	1,554,956	\$171,045	\$142,677	\$1,402,331	\$847
Kamm's	34%	3,199	73,139	\$160,761	140,658	\$2,723,599	202,207,281	\$1,213,244	3,665,319	\$403,185	\$459,043	\$4,959,831	\$1,550
Kinsman	22%	1,071	15,839	\$34,805	30,453	\$589,670	44,096,775	\$264,581	448,754	\$49,363	\$111,817	\$1,050,236	\$981
Lee-Harvard	20%	1,059	14,204	\$31,222	27,317	\$528,954	39,529,462	\$237,177	1,226,879	\$134,957	\$109,730	\$1,042,040	\$984
Lee-Seville	21%	914	12,749	\$28,020	24,516	\$474,719	35,610,874	\$213,665	613,932	\$67,533	\$102,304	\$886,241	\$970
Mount Pleasant	22%	1,402	21,315	\$46,822	40,967	\$793,254	59,207,420	\$355,245	1,476,642	\$162,431	\$192,622	\$1,550,373	\$1,106
North Shore Collinwood	22%	1,451	21,883	\$48,065	42,054	\$814,308	60,763,263	\$364,580	1,126,266	\$123,889	\$177,095	\$1,527,937	\$1,053
Ohio City	22%	709	10,767	\$23,657	20,699	\$400,795	29,886,271	\$179,318	384,754	\$42,323	\$63,575	\$709,668	\$1,002
Old Brooklyn	22%	3,794	57,455	\$126,266	110,476	\$2,139,178	159,255,586	\$955,534	3,262,840	\$358,912	\$350,141	\$3,930,030	\$1,036
St.Clair-Superior	19%	1,037	13,522	\$29,723	26,006	\$503,559	37,430,687	\$224,584	520,554	\$57,261	\$84,734	\$899,860	\$868
Stockyards	16%	1,065	11,609	\$25,501	22,312	\$432,031	32,373,255	\$194,240	584,218	\$64,264	\$75,968	\$792,004	\$744
Tremont	17%	1,068	11,887	\$26,154	22,883	\$443,092	33,254,364	\$199,526	308,522	\$33,937	\$68,706	\$771,414	\$722
Union-Miles	22%	2,045	30,315	\$66,627	58,295	\$1,128,780	84,362,987	\$506,178	2,320,050	\$255,206	\$263,988	\$2,220,778	\$1,086
University	26%	971	17,205	\$37,833	33,102	\$640,957	47,855,703	\$287,134	152,929	\$16,822	\$61,769	\$1,044,515	\$1,076
West Boulevard	20%	1,219	16,728	\$36,801	32,199	\$623,473	46,287,304	\$277,724	1,325,077	\$145,758	\$131,073	\$1,214,829	\$997

The State of Cleveland's Urban Forest Today

The State of Cleveland's urban forest was assessed using 25 *Indicators of a Sustainable Urban Forest*, organized into three categories: the trees, the players, and the management approach.

In the following pages, a matrix for each category lists each indicator, including overall industry performance standards and objectives as well as Cleveland-specific data. Cleveland's performance level in each indicator is highlighted in green. Discussions of findings within each category are described in the text on the facing page.

The Trees

The Trees category includes indicators related to the status of the tree resource itself, including knowledge of that resource.



The Players

The Players category evaluates the necessary involvement and collaboration of stakeholders at all levels.



The Management Approach

The Management Approach category evaluates availability and use of different tools and/or actions to improve and sustain the urban forest resource.



The Trees

Table 7. Indicators of a Sustainable Urban Forest: The Trees Category

Indicators of a Sustainable Urban Forest	Cleveland Today	Standard Performance Levels (Cleveland assessed level is highlighted in green)			Suggested Objective and/or Industry Standard
		Low	Moderate	Good	
Relative Urban Tree Canopy	Tree canopy cover is 27% of what is possible. No desired canopy goals have been set.	Existing canopy cover is <50% of what is desired (or possible) for the entire city.	Existing canopy cover is 50% to 75% of what is desired (or possible) for the entire city.	Existing canopy cover is above 75% of what is desired (or possible) for the entire city.	Achieve the desired tree canopy cover according to goals set for the entire city neighborhoods. Alternatively, achieve 75% of the total canopy possible for the entire city and in each neighborhood.
Size and Age Distribution	Age distribution is estimated to be unevenly distributed, with the majority of trees in the younger size classes*: 0–8" DBH: 59% 9–17" DBH: 21% 18–24" DBH: 11% Over 24" DBH: 9%	Age distribution is either evenly distributed across size classes or the majority of trees fall into the mature size classes (greater than 8" DBH).	Age distribution is unevenly distributed, with the majority of trees in the younger size classes (0–8" DBH).	Age distribution is generally aligned with the ideal standard diameter classes: 0–8" DBH: 40% 9–17" DBH: 30% 18–24" DBH: 20% Over 24" DBH: 10%	Establish a genetically diverse population of publicly owned trees across the entire city and for each neighborhood. Tree populations should be comprised of no more than 30% of any family, 20% of any genus, and 10% of any species.
Condition of Publicly Owned Trees (trees managed intensively)	80% of the inventory contains incomplete data.	Data on tree condition and risk is unavailable, insufficient, or outdated.	Information is current but not comprehensive. Or sample inventory is used to estimate tree condition and risk.	Information from a current, GIS-based, complete public tree inventory is used to indicate tree condition and risk.	Possess a detailed understanding of tree condition and potential risk of all intensively managed, publicly owned trees. This information is used to direct maintenance actions.
Condition of Publicly Owned Natural Areas (trees managed extensively)	No reliable data available.	No current information about publicly owned natural areas.	Publicly owned natural areas are identified in a "natural areas survey" or similar data.	Information from a current, GIS-based, complete natural areas survey is utilized to document ecological structure, function, and usage patterns.	Possess a detailed understanding of the ecological structure and function of all publicly owned natural areas (such as woodlands, ravines, stream corridors, etc.), as well as usage patterns.
Species Diversity	Street trees are estimated to exceed species diversity thresholds for Norway maple (15%) and genus diversity thresholds for maples (31%). Condition of trees on parks is unknown.	Fewer than five species dominate the entire tree population citywide.	No species represents more than 20% of the entire tree population citywide.	No species represents more than 10% of the entire tree population citywide.	Establish a genetically diverse population of publicly owned trees across the entire city and for each neighborhood. Tree populations should be comprised of no more than 10% of any species, 20% of any genus, and 30% of any family. Use native species where possible and practical and avoid invasive species.
Species Suitability	No reliable data available.	Less than 50% of trees are considered suitable for the site, or no data available.	50% to 75% of trees are considered suitable for the site.	More than 75% of trees are considered suitable for the site.	Establish a tree population suited to the urban environment and adapted to the overall region. Species are matched to the site using the "Right Tree for the Right Place" concept.

The first six indicators of a sustainable urban forest focus on the trees themselves (Table 7). Unfortunately, 80% of Cleveland’s public tree inventory is outdated; there has been very little recent analysis or data collection on this resource. However, Cleveland does have a regional 2013 urban tree canopy assessment, implemented by the Cuyahoga County Planning Commission in partnership with ODNR and Metroparks. The urban tree canopy assessment has found that tree canopy is 19%, and that relative canopy (today’s canopy compared to total canopy possible) is 27%. Both are low by most standards. No desired standard or goal has yet been set for Cleveland by its stakeholders.

The city had an inventory conducted in the 1990s, although the data were not maintained between 2000 and 2013. Thus, today’s inventory does not wholly represent current conditions. The lack of an updated tree inventory means there is insufficient information on the condition of public trees (size/age, condition, species diversity), which is the basis on which many decisions should be made for public tree management. Without a more comprehensive inventory, there is little possibility for a long-term, sustainable, and effective tree management plan.

Condition and risk are primary drivers in day-to-day public tree management. Current reports by those working in the field each day point to a state of disrepair (poor condition). Thus the management approach is primarily reactive with little to no proactive tree care.

The diversity of species, size distribution, and proper placement of Cleveland’s public trees can be considered predictors of what future tree canopy in the city will look like. These predictors assist in driving the management decisions of today to ensure canopy for years to come. Poor species selection, planting practices, and inadequate growing space translate to short-lived, high-maintenance trees. Likewise, poor size distribution translates to an unsustainable population of trees. Species diversity also encompasses planting native trees where appropriate and avoiding planting known invasive trees identified by state and federal government.

A lack of information translates to an inability to make solid data-driven management decisions. Cleveland and its partners are operating at a low performance level based on declining canopy, lack of desired canopy goals, and a lack of knowledge on the status of the resource.

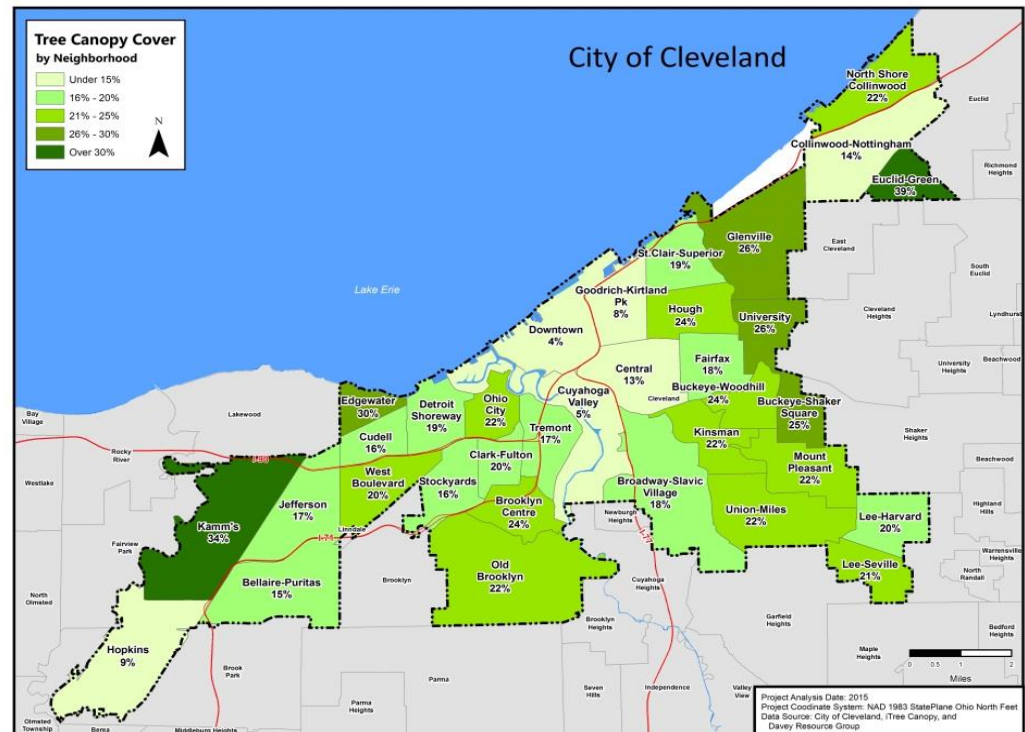


Figure 16. Tree canopy cover by neighborhood. Source: Cuyahoga County Planning Commission

