FINAL DRAFT Community Forest Management Plan for Auburn, New York.

20 July 2022

Walt Aikman, Ph.D.

EartHeritage

The Mayor's White oak on Grover Street looking to the William Seward House
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NYS Department of Environmental Conservation

Urban and Community Forestry Grant Program (UCF1-2019)

Department of Engineering Services, City of Auburn, NY

William H. Lupien, Jr. P.E., Superintendent

One of Our Oldest Residents

by Bobbie Panek

Inaugural Poem for Auburn delivered on January 1, 2022 at the special meeting of the Auburn City Council held to administer the Oath of Office for members of City Council elected in the November 2, 2021 general election.

Auburn churns with history, talking movies,
underground railroads, Tiffany windows, and
a yellow mansion where Seward lived when he
bought us Alaska. Spirit leads our fine city, as
Farmlands surround, while lakes splay like fingers.

Nature trails, river walks, Emerson Park, world
famous quilts at the Schweinfurth Art Center, yet
it's the Ginkgo tree which I hold most dear. Yellow
gold tree so bold, a sight for eyes weary. Fan shaped
leaves scalloped, pleated, tactile and waxy.

Illuminates Washington Street, sculpted in heaven on-
loan by nature, for us to nurture, resplendent near red
orange doors for us to adore. Native to Japan, regal in
our town for way over a century, Who planted it? We
don't know. Our hearts so grateful, our spirits aglow.

Who in our history has seen its beauty? Did Thomas
Mott Osborne walk beneath its wide berth as he roamed
streets? Did Theodore Case gaze out his workshop window
and smile at its color? Did Harriet Tubman palm gold leaves
as she spoke to William Seward or Frederick Douglas?

City of Auburn how lucky are we, surrounded by vineyards
apple orchards, strawberry fields and hops. Cayuga
Museum of History and Art, many treasures you impart.
However, it's in your backyard where we find the gold,
perceptible leaves for us to hold.

Two boys at play under the Cayuga Museum's Ginkgo
© Arthur Hutchinson, 2022.

Acknowledgements

This Community Forestry Management Plan for the City of Auburn is the product of a year-long effort by many people in and around the City who share a passion to identify, manage, and protect trees and forests for the long-term benefit of Auburn and the Finger Lakes.

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Table of Contents

Regional locator map with view looking Northwest to Lake Ontario with the Finger Lakes in the foreground, City of Auburn boundary in red. 5 April 2021 Landsat & Copernicus Imagery displayed in Google Earth.

City of Auburn, New York.
14 March 2020 Landsat & Copernicus Imagery displayed in Google Earth.

Executive Summary

The forest resources in the City of Auburn are gradually declining, both in quantity and quality. A measurable decrease in the City's tree cover since 2005 is underway, and the growing stock of street trees is skewed to a very few species of declining health and vigor. Happily, not all the news is bad: the City has maintained a small but impactful urban forestry program that over time has sustained community support in tree planting and care. This effort has consistently partnered with the NYS Department of Environmental Conservation and organizations like the National Arbor Day Foundation and the NYS Urban and Community Forestry Council to train staff and foster program success. Through determination and hard work the Auburn Community has continued to invest in the City's future forest and is now poised to take additional steps to deliver a safe, sustainable, and healthy forest for future generations of Auburn residents. The challenge is considerable: delivering a forest resource worthy of our residents will demand we change how we prioritize and target tree care, how we track the health of our trees, how we tackle invasive plant species, and how we fund, staff, and develop a more robust urban forestry program.

This management plan is organized into four parts. Part 1 provides an introduction to the City's urban forest canopy, together with notable details about the distribution of tree species and their sizes in the City. To some extent this section is a dive into tree data to characterize the benefits provided by our more than 6,500 street trees - what ecologists and foresters refer to as ecosystem services. Most of us recognize that trees provide practical benefits, ranging from timber and fuel, to fruit and fiber. Trees and woodlands also sequester carbon and transpire water to great benefit of humans. And trees are beautiful organisms, lending value to property beyond their ability to block winds and shade and cool our homes and buildings.