The Players

Table 8. Indicators of a Sustainable Urban Forest: The Players Category

Indicators of a Sustainable Urban Forest	Cleveland Today	Standard Performance Levels (Cleveland assessed level is highlighted in green)			Suggested Objective and/or Industry Standard
		Low	Moderate	Good	
Neighborhood Action	Watershed groups CDC's and other NGOs lead grassroots efforts, although most are working independently.	Little or no citizen involvement or neighborhood action.	Some active groups are engaged in advancing urban forestry, but no unified set of goals or priorities.	The majority of all neighborhoods are organized, connected, and working towards a unified set of goals and priorities.	Citizens understand, cooperate, and participate in urban forest management at the neighborhood level. Urban forestry is a neighborhood-scale issue.
Large Private & Institutional Landholder Involvement	There is currently no outreach to large private landholders.	Large private landholders are unaware of issues and potential influence in the urban forest. No large private land management plans are currently in place.	Education materials, advice are available to large private landholders. Few large landholders or institutions have management plans.	Clear and concise goals are established for large private landholders through direct education and assistance programs. Key landholders have management plans.	Large, private, and institutional landholders embrace citywide goals and objectives through targeted resource management plans.
Green Industry Involvement	Some green industry involvement (i.e., WLRC and Holden holding tree stewardship training program) and st from ODNR.	Little or no involvement from green industry leaders to advance local urban forestry goals.	Some partnerships are in place to advance local urban forestry goals, but more often for the short term.	Long-term committed partnerships are working to advance local urban forestry goals.	The green industry works together to advance citywide urban forest goals and objectives. The city and its partners capitalize on local expertise.
City Department and Agency Cooperation	Urban forestry is not incorporated in the planning stages of projects. No clear goals set, minimal buy-in at upper levels. Urban forestry advanced after other priorities.	Conflicting goals and/or actions among city departments and agencies.	Informal teams among departments and agencies are communicating and implementing common goals on a project-specific basis.	Common goals, collaboration occur across all departments and agencies. City policy and actions implemented by formal interdepartmental working teams.	All city departments and agencies cooperate to advance citywide urban forestry goals and objectives.
Funder Engagement	Though the City and local nonprofits funded this plan, there are few long-term projects in place. City funding is inadequate due to the large maintenance backlog.	Little or no funders are engaged in urban forestry initiatives.	Funders are engaged in urban forestry initiatives at minimal levels for short-term projects.	Multiple funders are fully engaged and active in urban forestry initiatives for short-term projects and long-term goals.	Local funders are engaged and invested in urban forestry initiatives. Funding is adequate to implement a citywide urban forest management plan.
Utility Engagement	No partnerships are in place with utilities, as urban forestry goals have not been determined.	Utilities and city agencies act independently of urban forestry efforts. No coordination exists.	Utilities and city agencies have engaged in dialogues about urban forestry efforts in capital improvement and infrastructure projects.	Utilities, city agencies, and other stakeholders integrate and collaborate on all urban forestry efforts, including planning, site work, and outreach/education.	All utilities are aware of and vested in the urban forest and cooperate to advance citywide urban forest goals and objectives.
Public Awareness	The general public perceives trees as a nuisance and financial drain, likely a result of the problems trees create (i.e., sidewalk heave, leaf pickup).	Trees are generally seen as a nuisance and, thus, a drain on city budgets and personal paychecks.	Trees are generally recognized as important and beneficial.	Trees are seen as valuable infrastructure, vital to the community's well-being, and recognized for the unique services it provides to the community.	The general public understands the benefits of trees and advocates for the role and importance of the urban forest.
Regional Collaboration	No current regional activity.	Little or no interaction between neighboring communities and regional groups.	Neighboring communities and regional groups share similar goals and policy related to the urban forest.	Regional urban forestry planning, coordination, and management are widespread.	Neighboring communities and regional groups are actively cooperating to advance the region's stake in the urban forest.

The next are eight indicators of a sustainable urban forest center on the players, as listed in Table 8. Many groups have a stake in the success of Cleveland’s urban forest, but there are countless untapped players interested in maximizing the benefits of trees in the interest of Cleveland’s success as a community. There is neighborhood level engagement through the network of community development corporations (CDCs), Western Reserve Land Conservancy, The Holden Arboretum, Cuyahoga River Restoration, and a number of watershed groups. However, many are individuals and agencies working independently and, thus inefficiently, without a unified vision.

The city has multiple departments that influence the urban forest, but coordination is minimal. City budget levels have remained level since 2005, departments are stretched thin, and trees are currently a low priority compared to other city infrastructure such as roads, curbs, and sidewalks.

Funders are somewhat engaged in urban forestry projects; there is potential for them to be more engaged through the creation of larger community vision and goals. Utilities and the larger green industry have expressed interest but have not yet been tapped into in terms of contributing to this effort. The various potential opportunities and partnerships include:

- **Utility companies** may be interested in partnering with the community on tree planting and maintenance.
- **Large private landowners** make up the lion's share of land in Cleveland, more than just multi-family residential complexes, campuses, hospitals, industry, etc. There are numerous outreach opportunities to share the importance of trees or the state of the urban forest. Large private landowners are places where Cleveland can quickly make direct and substantial impacts.

- **Green industry:** The region of northeast Ohio has a wealth of industry leaders (nurseries, The Holden Arboretum, Western Reserve Land Conservancy, Ohio Department of Natural Resources, etc.), and a large population of landscape, tree, or grounds management companies that do large amounts of work in the area. There is potential to invite them to be more involved.

The general public may broadly view trees as a nuisance. This is attributed to lack of education on the benefits trees provide as well as the tangible negative issues trees can pose. For example, residents must pay for a portion of sidewalk repair from trees, and there is currently only limited leaf pickup offered to Cleveland residents. Combined with the presence of large shade trees incorrectly planted under utility lines that get severely pruned, public perception of trees is often a negative one. These perception issues are a hurdle that needs to be overcome.

Cleveland and its partners are operating at a low to moderate performance level based on lack of formal engagement, education, and cooperation around urban forestry issues. With a unified vision or cooperation plan, the aforementioned assets can lead to effective partnerships.

Table 9. Indicators of a Sustainable Urban Forest: The Management Approach Category

The Management Approach

Indicators of a Sustainable Urban Forest	Cleveland Today	Standard Performance Levels (Cleveland assessed level is highlighted in green)			Suggested Objective and/or Industry Standard
		Low	Moderate	Good	
Tree Inventory	Inventory from 1990s was not updated for 13 years. Though in process of updating now, data on condition and risk level of trees are now outdated and inaccurate. There is a lack of data on the intensively managed trees.	No inventory or out-of-date inventory of publicly owned trees.	Partial (geographically) or sample-based inventory of publicly owned trees.	Complete, GIS-based inventory of publicly owned trees.	Comprehensive, GIS-based, current inventory of all public trees to guide management, with mechanisms in place to keep data current and available for use. Data allow for analysis of age, condition, risk, diversity, and suitability.
Canopy Assessment	An urban tree canopy assessment was conducted in 2013 by Cuyahoga County Planning Commission.	No tree canopy assessment.	Sample-based canopy cover assessment.	High-resolution tree canopy assessment using aerial photographs or satellite imagery.	Accurate, high-resolution, and recent assessment of existing and potential city-wide tree canopy cover. Regularly updated and available for use across various agencies and/or disciplines.
Equitable Distribution	There are gaps between the location of the urban forest and the neighborhoods that need urban forest benefits the most. Equitable distribution of trees and benefits is actively discussed, but not currently a central component of the management program.	Tree planting and public outreach and education is not determined by tree canopy cover or benefits.	Tree planting and public outreach and education is focused on neighborhoods with low tree canopy.	Tree planting and public outreach and education is focused in neighborhoods with low tree canopy and a high need for tree benefits.	Ensure that the benefits of tree canopy are available to all, especially for those most affected by these benefits. Achieve low variation between tree canopy and equity factors citywide by neighborhood.
Management Plan	No formal, written plan exists. The city's public tree management program is largely reactive.	No urban forest management plan exists.	A plan for the publicly owned forest resource exists but is limited in scope, acceptance, and implementation.	A comprehensive plan for the publicly owned forest resource exists and is accepted and implemented.	Existence and buy-in of a comprehensive urban forest management plan to achieve city-wide goals. Re-evaluation is conducted every 5 to 10 years.
Risk Management Program	Municipal tree work is primarily risk-driven, but no formal risk management plan exists. Risk is used to prioritize removal and pruning work based on Forestry Division inspections.	Request-based, reactive system. Data on the condition of publicly owned trees are largely unknown.	There is some degree of risk abatement thanks to knowledge of condition of publicly owned trees, though they are generally still managed as a request-based reactive system.	There is a complete tree inventory with risk assessment data and a risk abatement program in effect. Hazards are eliminated within a set time period depending on the level of risk.	All publicly owned trees are managed for maximum public safety by way of maintaining a city-wide inventory, conducting proactive annual inspections, and eliminating hazards within a set timeframe based on risk level. Risk management program is outlined in the management plan.

Indicators of a Sustainable Urban Forest	Cleveland Today	Standard Performance Levels (Cleveland assessed level is highlighted in green)		Suggested Objective and/or Industry Standard	
Maintenance Program of Publicly Owned Trees (trees managed intensively)	No proactive, cyclical pruning and maintenance program exists. The Forestry Division is focused exclusively on risk-based work.	Request-based, reactive system. No systematic pruning program is in place for publicly owned trees.	All publicly owned trees are systematically maintained, but pruning cycle is inadequate.	All publicly owned trees are proactively and systematically maintained and adequately pruned on a cyclical basis.	All intensively managed, public trees are well maintained to extend longevity and maximize benefits. A reasonable cyclical pruning program is in place, maintenance program is outlined in management plan.
Maintenance Program of Publicly Owned Natural Areas (trees managed extensively)	Municipal parks maintenance is focused on mowing and does very little tree maintenance or ecological enhancement.	No natural areas management plans are in effect.	Only reactive management efforts to facilitate public use (risk abatement).	Management plans are in place for each publicly owned natural area focused on managing ecological structure and function and facilitating public use.	The ecological structure and function of all publicly owned natural areas are protected and enhanced while accommodating public use where appropriate.
Planting Program	Tree planting is funded by the general fund, capital project bonds, and grants. Funding is sporadic. Tree planting activity is a recent focus for a few NGO partners of the city that may be willing to formally support public tree planting agreements.	Tree establishment is ad hoc.	Tree establishment is consistently funded and occurs on an annual basis.	Tree establishment is directed by needs derived from a tree inventory and other community plans and is sufficient in meeting canopy cover objectives.	Comprehensive and effective tree planting and establishment program is driven by canopy cover goals, equity considerations, and other priorities according to the plan. Tree planting and establishment is outlined in the management plan.
Tree Protection Policy	There are currently some policies in place but no strong deterrents attached to these policies. Enforcement is inconsistent or ineffective.	No tree protection policy or policies exist but on an informal basis only.	Some policies are in place to protect trees, but the policies are not well enforced.	Protections policies ensure the safety of trees on public and private land. The policies are enforced and supported by significant deterrents and shared ownership of city goals.	Comprehensive and regularly updated tree protection ordinance with enforcement ability is based on community goals. The benefits derived from trees on public and private property are ensured by the enforcement of existing policies.
City Staffing and Equipment	Staffing is solely focused on operations. There have been no high-level urban forest advocates or decision-makers within city ranks. Existing positions are filled with qualified arborists, with some professional development. Department equipment and vehicles are not dependable.	Insufficient staffing levels, insufficiently trained staff, and/or inadequate equipment and vehicle availability.	Certified arborists and professional urban foresters on staff have some professional development, but are lacking adequate staff levels or adequate equipment.	Multi-disciplinary team within the urban forestry unit, including an urban forestry professional, operations manager, and arborist technicians. Vehicles and equipment are sufficient to complete required work.	Adequate staff and access to the equipment and vehicles to implement the management plan. A high level advocate, decision-maker or planning professional, strong operations staff, and solid certified arborist technicians.
Funding	Urban forestry is funded from the stagnant general fund and sporadic grants. Low level of funds cause a request-based reactive system.	Funding is for reactive work only in the absence of a management plan.	Funding levels allow for risk management and some proactive management and planting based on a management plan.	Dynamic, active funding from engaged private partners and adequate public funding are used to proactively manage and expand the urban forest.	Appropriate funding in place to fully implement a comprehensive urban forest management plan.

The last eleven indicators of a sustainable urban forest center on the management approach to public trees is shown in Table 9.

The City of Cleveland has a high-resolution recent tree canopy assessment, some tree protection policies, and certified arborists on staff. However, the canopy assessment data are marginally utilized, tree protection policies need to be updated, polished, and enforced, and arborists need more training. The tree maintenance program needs to be updated so that it reflects immediate pruning and removal needs based on a complete comprehensive tree inventory.

Funding for the city’s urban forestry program is currently inadequate to handle the large maintenance backlog. However, once the backlog is eliminated, the current budget *may* be adequate for ongoing and proactive pruning and removal needs, though without a tree inventory, it is impossible to make that determination. The lack of dependable inventory data makes tree management extremely difficult. Initial calculations to assess the city’s urban forestry budget used APWA statistics and guidelines and should be considered a generalization until complete tree inventory data are available. Full calculations and methodology can be found in *Appendix D* under *Urban Forestry Budget Calculations*. An inventory is the foundation of a city’s tree management plan, risk management program, tree maintenance program, and planting program. Without comprehensive data on the condition of public trees, the city is exposed to a high risk of liability, and protection of public safety is tenuous.

According to the available inventory data, there are large gaps between areas receiving substantial benefits from higher canopy cover and those areas receiving few benefits. Equity issues like this one are difficult to address without public tree inventory data.

A tree ordinance is in place. The ordinance includes some tree preservation and protection, but it is outdated and lacks significant consequences for neglect. Fines range from only \$5 to \$50, which is probably too small for people to follow or enforce. A copy of the ordinance can be found in Appendix E.

The city tree commission is currently inactive, so there is little to no public input on the management process or tree resource (a copy of the tree commission ordinance can be found in Appendix E). High level advocacy and planning is missing. The city has arborists on staff, but arborists are focused on day-to-day operations and often working with failing equipment. Urban forestry work connected to capital improvement projects is often poor quality due to the lack of specifications on tree selection, installation, and establishment.

Based on lack of current data, tools, policies, and plans to drive the management of public trees, Cleveland and its partners are operating at a low performance level with respect to management approach.

The Way Forward

The need for trees and the benefits they provide is clear. Now that Cleveland's urban forest has been assessed, the next step is to look ahead and identify the vision for the future.

The Vision

Through partnership, Cleveland will once again be known as the Forest City. Residents from every neighborhood in Cleveland will experience the many benefits of a healthy and prosperous urban forest.

Cleveland's vision for a healthy urban forest today and into the future requires.

- Collaborating effectively amongst a variety of stakeholders
- Prioritizing trees in government, nonprofit, and the business sectors
- Implementing best practices in urban forestry
- Increasing tree canopy and the benefits it provides
- Ensuring that benefits from trees are equitably distributed
- Leveraging the economic advantages of urban trees
- Engaging people to revitalize neighborhoods through community forestry

This vision must ultimately be sustainable – financially, politically, and socially – and carefully and practically considered through the lens of today's realities in Cleveland:

- The city is stretched thin financially.
- The urban forest spans across both private (80%) and public (20%) lands.

With these realities in mind, the path to moving forward is clear: ***Only through partnership can Cleveland rebuild its urban forest.***

Progress is possible and realistic. Cleveland has a significant number of active, qualified, and willing potential partners in the urban forestry industry. While the city does not have the financial means to implement many of the actions in this report, it does have the power to lead, and clear obstacles for tree preservation and work by partners.

Because partnership is the key to success in Cleveland, each action considers not only *what* needs to be done, but also *by whom* can it be realistically accomplished, and *how* we can move forward together.

Three Goals/Ongoing Challenges

Three ongoing fundamental challenges have determined the goals for this plan. These are the major solutions that will help Cleveland achieve a healthy, vibrant, and sustainable urban forest. Once achieved, the following three goals will pave the way for real and sustainable progress in rebuilding the urban forest:

- Goal #1: A shift in thinking to acknowledge trees as critical community infrastructure.
- Goal #2: Reverse the trend of canopy loss.
- Goal #3: Assume full stewardship for the tree infrastructure.

Actions are based off of these challenges and illustrate the broad changes required for any real progress to be made in Cleveland. Only by addressing all three of these challenges can Cleveland make any sustainable progress in rebuilding the 'Forest City'.

Goal #1: A Shift in Thinking to Acknowledge Trees as Critical Community Infrastructure

A vibrant city like Cleveland can benefit from progressive thinking on the role of the urban forest. By shifting thinking to prioritize trees as vital infrastructure, stakeholders will perceive the urban forest as a driver for continued revitalization.

Trees used to be central to Cleveland’s identity and their health was a higher priority. By engaging the public, the business community, city departments, and elected officials in revitalizing our neighborhoods through urban forestry, Cleveland can begin to realize the vision set forth in this plan. By providing clear goals and a unified vision, city departments can increase tree canopy and the health of tree infrastructure.

Through education, stakeholders will recognize the value and solutions trees provide to the urban environment (often at a fraction of the cost of man-made solutions) and will become a more valued community infrastructure.

Trees pose an economic advantage to communities.

Goal #2: Reverse the Trend of Canopy Loss

Based on the urban tree canopy data calculations, Cleveland is losing an estimated 97 acres of tree canopy, or just over 6,400 trees (public and private) each year. At this rate, canopy cover will drop from 19% to only 14% of Cleveland by 2040 as seen in Figure 17 (methodology for projections can be found in Appendix D).

Looking further back in history (see *About Cleveland*), the population of street trees has dropped by 100,000 trees since the 1940s (a 45% decrease). This equates to an average of almost 1,500 public street trees lost per year (not factoring in new plantings).

Regardless of which data are used, there is a clear trend of ongoing loss. Canopy loss equates to significant losses in air and water quality, property value, stormwater management, and many other important services provided by trees (see *Why Trees*). Reversing this ongoing canopy loss is critical to the well-being of Cleveland residents and the future viability of the city.

In general terms, reversing canopy loss can be achieved in three ways:

- Caring for existing trees
- Planting and establishing more trees
- Ensuring a supportive environment for care and planting

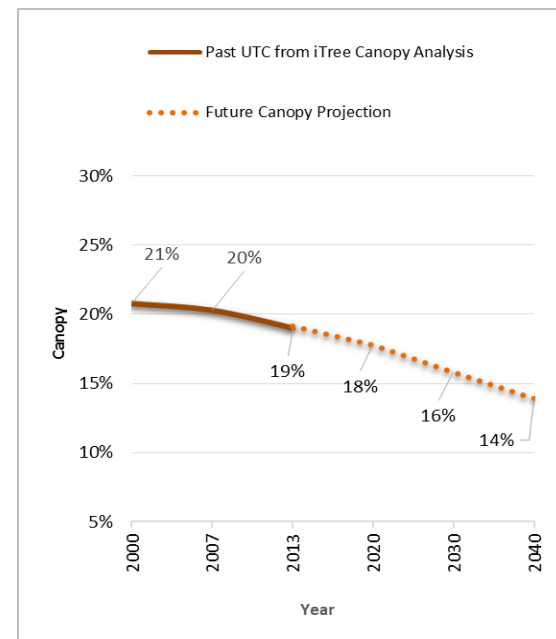


Figure 17. Cleveland canopy – past and future projections – if no action is taken

1. Care for Existing Trees

Cleveland's first and most important priority is to care for existing trees. The lion's share of benefits comes from mature trees, so ensuring that trees grow to a large size is essential. Second, the loss of benefits resulting from the removal of a mature tree cannot be immediately replaced (see inset at right). Third, maintenance of public trees involves risk assessment and directly impacts public safety, which is always a priority. Finally, the significant backlog in public tree maintenance and care could result in even higher rates of annual loss than currently reported, and tree canopy loss could drop even lower than 14%. For these reasons, caring for existing trees needs should be a primary focus.

2. Plant and Establish Additional Trees

Planting and establishing more trees seems obvious; however, there are two important points to note. First, as stated earlier, the majority of the urban forest in Cleveland is on private land. Planting needs to occur on both private and public land. Second, all new tree plantings must include a plan and funding arrangement in place for the first 5–7 years of care. If long-term care isn't planned, planting new trees may be a wasted investment.

3. Ensure a Supportive Environment for Care and Planting

Planting and maintaining tree canopy can be difficult without supportive policies and partnerships. Policies must protect public trees and support the work of partners. They must also incorporate specifications on best practices in urban forestry, institute penalties for non-compliance, and include support for enforcement.

The Higher Priority of Mature Trees

It is no surprise that larger trees provide more services: they intercept more stormwater, remove more air pollution, provide more energy savings, and sequester more carbon. However, it is important to understand that this increase in services is exponential.

Consider the air pollution benefits alone: large healthy trees (>30" DBH) have been shown to remove 70 times more air pollution annually than small healthy trees (<8" DBH) (Marritz 2012).

In another example, we can examine the number of new trees it would take to replace one mature tree. According to the National Tree Benefits Calculator, between 10 and 24 new 3"-caliper swamp white oaks would be needed to make up for the benefits lost from just one 30" DBH swamp white oak (range depends on which benefit is being matched).

Because part of Cleveland's vision is to maintain and enhance the benefits trees provide to the community, it is more critical to prioritize care for existing trees than to replace them with newly planted trees.

Goal #3: Assume Full Stewardship for the Tree Infrastructure

Trees on public property are city infrastructure. Just as Cleveland invests in assessment of its road conditions, the city also needs to invest in assessments of its public tree infrastructure. As it stands today, property owners in Cleveland often refuse a street tree planting in front of their property because of the perceived nuisance it creates: autumn leaf cleanup and disposal is difficult (minimal leaf pickup by the city), expensive sidewalk issues arise (paid by property owner), and if the tree is removed by the City, the adjacent property owner is left with the stump grindings to dispose of and a void to fill with soil to bring the area back up to grade.