For all these reasons people are very attached to trees. As beautiful companions in a landscape they can and do become emotional anchors for residents, owners, and visitors who invest needs and expectations in their health and very presence such that they lend stability to our memories and ground our hopes for the future. So if Part 1 is based on digging into tree *data*, then Part 2 is where we delve into tree *stories*; in particular the role they serve in our hearts as well as in our tree canopy. Trees present more than benefits and fond memories of course, and in Part 2 we can characterize them in meaningful ways to responsibly identify and report the specific costs and risks some trees present. The art shared by our talented and generous arts community will be very helpful in framing the tree stories in this section.

Although we live in a wealthy nation, not every American lives in a tree-rich environment. Tree inventory analyses conducted in American cities over the last decade identify a correlation between income and the key benefits provided by the urban forest canopy - shading and cooling. The findings of this resource disparity - what is termed "tree equity" - are common enough in New York State that addressing it has become a state policy priority. While it may

seem to deserve attention in our community for that reason alone, the fact is that while the general decline in Auburn's forest canopy will impact all residents, it will differentially impact low-income residents even more. This is the purpose of Part 3: a large-scale analysis of neighborhood-level challenges in stewarding Auburn's forest. Street tree, park tree, and canopy data is presented on a neighborhood basis to uncover where we must focus our future management efforts.

Finally, in Part 4 the reader may engage a variety of program and policy adaptations Auburn may take to address the specific challenges presented in the earlier parts of our plan. These range from practical matters that most readers will expect like funding and staffing, to rather nuanced recommendations to adopt new tree work-flow management technology, an updated systematic risk assessment approach, and a revision to our shared understanding of tree management authority. It is the latter realm that our real challenges begin because a tree's symbolic value will often transcend an objective assessment of it's actual benefits and/or costs. We do not need to imagine how these cultural dynamics play out "close to curb". All we need do is reflect on how the magnitude of our dying ash trees in our yards, our parks, and along our streets is impacting our streetscapes and our souls. As the summer of 2021 progressed and necessary removals of dangerous dying ash advanced across the City, residents became increasing frustrated over the impact to their neighborhoods and their everyday expectations of what happens on their streets.

It is simply a fact that managing trees for any reason - be it pruning, removal, or replacement - may cause social disruption because people have strong cultural and therefore emotional connections to their local landscape in general, and trees they have become accustomed to in particular. It is true that these impacts to our expectations often go unremarked, but because they contribute to our shared sense of stability and our natural need for predictability these events make an impact on our minds and our memories. Most of us recall the impacts of the 1998 Labor Day Storm. And many of us remember the impacts to our neighborhoods when the City's American elms were killed by the Dutch Elm Disease; it left holes in our neighborhood tree canopies, our hearts, and our purses and wallets. The removal of hundreds of large and stately elms in our neighborhoods coincided with Auburn's urban renewal program, and it is easy to imagine how it must have felt to travel about the City during massive infrastructural change and neighborhood transformation only to come home to a denuded street-scape.

There is no question that we often must remove trees when they become dangerous, when construction or infrastructure repairs are necessary. While there is little we can do but react when major storms or unprecedented invasive insect attacks impact our urban forest, there is much we can do to anticipate change and organize ourselves to proactively manage our forest. In so doing we may yet adapt to the urgency of our times and therefore sustainably grow the community forest Auburn so richly deserves.

Part 1. An Introduction to the Forest Resources in Auburn, NY

This report summaries the forest resources in the City of Auburn, NY. As such, it provides the basic information necessary for drafting a community forest management plan for the City of Auburn. The report begins with a description of the City's Urban Tree Canopy (UTC): the percentage of land in the City that is shaded by the leaves, branches, and trunks of trees that cover the ground when observed from above. Next, the report presents findings from the 2021 Street and Park Tree Inventory to illustrate the specific challenges facing the City in the decades to come. Finally, the report outlines the management planning process that will unfold in the coming weeks. A summary of the tree inventory is appended to this report.

Auburn's Urban Tree Canopy: a Key Ecosystem Service

Ecosystem services are the benefits provided by healthy biological processes connecting living organisms and the environment. As key components of the urban ecosystem, trees provide numerous benefits to urban residents, some easier to quantify than others. Trees are beautiful and deliver an enormous range of ecosystem services; trees enhance property values and help retail businesses attract and retain customers; and trees provide practical health benefits ranging from culturally-grounded emotional support to the many healthy chemical compounds trees release into the air we breathe. And best of all, trees provide shade. As our climate warms, America's urban areas heat up as well and create stressful and unhealthy living conditions.