Although the city holds the responsibility to prune public trees, the current backlog of required maintenance results in poor response rates to citizen requests, perpetually reactive maintenance, and many trees left unmaintained altogether.

Currently, city budgets are stretched thin, maintenance is backlogged, and the city touches only 2,000 out of the 120,000 public trees in Cleveland each year. This means that the urban forestry department spends the majority of its resources doing reactive work. Few funds are left available for proactive care and related forestry needs like leaf pickup service and stump chip removal. Reactive forestry also typically leads to higher rates of storm damage.

Acquiring additional city funding may take time, but it is still possible to take full responsibility for the infrastructure in its entirety by using existing resources, creating partnerships, and developing new revenue streams. There are some aspects of urban tree care for which the city will always need to be responsible (public safety, utilities); however, some work is well suited for partners to initiate. Oftentimes, these partners can do the work better than a municipality (described further in Action #1). A new revenue stream of violation fees could start funding to address these issues and improve recognition of trees as necessary tools of a thriving urban environment. Funding options are further explored in Action #3.

In the end, cities lead communities by example (whether they mean to or not). The city must take financial accountability and control of its infrastructure.

Progress is Possible

Making the urban forest a priority does not mean huge outlays of new funds. Other cities have made trees a priority despite funding challenges.

The act of agreeing on canopy as a priority from the top down within the city will have an impact. Charlotte, North Carolina assigned the responsibility of maintaining and growing the tree canopy to the city engineer. All project planning teams now include a tree/landscape expert, resulting in significant savings by doing things right the first time (Meachum 2014).

And it *is* possible to get caught up on large backlogs in maintenance. In the late 80s/early 90s, the City of Cincinnati had no arborist, no forestry staff, and trees were cut down to 8' trunks when needed by the highway department. Over 1,000 "tall trunks" were left behind, along with thousands of trees that had not been pruned. After a front footage assessment was instituted, the city spent the next 10–15 years successfully catching up on maintenance (Gulick 2015).

The Plan of Action

Short-Mid Term Plan. Based on the vision and goals, the nine actions were identified for the next five years to rebuild the urban forest. These recommended actions detail the scope of work required of all partners to achieve the goals of this plan.

Many actions include multiple smaller steps or recommended projects, which have been detailed in an *Action Sheet*. Each *Action Sheet* details the steps to complete each task and defines the partner responsible for leading that effort (see screen shot below). The *Action Sheets* were designed to be working documents for the new coalition to guide and track implementation progress.

The individual steps within each action have also been compiled in an **achievement schedule**, based on the target completion dates specified in the Action Sheets.

Action Sheet Snapshot

Cleveland Tree Plan Action Sheet <small>A roadmap for progress</small>		Action #1: Establish a Unified Voice, Formalize Partnerships		LEAD AGENCY / OWNER: Mayor's Office of Sustainability	
		<p>There are many active players in Cleveland and most are working independently on short-term projects. Formation of a coalition of urban forest stakeholders will serve to create a unified voice and direction for all urban forestry efforts.</p> <p>The city has a substantial backlog in tree maintenance, which can have serious impact on public safety. A formal partnership between the city and the coalition has the potential to reduce some of the city's workload, freeing up time and resources for the city to address the maintenance backlog. Prerequisite: None</p>			
Steps	Resources Required	Suggested Participants	Target Completion Date	Progress Tracking	
<input type="checkbox"/>	1. Build an advisory team for the formation of the coalition, starting with Tree Plan team plus a few additional key stakeholders.	Time	City (Sustainability, Urban Forestry, Planning, Capital Projects), Western Reserve Land Conservancy, Holden Arboretum, Cleveland Neighborhood Progress, LAND Studio, NEORS, First Energy, Dominion, NOACA, NEORS, Metroparks	End of 2015	
<input type="checkbox"/>	2. Define how the coalition is to be set up, funded, and staffed. The coalition could take many forms, from a collection of organized stakeholders to a brand new non-profit to a municipal tree commission. However, it is set up, there needs to be lead agencies from both the public and private sectors that are committed to urban forestry as part of their mission and willing to fundraise.	Time	Same as above	End of 2015	
<input type="checkbox"/>	3. Map out coalition's program of work, using the goals and recommendations in this plan as the foundation. Gauge interest of other potential participants.	Time	Same as above	Q1 2016	
<input type="checkbox"/>	4. Determine interest of city in formal agreement, start discussions between coalition, city leadership, and/or lead agencies.	Time	Office of Sustainability to start discussion with City leadership. City Legal Department, Public Works/ Urban Forestry, Coalition Members.	Q1 2016	
<input type="checkbox"/>	5. Define clear responsibilities for each partner, work out particulars of agreement. Determine what groups are authorized to work on public property on behalf of this plan, and in what ways the city supports them.	Time	Coalition members, as will be defined in Steps 1, 2 & 3.	Q1 2016	
<input type="checkbox"/>	6. Formalize agreement with city.	Time, Legal Services	Legal, Coalition members as will be defined in Steps 1, 2 & 3.	Q2 2016	

Long Term Plan. Implementation progress and improvements in performance should be reevaluated every five years using the achievement schedule and the 25 indicators of a sustainable urban forest. The achievement schedule provides a gauge to measure progress in overall plan implementation, while performance ratings in the 25 indicators can be reassessed to measure improvements.

A ROADMAP FOR REBUILDING

Action #1: Establish a unified voice/formalize partnerships

Owner: Mayor's Office of Sustainability

Action #2: Develop and implement an outreach and education strategy

Owner: Western Reserve Land Conservancy

Action #3: Develop and implement a funding plan

Owner: Mayor's Office of Sustainability & Cleveland Neighborhood Progress

Action #4: Complete a comprehensive tree inventory

Owner: City Public Works

Action #5: Develop and implement a management plan for city-owned trees

Owner: City Public Works

Action #6: Undergo an operational review

Owner: City Public Works

Action #7: Establish a canopy goal, plan for canopy updates

Owner: Mayor's Office of Sustainability

Action #8: Institute policy changes supportive of urban forestry

Owner: City Planning & City Public Works

Action #9: Plant with a purpose

Owner: Cleveland Neighborhood Progress & Western Reserve Land Conservancy

LAND Studio and Holden Arboretum to assist in all actions.

Action #1: Establish a Unified Voice/Formalize Partnerships

The City of Cleveland needs a central, unified voice for trees, and the city needs partnerships to make headway in rebuilding the urban forest. For these reasons, the first action is to initiate the formation of a coalition of stakeholders that can then partner with the city. This first step is critical to making realistic progress and serves as the foundation for many other actions in this plan.

Part I – Establish a Unified Voice. Cleveland has a number of entities currently working to improve the urban forest; however, most are acting independently and with varying goals and messages. For example, in any one day in Cleveland, trees can be planted by contractors as part of a capital improvement project; urban forestry staff arborists are out pruning trees and managing contractor tree work; First Energy is pruning and sometimes removing trees around power lines; Dominion is working under sidewalks and in some cases removing trees; Holden Arboretum is holding education and citizen scientist programs that get the public involved in trees and conservation; the Western Reserve Land Conservancy is training tree stewards to care for newly planted trees; multiple watershed groups are working to plant trees along streams to improve water quality; community development corporations are helping to identify planting sites for new trees in efforts to revitalize their neighborhoods; Cleveland Metroparks is working to increase trees in areas around their parks to improve the quality of water flowing into the parks; and the NEORSD is implementing green infrastructure projects as part of stormwater reduction efforts. *This is not even a complete list of active players in the urban forest.*

All of these efforts are important, and Cleveland is fortunate to have so many active entities. However, many independent efforts moving in multiple directions with multiple messages have watered down the movement and serve to weaken any sense of a central campaign or movement. One unified voice is critical to building an effective campaign that fosters progress in the urban forest. That voice could take shape through a formal coalition of stakeholders already active and committed to urban forestry in Cleveland.

Public/Private Partnerships in Other Cities

Many cities are already working in partnership with local players. This is not a new concept in urban forestry and partnerships have been proven to be effective as shown in the following three case studies:

Pittsburgh. Tree Pittsburgh and The Western Pennsylvania Conservancy are the primary partners helping to supplement the City's Forestry Division budget through tree purchase and planting programs and a volunteer stewardship program for young tree maintenance services.

Indianapolis. The non-profit Keep Indianapolis Beautiful (KIB) is partnering with the City of Indianapolis to plant 100,000 trees. KIB's agreement with the city to manage tree planting has been in place since 2011. KIB installs the trees and provides care for the first 3–5 years after installation. To date, KIB has planted 9,500 trees with a 89% success rate (11% mortality) (Kincius 2015) (Faris 2015).

Washington, D.C. Casey Trees is a Washington, D.C. non-profit started in 2002 with the goal of restoring and protecting urban tree canopy in the city. The organization supports D.C.'s municipal urban forestry department by planting trees on public and private lands not serviced by the city. Each year, the city plants over 2,500 trees with the end goal of achieving 40% canopy by 2032.

This new voice would serve as the hub for everything related to trees in Cleveland, both public and private. The collective voice would be well suited to spearhead the targeted roll-out of this tree plan to a variety of constituents: neighborhoods, CDCs, elected officials, city leadership (chiefs and staff), large landholders, landscape contractors, utilities, funders, and more. A central website could be built to provide the public all of the information they might need or want—who to contact for utility/tree issues, how they can get a tree, who to call with questions about their tree, how to start planting in their neighborhood, how to identify a place to access urban tree canopy cover rates and benefits, etc. A full list of recommended activities for this coalition can be found in Action #2.

Part II – Define and Formalize Partnership Roles and Responsibilities. Within Cleveland’s fiscal environment, the only sustainable way to achieve urban forestry goals is through public/private partnership. For this reason, the second part of this action calls for the coalition and the City of Cleveland to formally define and agree on roles and responsibilities.

Suggested City Role: With the substantial backlog in tree maintenance, planting new trees is not a sensible task for the city. For this reason, it is recommended that the city stop planting new trees and focus primarily on caring for existing trees. Any planting funds should be diverted wholly to maintenance. In addition, the city should work to ensure a supportive environment for tree preservation and partner activity. This can be done through multiple policy changes discussed in Action #8.

Suggested Coalition Role: Ongoing tree planting and establishment is still needed to keep the urban forest sustainable in the long term. This is where the coalition can assist by assuming all tree installation responsibilities along with multiple years of new tree care. After the initial establishment of the new trees, established trees can then be folded into a proactive 5- to 10-year pruning cycle for all trees in the city. A coalition of organizations is better suited to do this type of work for a number of reasons. Raising funds is often easier for tree plantings (versus tree maintenance), and tree planting and establishment programs are appealing to the public and can be done with minor equipment needs. Tree steward training, which includes tree care for the first years during establishment, is already underway by WRLC and Holden; so far, more than 300 people are in the pipeline and working towards certification.

Action #2: Develop and Implement an Outreach and Education Strategy

Because there has been no coordinated advocacy for trees, there have been missed opportunities for large-scale outreach, education, and fundraising. This is a broad action that includes a number of individual projects (listed below) and would be likely spearheaded by the new coalition discussed in Action #1.

Develop Roll-out Strategy for Tree Plan. This plan means to get all players working in concert (if not in partnership). A detailed and targeted grassroots roll-out strategy to explain the plan and implementation opportunities is critical. This should not be a blanket one-message-fits-all effort. Each group of players or constituents needs to be approached in a targeted way for inclusion. CDCs, small neighborhood clubs, and neighborhood planners can review the plan at the grassroots level. Elected officials should be officially briefed as appropriate. City chiefs, and department heads need an update on the plan and a preview of what types of projects or change are likely to be coming down the pipe. Large private landholders can be approached in a peer-to-peer meeting for an introduction to the plan and how they can participate. Landscapers and property managers should be contacted directly. General advertising/marketing campaigns are needed to reach the business community and private citizens. Each constituent group needs to know the vision and goals of the new coalition, and how they can get involved and participate.

Craft Effective Messaging. It is recommended to hire a professional PR/marketing firm to assist in the development of messaging and roll-out campaign efforts. Messaging should be developed to be fun and phrased in terms the everyday person understands (not in “tree speak” by tree people). Messaging is needed for education on 1) why trees are important; 2) how trees need to be considered infrastructure; 3) how they save the public money; 4) the importance of tree preservation; and 5) how to care for trees, among other topics. At a minimum, all

participants can then use the same graphics and marketing materials, even if they don’t officially partner on projects or efforts. A talented firm can make this campaign fun and appealing to the public, and targeted to other potential partners.

Lead Fundraising. A coalition of partners can be much more effective in raising funds for urban forestry projects than an individual city or other entities. Funds can be raised not only for tree plantings and stewardship, but also to support the roll-out campaign and larger city projects like raising funds for a tree inventory, establishing a management plan, undergoing an operations review, and providing short-term supplemental assistance to reduce the large backlog in city maintenance work.

Foster Regional Partnerships. Like watersheds, the urban forest and benefits it provides spans across political boundaries. Through this planning process, many regional entities in northeast Ohio expressed interest in participating and fundraising for urban forestry renewal. Potential partners include utilities, regional planning entities, watershed groups, county agencies, and faith-based organizations. This is a real and immediate opportunity for real progress and economies of scale.

Host Annual Tree Summit. An annual meeting of those supporting this effort is a good opportunity to keep the momentum going, share successes, present awards for deserving efforts, find out what’s going on in the city, get more volunteers involved, discuss fundraising efforts and needs, and more. Cuyahoga River Restoration hosted the 2014 Forest Summit: Growing Together in fall 2014 for non-profits, watershed groups, and municipal tree commissions to share challenges, achievements, and provide opportunities for partnerships. Another event like this would provide a great opportunity to kick off the Tree Plan rollout by reviewing the findings, actions, and getting teams together for future works.

Build and Maintain Central Information Hub. Navigating all of the data and activities in Cleveland’s urban forest can be daunting. A central website should be developed that offers a one-stop place for “all things trees” in Cleveland. The site could serve as a starting point to improve customer service, much like the mayor’s help line, with information and links directing users to the right resources and contacts. It could be a resource for Clevelanders with questions about their street trees, park trees, sidewalk issues, utility issues, leaf pickup, and access to canopy cover data to provide information on neighborhood canopy levels. It would be a place to find out more about the urban forest in each neighborhood: what urban forestry activities are going on, how to start a tree planting, whether your neighborhood is part of a MetroPark Ecosite, what benefits do your neighborhood trees provide, etc. It would also provide a starting point for collecting data on the urban forest when applying for funding or developing projects.

Consider Landmark Tree Program. A landmark tree program highlights the value of some of the larger, more significant trees in Cleveland. These types of programs are an effective way to educate residents on the benefits these large trees provide, and would be an important part of developing the public’s appreciation of trees. There are two avenues to implement this program. One is an official city designation with associated code protection (discussed in Action #7 Policy Changes). The other is a more informal appreciation program with no legal implications or requirements. There has already been some talk of revisiting or restarting the Moses Cleveland Trees that have been around for almost 200 years (last inventoried in 1971).

Provide Technical Expertise. Tree planting projects require expertise to ensure that appropriate trees are planted, and planted correctly. Outreach and education is needed on the more technical skills of installations. More than half of Cleveland’s CDCs claimed in a recent survey that they consider tree planting a priority and would consider dedicating a staff person to planting projects; however, almost two-thirds of those CDCs reported little to no knowledge or skills in planting or tree care (WRLC 2015).

Develop a Tree Component to Northeast Ohio Regional Sewer District’s (NEORS) Residential Stormwater Credit Program. NEORS currently has a stormwater credit program in place called “Individual Residential Property Credit”. Homeowners that participate in this program can get a 25% discount off their sewer bill if they install an approved green infrastructure feature (rain gardens, filter strips, on-site water storage, and pervious pavement) on their property. Currently, there is no tree component to this program, although NEORS has expressed interest and willingness to add one. The city and its partners should assemble a proposal to NEORS that aligns with the goals of this plan.

Make Arbor Day a Cleveland Institution. Capitalize and expand upon the Arbor Day celebrations in the City of Cleveland by incorporating the goals and actions of this plan where appropriate.

Action #3: Develop and Implement a Funding Plan

A funding plan should be formally developed between the city and its partners once all actions have associated cost estimates and the public/private partnership is formalized. There are two funding needs to consider: long-term operation funds and shorter term project-based funds. Because Cleveland does not have accurate inventory data, it is not possible at this point to determine the ideal annual funding needed for public tree care operations. However, what *is* known is that the demand for ongoing maintenance combined with the existing backlog of work means city urban forestry department funds are currently inadequate. After the backlog is eliminated, however, current funding levels *may* be adequate for ongoing operations based on initial calculations and comparisons to the American Public Works Association's compilation of national statistics on urban forestry (calculations detailed in Appendix D). Ongoing maintenance is considered long-term operation funding and should be sustainable, while backlog work can be considered a short-term project (3–5 years) and fall into eligibility for grants and other short-term funds.

Short-Term Funds. Short-term/project-based funding may be better suited to be raised through the coalition for both public and private use together. Funding options include:

Grants and Gifts. Though grants and one-time gifts should not be used for ongoing yearly budgets, they can be extremely useful in short-term projects. It is important to consider applying for funds based on the services that trees provide, beyond just forestry sources to fund greenspace projects. For example, government and private grants are often available for air quality, water quality, and energy saving efforts.

Capital Improvement Project Budgets: Capital projects have large comprehensive budgets that have been carefully determined. The city's Rebuilding Cleveland 2015: A Five-Year Capital Improvement Program plan includes funding plans for dealing with emerald ash borer and tree planting in coming years. Tree maintenance, tree preservation, and planting should also be included in road and bridge construction or resurfacing and utility projects.

Long-Term Funds. Securing adequate long-term funding is critical to ensuring a more sustainable urban forestry program. It would also allow the city urban forestry program to evolve from a reactive to proactive program. It is likely that the urban forestry department will always rely heavily on general fund allocations for its operations budget. But these funds can be supplemented by other sources. Funding options include:

Tree Ordinance Revenue. Significant penalties for damage to or removal of public trees should be written into a revised tree ordinance. Revenue generated is deposited into a dedicated tree fund.

Special Assessments: One of the most stable sources of funding for urban forestry programs is a special assessment. Some states authorize cities to assess all property owners for specific public benefits and services such as stormwater and sewer systems, and public trees. The assessment can be levied as a fee per foot of right-of-way frontage or as a percentage of the property value. The same enabling state law restricts the use of this revenue for anything other than maintenance and planting of trees. Special assessments are approved annually by Council with the support of the community.

The Cities of Cincinnati and Toledo, Ohio have a frontage street tree assessment authorized by state and city codes that has been in effect for over 30 years. Cincinnati created and funded their urban forestry program in 1981 through the creation of an annual assessment. Every property owner annually pays \$0.18 per front footage of property, averaging \$7 a year for the average homeowner, and the assessment generates over \$1 million annually for the program.

In Milwaukee, Wisconsin, almost all tree canopy maintenance expenses including cyclical tree pruning, tree planting, and emerald ash borer mitigation activities are now funded by the city's sewer maintenance fee. This practice, first initiated in 2010, recognized the contribution of Milwaukee's urban tree canopy to storm water management while equitably distributing the costs across all property owners including those that are otherwise tax exempt. This funding system resulted from a \$400,000 urban forestry funding cut in the Mayor's 2010 proposed budget. The Common Council wanted to restore those funds. Because they recognized that trees help to mitigate stormwater, the Council voted to fund \$5M in tree maintenance activities in that year through a transfer payment from the Sewer Maintenance Fee (Sivyer 2015).

Taxes. Many cities throughout the U.S. attain funding for urban forestry through special taxes. While new taxes are currently politically unpopular, earmarking a small percentage of existing taxes may be a source of revenue to consider.

St. Louis, Missouri implements a property transfer tax and a sales tax (1/2 cent) to pay for the city's urban forestry program. In Burlingame, California, a portion of a gas tax has provided \$100,000 to the urban forestry's departmental budget in previous years.

Tree Work Permit, Development, and Inspection Fees: These common funding mechanisms can be used for urban forest management, to the extent permitted under state and local codes. Examples include:

Permit and Plan Review and Inspection Fees: Cities often require private developers and businesses to provide funding for plan review and site inspection. Charging for the time and expertise needed to approve permit applications, review plans, and make site inspections might be a viable option to finance additional urban forestry positions.

Development Fees: Landowners in a "benefit area" may be required to pay for a proportionate share of the public facilities required to serve a development. Trees can be considered public facilities, and the costs to plant and care for them can be supported by these fees. Developers could also be required to pay a set amount to support a community's overall urban forestry program, as a cost of doing business within the city limits. The fee could be a percentage of the total project cost, based on the number of housing units built, or based on the area of land being developed.

Compensatory Payments and Environmental Fines: Trees on public land are public property, and the cities should be compensated for the loss or damage to public property. If tree damage or loss occurs due to a development project, vehicular accident, vandalism, private utility work, etc., then the responsible party should be required to pay for the appraised or replacement value or repair costs. This source may not generate a great deal of money, but it is a legitimate and often under-pursued source of funds. Generally, compensation is collected from the insurance company of the person/agency responsible for the damage or directly from the business that caused the damage to public trees. Compensation funds can be used to remediate the specific damage or for other legitimate urban forestry functions. Environmental fines can be another source of legitimate funding. Since the enactment of federal and state clean water and air legislation, companies in violation of those laws are often required to pay significant sums through environmental court fines. By coordinating with the enforcement agency, all or a portion of those fines can be directed to the urban forestry program.

Atlanta, Georgia assesses penalties for tree damage and removal with steep fines for violations. The first violation is a minimum of \$500; the second violation is \$1,000. If the violation cannot be tied to an exact number of trees (for example in a natural area), fines are set at \$60,000.00 per acre of land affected (Atlanta 2015)



A tree is missing from a newly constructed tree pit on East 9th. With a strong ordinance and penalty structure in place, parties can be held responsible to replace missing trees. Image courtesy of City of Cleveland.