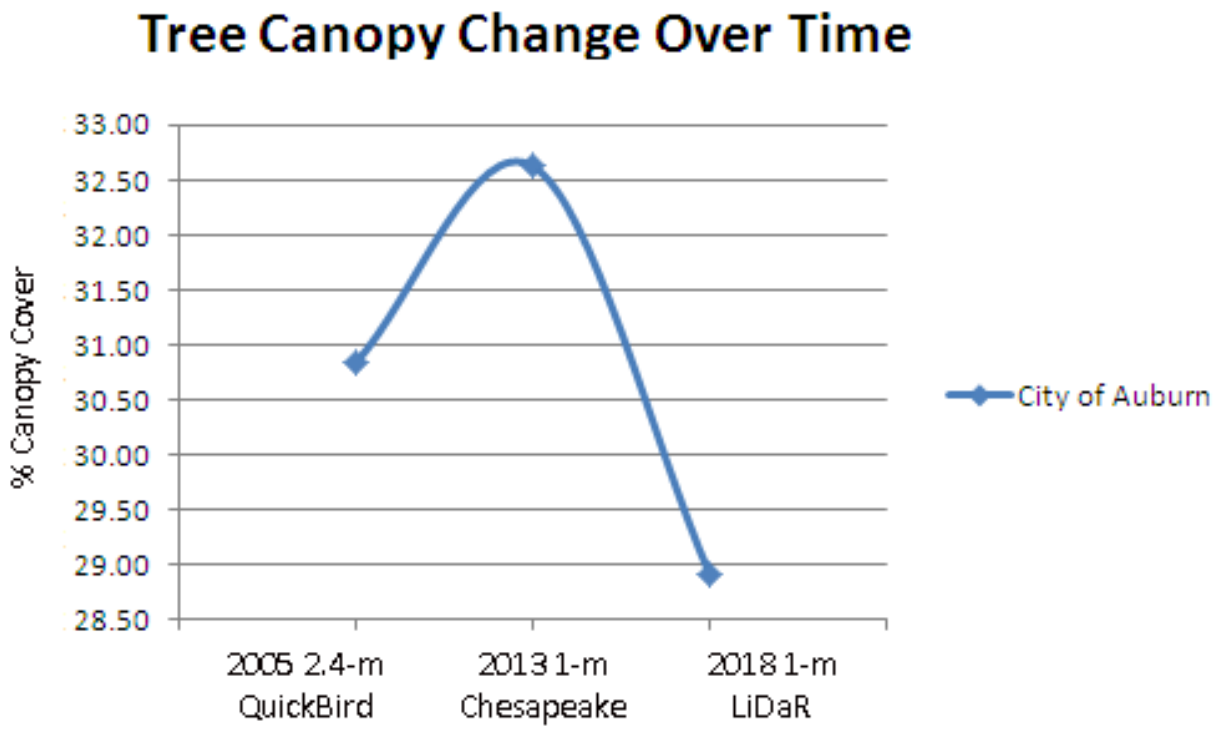
Tree canopy is assessed through the analysis of satellite imagery and by random sampling of the forest. Both methods depend on mathematical models that have built-in limitations that, while not perfect, do provide a reliable snapshot of the overall trend in forest cover. Remotely sensed data from the years 2005, 2013, and 2018 were analyzed for the purpose of assessing the change over time in the forest canopy cover over Auburn. These data sources were:

1) 7 August 2005 QuickBird Multispectral satellite imagery taken at 2.4-meter resolution. These data was purchased by the City of Auburn directly from DigitalGlobe for spatial analysis by Cayuga County planner Nick Colas.
2) 2013 Chesapeake Conservancy Land Cover Data taken at 1-meter resolution. Although not in the Chesapeake Bay watershed, the data set for Cayuga County is available through Cornell University's online GIS server, CUGIR.
3) 23 April to 2 May 2018 LiDaR data for the City of Auburn, taken at 1-meter resolution. These data are provided by the NYS Discover GIS Data NY website.