Raleigh, North Carolina requires a \$100 tree impact permit for any work done in the right-of-way where trees are located. Activities that require this permit include heavy equipment use or storage of soil, stone, or mulch in the critical root zone. Raleigh reminds its citizens “remember, you can greatly reduce costs by protecting a tree at the beginning of a project rather than paying up to thousands of dollars for removal and replacement at the end of a project when an impacted tree becomes hazardous” (Raleigh 2015).

In Cincinnati, if a property owner or contractor significantly damages a public tree, they are charged the assessed landscape value of the tree (a 20” DBH maple, for instance, has a landscape value of over \$2,000), the cost of its removal, and new replacement planting. These penalties make tree protection and preservation a priority for both the public and contractors. All revenue is deposited into a dedicated urban forestry fund (Gulick 2015).

Sale of Municipal Wood Products: If city policies allow public property to be sold, the wood waste from tree maintenance can be a source of funds. Rather than pay for removal and disposal, many cities sell excess wood products (firewood, hardwood timber, rough wood chip mulch, and compost) to the general public and commercial businesses. A new trend is to use the removal of a significant or historic public tree as a source of creative fundraising. The logs and useable wood are given to local craftsmen who create furniture, sculpture, and other collectibles from it. These are sold and proceeds are returned to the urban forestry program. Another new trend is to use tree removals due to invasive insects and disease as a source of quality lumber products.

The cities of Winnipeg, Manitoba, and Cincinnati have codes in place to allow sales of wood that have succumbed to Dutch elm disease and EAB to local companies that mill dimensional lumber as environmentally sustainable products used in buildings and projects that qualify for LEED certification.

Cincinnati’s ReLeaf reforestation program receives a portion of the sale of felled logs sold as flooring, tabletops, and dimensioned lumber. The program is run by Cincinnati Parks with the goal of replenishing the urban forest with new trees as old or diseased trees are removed (Algin 2015).

These funding methods can be explored by city staff to determine their legality, viability, and practicality.

- **Partnership.** While partners are not good sources for long-term funding, they can assist by alleviating funding pressures and taking on annual work such as tree plantings and new tree care.



Damage occurs when trees aren't protected during construction. Without significant penalties in place through a tree ordinance, tree mortality in construction will continue and a potential revenue source is not utilized. Image Courtesy of City of Cleveland

Action #4: Complete a Comprehensive Public Tree Inventory

A comprehensive inventory of public trees (on streets and in parks) is the foundation for both public safety and management planning. It is the base information on which all other urban forestry efforts should be evaluated and the first step for many of the initiatives recommended in this plan.

Management plans, operation reviews, proactive maintenance, and budget planning all depend on tree inventory data. An effectively managed urban forest depends on accurate and reliable tree data. Neighborhood level tree inventories were also cited as a goal in the 2013 Cleveland Climate Action Plan.

Resource: ISA’s Best Management Practices for Tree Inventories, Second Edition (2013) by Jerry Bond

Cleveland’s public tree inventory data sat idle without updates for more than 10 years. However, since hiring a new city arborist in 2013, the urban forestry department is actively updating inventory data as part of daily work. Each year 8,000–9,000 records are updated, although because there are approximately 120,000 public trees in the system, inventory data are currently considered inaccurate, unreliable, and therefore unusable.

Following the Cleveland Mayor’s “efficiency through technology” focus, modern tree inventories also include the newest technology to manage the data. Inventory data are collected in a GIS-based system, with associated software applications that support daily operations like tree inspection recording, maintenance scheduling, and maintenance histories on a per-tree basis. Inventories also provide a system to catalog future planting sites, expediting planning work as planting funds become available.

Additionally, the latest technology would allow partner organizations or other city departments to potentially record and track new tree plantings, ensuring the urban forestry department is aware of all public trees installed. Calculations examining Cleveland’s return on investment in urban forestry can also be calculated once accurate data are available.



Condition of trees directly affects public safety.

Action #5: Develop and Implement a Management Plan for City-Owned Trees

Management plans are important for projecting maintenance priorities and costs, and developing a short-term plan of action to be implemented daily by the urban forestry operations manager.

Management plans help set goals, metrics, and answers to questions that are essential to public safety. Such questions include:

- Are all trees in highly trafficked areas visited annually?
- What is the city's threshold for acceptable risk?
- Is there a tree emergency management process in place?
- Is it part of a larger disaster or storm response plan?

A management plan uses accurate and comprehensive tree inventory data to map out a plan of action for trees on public land.

Interdepartmental Cooperation in Charlotte, NC

In Charlotte, North Carolina, the city engineer has been tasked with maintaining and reaching overall canopy goals. For this reason, the engineer makes it a point to include an urban forest representative at the table in planning, design, and implementation phases of every capital project (PCF 2014).

Action #6: Undergo an Operational Review

While a public tree inventory first illustrates the amount of work to be done, and the management plan then determines how the work will be done, an operations review would follow, evaluating the capacity of a municipal forestry department and proposes a series of actions on how to efficiently carry out a management plan.

Operational reviews can evaluate the many components of an organization's urban forestry program, provide summaries of existing conditions, identify strengths and areas for improvement, and ultimately suggest goals, guidelines, and rationale to optimize the urban forestry program. Elements typically reviewed include workload, staffing, equipment, risk management programs, maintenance, planting, and spending/budget levels.

City trees are often affected by more than one city department: capital projects, utilities, planning, parks and recreation, and engineering are just a few of Cleveland's city departments that touch public trees. Coordination of projects and communication between city units through inclusion on planning teams or staff working groups will strive to resolve conflicting policies and practices. This can also be explored in an operational review.

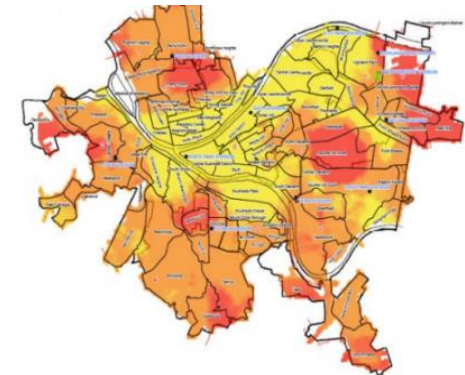


Figure 18. Sample Map: Maintenance Hotspots
One of many analyses performed in an operations review.

Action #7: Establish a Canopy Goal, Plan for Canopy Updates

Setting a tree canopy goal is an important step in the planning process, as goals provide metrics by which performance can be measured throughout the coming years. Tree canopy goals were called for in the Cleveland 2020 plan. The process of setting a goal is also helpful in ensuring that goals are realistic.

According to the recent 2013 county-wide urban tree canopy assessment, tree canopy covers 19% of Cleveland. The assessment also determined that a 71% tree canopy cover is possible, showing that Cleveland has achieved 27% of the total possible canopy (termed relative canopy).

There are a number of ways canopy goals can be set:

- Comparisons to an Industry Standard.** American Forests, a recognized leader in conservation and community forestry, has established standards and goals for canopy cover in metropolitan areas. They recommend that cities have an overall canopy of 40%, with 15% in the central business district, 25% in urban neighborhoods, and 50% in suburban neighborhoods. Cleveland falls below those standards, as seen in Table 10.
- Comparison to What is Possible.** Relative canopy is a measure of how much canopy has been achieved compared to what is possible. This metric is useful to setting realistic goals for very different areas. Cleveland has a potential canopy cover of 71%. The recent UTC revealed Cleveland actual canopy to be 19%, making relative canopy 27% (19% divided by 71%). Relative tree canopy is a logical metric to measure until an actual canopy goal is set.

Table 10. American Forest UTC Standards Compared to Cleveland Current Canopy

	American Forest Recs.*	Cleveland 2011
Average of All Zones	40%	19%
Central Bus. Districts	15%	4%
Urban Residential**	25%	21%
Suburban Residential	50%	n/a

*American Forests recommendations for metropolitan areas east of the Mississippi.

** Considered all Cleveland neighborhoods excluding downtown, Cuyahoga Valley, and the airport (Hopkins).

Another way of examining “what is possible” is calculating the *quantity of new trees* a particular canopy goal would require, then determining whether that number is realistically possible. For example, as shown in Table 11, to reach 40% canopy, 10,500 acres or almost 650,000 trees would need to be planted. And these numbers do not take into account canopy lost each year in Cleveland. Installation of 650,000 is not likely to happen in the next 5–10 years, so it can be determined that a 40% canopy goal is not realistic.

- **Comparisons to Other Cities.** Comparing Cleveland’s canopy cover to other cities can be a helpful exercise, but with the caveat that every city is unique. Some cities assess their canopy cover county-wide. Charlotte and Louisville have high canopies, but span large counties which include more rural areas. Other cities have geography or climates that affect canopy levels. Cincinnati and Pittsburgh have high canopies, but both have many undevelopable hillsides that require trees for stabilization. Other western cities like Phoenix or Las Vegas have very little natural vegetation, so high rates of canopy cover aren’t realistic. A list of city tree canopy cover and goals can be found in Table 12.
- **Outcome-Based Goals.** Choosing a canopy goal based on the desired benefits outcome, e.g., reduction in heat stress, stormwater intercepted, etc., is also a possibility using i-Tree analysis projections.
- **Neighborhood Goals.** Canopy goals can also be set beyond simply citywide numbers. Neighborhoods in need of more canopy (and associated benefits) can help focus preservation and planting activities to areas in need in coming years. These local goals help distribute canopy benefits equally among all residents, no matter where they live.

It is not uncommon to use a combination of the above methods. A phased goal approach is also common, for example achieving no-net-loss within five years, then 25% canopy by 2025. Some establish target dates; others have ongoing goals. Some establish target percentages; others aim for an increase of any kind.

Table 12. City Comparisons of UTCs and UTC Goals

Location	UTC	Year	UTC Goal	Goal Target Date
Atlanta, GA	48%	2008	Increase	Ongoing
Annapolis, MD	42%	2006	50%	30-year plan (2036)
Stow, OH	41%	2013	Increase	Ongoing
Pittsburgh, PA	40%	2011	60%	20-year plan (2031)
Cincinnati, OH	38%	2011	Increase	Ongoing
New Haven, CT	38%	2009	Add 10K trees	5-year plan (2014)
Louisville, KY	37%	2013	40%	Ongoing
Washington, DC	35%	2009	40%	20-year plan (2029)
Boston, MA	29%	2006	49%	10-year plan (2016)
Lexington, KY	25%	2013	30%	ongoing
New York, NY	24%	2006	30%	2036
New Orleans, LA	23%	2009	Increase	Ongoing
Providence, RI	23%	2007	30%	10-year plan (2020)
Seattle, WA	23%	2007	30%	30-year plan (2037)
Cleveland, OH	19%	2013	-	-
Chicago, IL	17%	2007	25%	Ongoing
Denver, CO	16%	2010	31%	20-year plan (2025)
Indianapolis, IN	14%	2008	19%	10-year plan (2018)
San Francisco, CA	14%	2012	20%	20-year plan (2034)
Las Vegas, NV	9%	2012	20%	2035
Phoenix, AZ	8-10%	2007	25%	2030

Once established, the goal should be adopted by the city council, and referenced into city policy (especially as a rationale for preservation, Action #7), to inform planting strategy (Action #9), and to use in outreach and education campaigns (Action #2). To ensure that tree canopy goals survive transitions in leadership, these goals must be institutionalized in other processes (including legislation and regulation) and included in the next version of the city’s comprehensive plan.

In order to track progress, the urban tree canopy assessment should be updated every five years. When multiple years of data are available, trends of which neighborhoods are losing the most canopies or losing canopy at a faster rate can be determined which will help aid in future canopy goals.

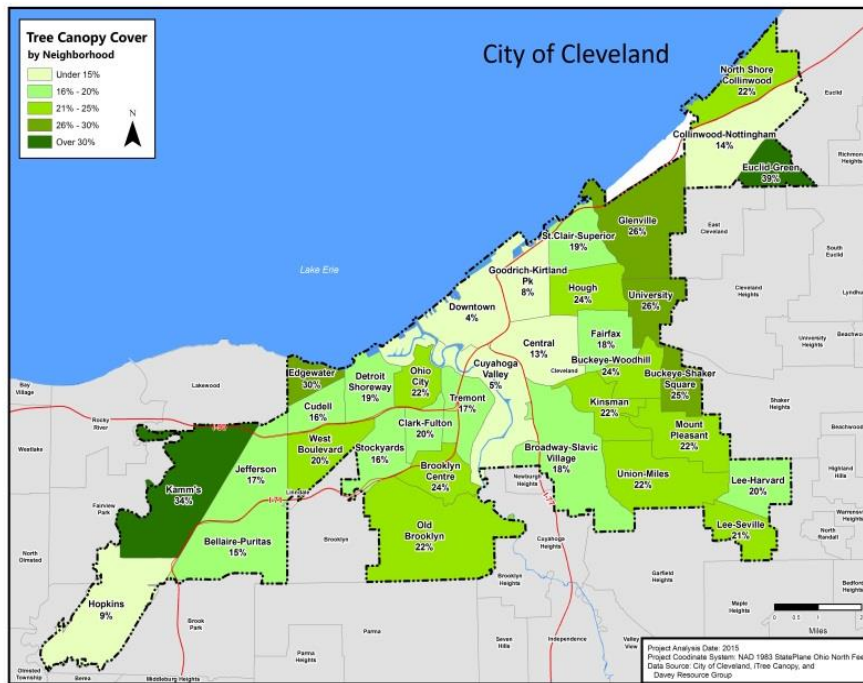


Figure 19. Tree canopy cover by neighborhood. Cuyahoga County Planning Commission

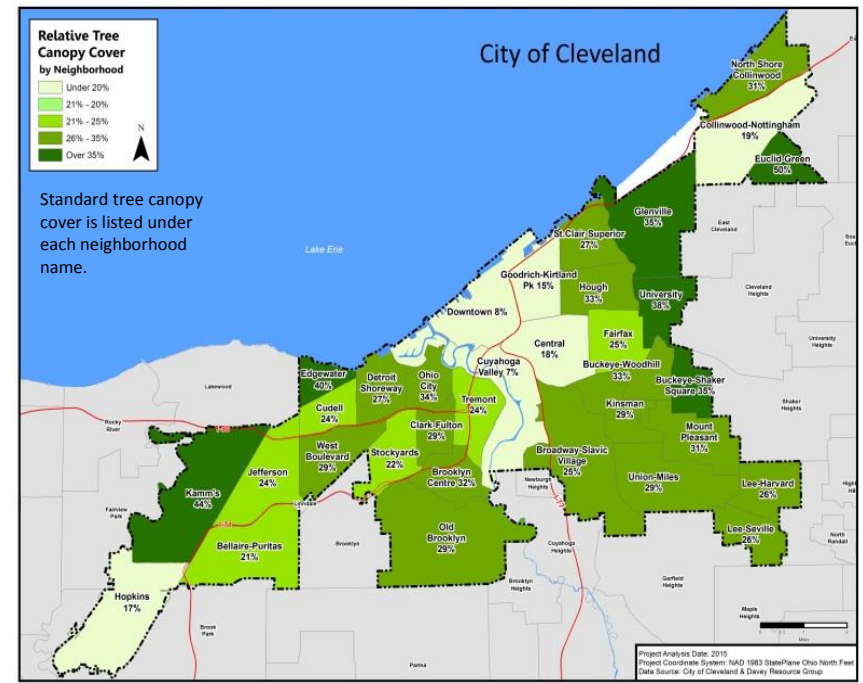


Figure 20. Relative tree canopy cover by neighborhood. Cuyahoga County Planning Commission

Action #8: Institute Policy Changes Supportive of Urban Forestry

City policy that supports both public and private urban forestry is essential to making any real and lasting progress in restoring and maintaining a vibrant urban forest. However, if there is no effective mechanism or incentive in place to preserve trees during development, no consequences to damage or removal of trees during construction projects (public or private) or utility repairs, no specification on tree selection or proper planting and care, conflicting or unclear practices among city departments, and no enforcement capabilities, tree loss will continue.

Existing city policy affecting the urban forest in Cleveland is outdated and ineffective. The specific examples of policy changes and improvements should be explored by the city and its partners.

Chapter 509: Tree Ordinance: Cleveland’s tree ordinance was passed in 1924. Though it does include verbiage on protecting trees, the ordinance does not include modern best practices nor does it include adequate penalties for non-compliance (violators are currently fined only \$5–\$50 per instance). Additionally, adjacent property owners are currently responsible for removing debris after stumps are ground out, along with refilling the void with soil to return the area to grade. The ordinance also calls for decisions by the Tree Commissioner, which is a position no longer active in Cleveland. Reworking this ordinance will not only make significant progress in preserving trees, but it can also create a new and substantial revenue stream for the urban forestry department. Copies of the current Tree and Tree Commission ordinances can be found in Appendix E.



Left: Without clear planting specifications in place, investment is wasted and there is little recourse to replace trees. Trees planted by contractors as part of a casino project lack adequate planting space. Right: Trees are planted by contractors in such poor soil that even weeds will not grow.

Images courtesy of the City of Cleveland.

Tree Planting & Establishment Specifications: Specifications on tree planting and care should include site plans for development with an approved tree species list. These specifications should apply to all public trees on treelawns, parks, and city-owned properties and also be used as guidance to privately developed projects. City of Cleveland Urban Forestry has recently created updated specification; there is currently no system to monitor and enforce planting that occurs in development projects (both public and private).

Cleveland City Planning is currently working on a Streetscape Design Guidelines Manual that will include approved species and planting specifications. By incorporating these guidelines into the normal project approval process it provides a framework by which Urban Forestry can provide clear and specific planting specifications to address quality of installations and increase the likelihood of tree survival. By incorporating planting specifications and species guidance into the Streetscape Design Guidelines manual, Urban Forestry can ensure that forestry goals are embedded in the site plan requirements and review process.

Utility Practices: Until recently, Cleveland had not permitted gas companies like Dominion to bore (drill) lines under sidewalks during repairs or installations. Instead, utilities were left to install pipes via digging trenches from above, resulting in significant street tree damage and often later removal. Fortunately, this is starting to change as written exceptions can now be requested on a project basis from the Mayor’s Office of Capital Improvements. More coordination like this and further streamlining is needed between utilities and city infrastructure improvements. Likewise, policies that deter such collaboration should be eliminated.

Tree Commission. Although a city tree commission is called for in city code, the commission is currently inactive, and thus the public has no direct input into city trees. The city and its partners should evaluate the role and makeup of a formal city Tree Commission.

Other Policy. Other ordinances should also at least reference tree preservation. For example, Chapter 505: Sidewalks has no mention trees or specification handling tree roots during replacement, nor does it reference the reader to the Tree Ordinance section for root protection regulations.

New policies or additions for consideration include adoption and inclusion of canopy goals into city policy, and a landmark or heritage tree program.

The Cost Savings in Tree Preservation

Tree preservation (the focus of much of city policy on trees) is a critical and cost-saving component to reversing canopy loss. Cleveland is projected to lose almost 2,300 acres by 2040, an estimated equivalent of 150,000 trees total, or 5,400 trees lost per year (see *State of the Urban Forest*).

If efforts to preserve existing trees cut these losses in half, funds required to rebuild the urban forest are cut in half. And this is no small sum. If an initial canopy goal (see Recommendation #8) was set to achieve no-net-loss, 5,400 trees would need to be planted per year. The installation of a 2” caliper tree can range from \$150 wholesale to \$400 retail. This equates to \$810,000–\$2.2 million per year required in planting funds. If canopy loss is cut in half through tree preservation efforts (better maintenance, stronger ordinances, development guidelines), required annual planting drops to 2,700 trees, saving the residents of Cleveland between \$405,000–\$1,000,000.

Adoption and Inclusion of Canopy Goal in Policy. Once a canopy goal has been set (see Action #8), this should be adopted by the city council and incorporated into existing policy as rationale for stricter policies. To ensure that tree canopy goals survive transitions in leadership, these goals must be institutionalized in other processes including legislation, regulation, and the city’s comprehensive plan.

Landmark/Historic Tree Program. Preserving landmark trees can happen informally through a general appreciation campaign, or more formally through a city ordinance. Historic tree appreciation and protection efforts go a long way towards preserving large trees, but also towards generating public interest and appreciation of trees.

Resources for Policy Research:

ODNR: Sample tree ordinances and Tree Commission Academy for examples of how commissions should operate.
<http://forestry.ohiodnr.gov/tca>

APWA’s Ordinances, Regulations, and Public Policies for Urban Forestry
<https://www2.apwa.net/about/coopagreements/urbanforestry>

Urban Tree Foundation for planting and care specifications.
http://www.urbantree.org/details_specs.shtml

Revisiting the Moses Cleaveland Trees

Western Reserve Land Conservancy and Holden Arboretum have begun to revisit their catalogue of trees in existence during Moses Cleaveland’s time. This program was launched by Arthur B. Williams, a local naturalist and the Natural History Museum’s Curator of Education in the 1940s with 150 selected trees. The Moses Cleaveland Trees project was “designed to involve the public, to create interest in history and science, and to create a lasting, living monument to Cleaveland and Moses Cleaveland. Each tree that was selected was labeled with a plaque describing the species of tree and explaining that the tree was standing when Cleaveland landed” (Wasman 2015). Last inventoried in 1971 as part of Cleaveland’s 175th birthday, a committee was formed to locate and assess the original 150 Moses Cleaveland Trees. They found 92 of the original trees were still standing and in good shape, though many of the plaques were gone (Wasman 2015) (ECH, 1997). The Moses Cleaveland Tree plaque reads: “This is a Moses Cleaveland Tree. It was standing here as a part of the original forest when Moses Cleaveland landed at the mouth of the Cuyahoga River July 22, 1796. Let us preserve it as a living memorial to the first settlers of the Western Reserve. Signed, The Sesquicentennial Commission.



Above Left: Williams measures a Cottonwood in 1946 for consideration in the Cleaveland Moses Trees project. Source: Cleveland Museum of Natural History Above Right: Moses Cleaveland Tree plaque (Wasman 2015)

Action #9: Plant with a Purpose—Trees for Neighborhood Equity

Trees planted over the next several decades should be planned equitably, for areas in most need and in places where they will provide the most benefits and return on investment. Cleveland has identified a number of priorities to help prioritize planting sites: overall canopy increase, socioeconomic, stormwater management, energy savings, heat stress reduction, public health, economic development and neighborhood revitalization, and vacant land use.

Planting plans can be developed by combining priorities or by focusing on one priority specifically. Figure 21 shows the neighborhoods in need of canopy when considering a number of equity-based socioeconomic factors. A *species selection guide and full planting strategy for neighborhoods with maps and analyses can be found in Appendices A & B.*

With defined planting objectives, Cleveland can use tree plantings to make the greatest environmental, economic, and social impact.

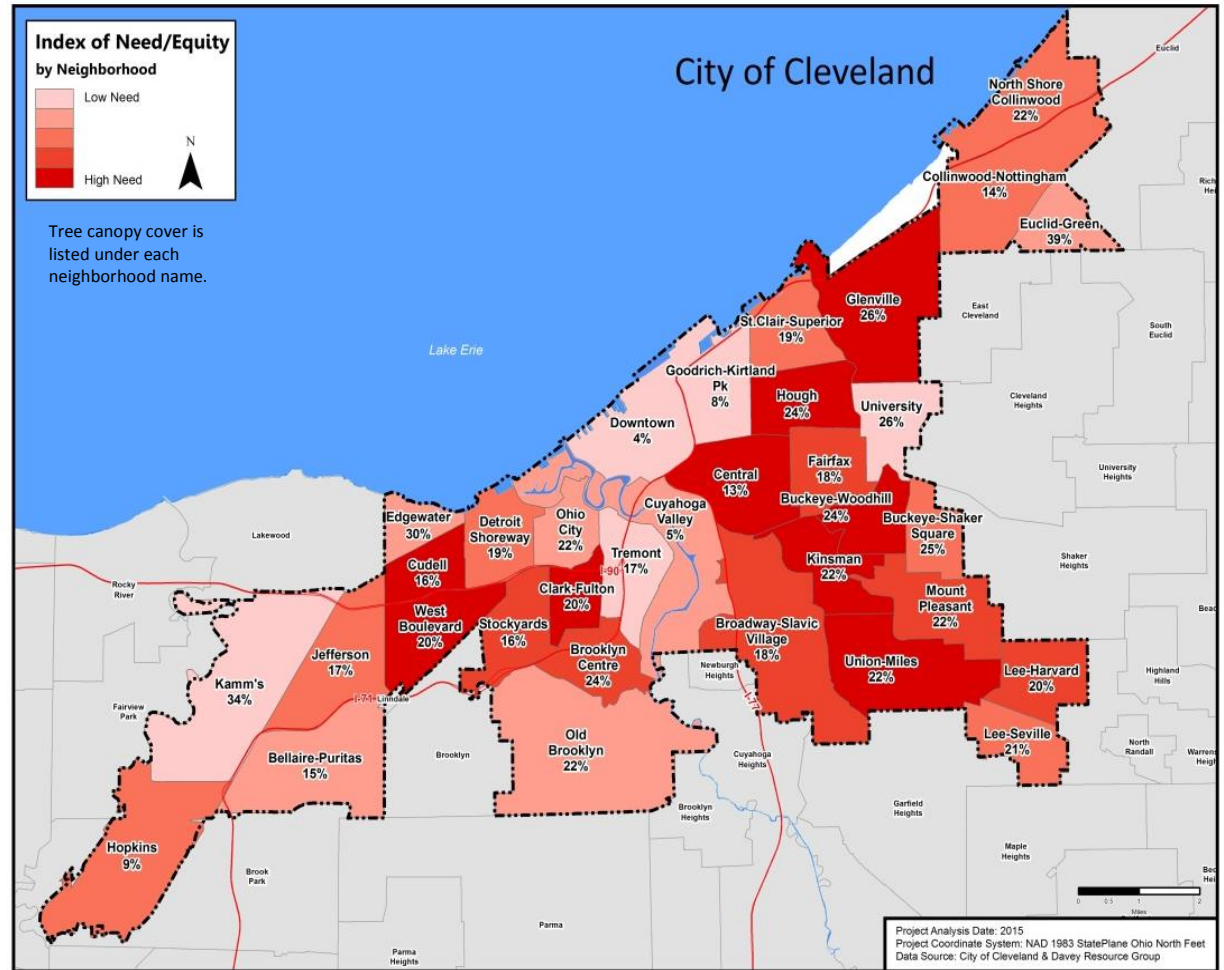


Figure 21. Index of need/equity by neighborhood.

Achievement Schedule

An achievement schedule has been compiled based on the target completion dates specified in the Action Sheets. Tasks that require a tree inventory or other prerequisite step is noted. The final timeline is subject to the development and decisions made by the coalition.

This schedule can be easily utilized, together with the three matrices from *The State of Cleveland's Urban Forest Today*, to evaluate performance and plan implementation progress during the recommended five-year reassessments.

Action Sheet number and owner for Action are noted in parenthesis.

Short Term (2015–2017)

By end of Fourth Quarter 2015:

- Build an advisory team for the formation of the coalition. (Action 1, Lead: Mayor's Office of Sustainability)
- Define how the coalition is to be set up, funded, and staffed. (Action 1, Lead: Mayor's Office of Sustainability)
- Develop a tree planting credit program with NEORSD. (Action 2, Lead: Western Reserve Land Conservancy)
- Explore scope, technology needs, and determine cost of tree inventory. (Action 4, Lead: City Department of Public Works)
- Start a master funding plan/needs document. (Action 3, Leads: Mayor's Office of Sustainability and Cleveland Neighborhood Progress)

- Explore and set a canopy goal – both city-wide and at the neighborhood level. (Action 7, Lead: Mayor's Office of Sustainability)

By end of First Quarter 2016:

- Map out coalition's program of work. (Action 1, Lead: Mayor's Office of Sustainability)
- Determine interest of city in formal partnership agreement. (Action 1, Lead: Mayor's Office of Sustainability)
- Define clear responsibilities for each partner, work out particulars of agreement. (1, Mayor's Office of Sustainability)
- Start plan for Annual Tree Summit. (Action 2, Lead: Western Reserve Land Conservancy)
- Have canopy goal adopted by city council. (Action 7, Lead: Mayor's Office of Sustainability)
- Establish and provide access to tools and data sources required for purposeful planting campaigns. (Action 9, Leads: Western Reserve Land Conservancy and Cleveland Neighborhood Progress)
- Estimate financial need for neighborhood efforts to reach canopy goals. Submit for inclusion in master funding document. (Action 9, Leads: Western Reserve Land Conservancy and Cleveland Neighborhood Progress)

By end of Second Quarter 2016:

- Formalize partnership agreement with city. (Action 1, Lead: Mayor's Office of Sustainability)
- Begin crafting effective messaging for Coalition. (Action 2, Lead: Western Reserve Land Conservancy)

- Complete master funding needs document, compiling costs for all plan implementation. Prioritize needs. (Action 3, Leads: Mayor’s Office of Sustainability and Cleveland Neighborhood Progress)
- Determine benchmarks for canopy progress and incorporate them into multiple city departments. (Action 7, Lead: Mayor’s Office of Sustainability)
- Assess existing policy affecting the urban forest and explore key components of tree policies. Develop appropriate timeline for changes. Build this timeline into this Action Plan Calendar. (8, City Planning & Public Works)
- Set the stage politically for urban forestry policy changes. (8, City Planning & Public Works)

By end of Third Quarter 2016:

- Develop targeted roll-out strategy for Tree Plan. (Action 2, Lead: Western Reserve Land Conservancy)
- Build and maintain coalition web site. (Action 2, Lead: Western Reserve Land Conservancy)
- Convene meeting of stakeholders to gauge interest of financial support of tree initiatives. (Action 3, Leads: Mayor’s Office of Sustainability and Cleveland Neighborhood Progress)

By end of Fourth Quarter 2016:

- Develop landmark tree program. (Action 2, Lead: Western Reserve Land Conservancy)
- Start to explore outside funding options for those projects with no funding or interested partners. (Action 3, Leads: Mayor’s Office of Sustainability and Cleveland Neighborhood Progress)

- Explore creative new revenue streams for long-term funding needs. (Action 3, Leads: Mayor’s Office of Sustainability and Cleveland Neighborhood Progress)
- Have plan in place for a UTC update in 2018. (Action 7, Lead: Mayor’s Office of Sustainability)

Throughout 2017 “Year of Vibrant Green Space”:

- Implement roll-out strategy for Tree Plan. (Action 2, Lead: Western Reserve Land Conservancy)

Post Tree Inventory:

- Explore scope and information required for Management Plan. (Action 5, Lead: City Department of Public Works)
- Use data to conduct i-Tree analysis, and refresh public/outreach messaging. (Action 5, Lead: City Department of Public Works and Action 2, Lead: Western Reserve Land Conservancy)
- Refine management plan cost estimate with tree inventory data and submit financial need for inclusion in master funding plan. (Action 5, Lead: City Department of Public Works)

Post Management Plan:

- Use management plan data, goals, and budget to assess capabilities in Operations Review. (Action 6, Lead: City Department of Public Works)
- Explore desired outcomes from an operations review. (Action 6, Lead: City Department of Public Works)
- Determine operations review cost and submit financial need for inclusion in master funding plan. (Action 6, Lead: City Department of Public Works)

Post Operations Review

- Institute recommended changes from operation review, track progress, and publicize efficiency victories. (Action 6, Lead: City Department of Public Works)

Mid-Term (2018–2020)

By end of fourth quarter 2018:

- Initiate UTC assessment update. (Action 7, Lead: Mayor’s Office of Sustainability)

By end of fourth quarter 2020:

- Ensure canopy goal is prominently included in next comprehensive plan. (Action 7, Lead: Mayor’s Office of Sustainability)
- Revisit progress to-date by reviewing the 2015 Tree Plan with all active stakeholders. Plan and goals can be revised from a two-part process. First, reassess performance levels in all three matrices (The Trees, The Players and The Management Approach) used in *The State of Cleveland’s Urban Forest Today* to gauge overall performance improvement. Second, use this achievement schedule to gauge and track implementation progress.

Ongoing Steps:

- Make Arbor Day celebration a Cleveland institution. (Action 2, Lead: Western Reserve Land Conservancy)
- Continue to explore outside funding options for new projects. (Action 3, Leads: Mayor’s Office of Sustainability and Cleveland Neighborhood Progress)

- Explore creative new revenue streams for long-term funding needs. (Action 3, Leads: Mayor’s Office of Sustainability and Cleveland Neighborhood Progress)
- Encourage, create, implement, track, and promote planting campaigns at neighborhood levels. (Action 9, Leads: Western Reserve Land Conservancy and Cleveland Neighborhood Progress)

Long-Term (2021–2040)

- Encourage, create, implement, track, and promote continuous planting campaigns at neighborhood levels. (Action 9, Leads: Western Reserve Land Conservancy and Cleveland Neighborhood Progress)
- Initiate UTC assessment update again in 2023, 2028, 2033, 2038, and 2043. (Action 7, Lead: Mayor’s Office of Sustainability)
- Continue to revisit Tree Plan and progress every 5 years after UTC update using the three matrices and this achievement schedule.