In all cases these data were imported into and analyzed with a geographic information system software called ArcView Image Analyst. LiDaR data is obtained by scanning the landscape with a low-energy laser instrument, and the 20 data scenes of 14.5 million data points each was

imported and converted into useable imagery with PDAL tools in the SAGA platform, System for Automated Geoscientific Analyses. In broad strokes, the findings are as follows:

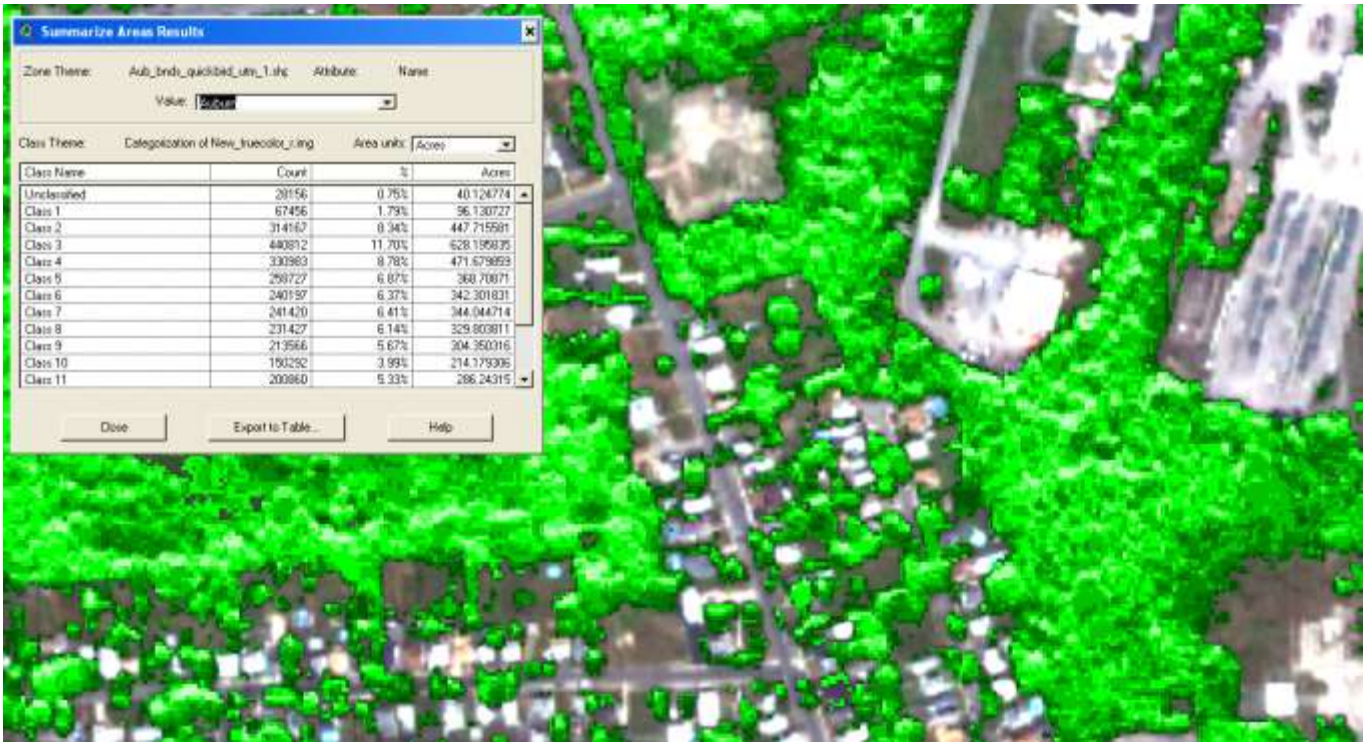
Percent Urban Tree Canopy for Auburn and City Quadrants			
Quadrant/Data	**2005 2.4-m QuickBird**	**2013 1-m Chesapeake**	**2018 1-m LiDaR**
NW	30.33	30.38	28.15
NE	33.03	34.48	29.57
SE	30.47	31.91	25.46
SW	29.36	30.42	27.62
City of Auburn	30.84	32.62	28.90



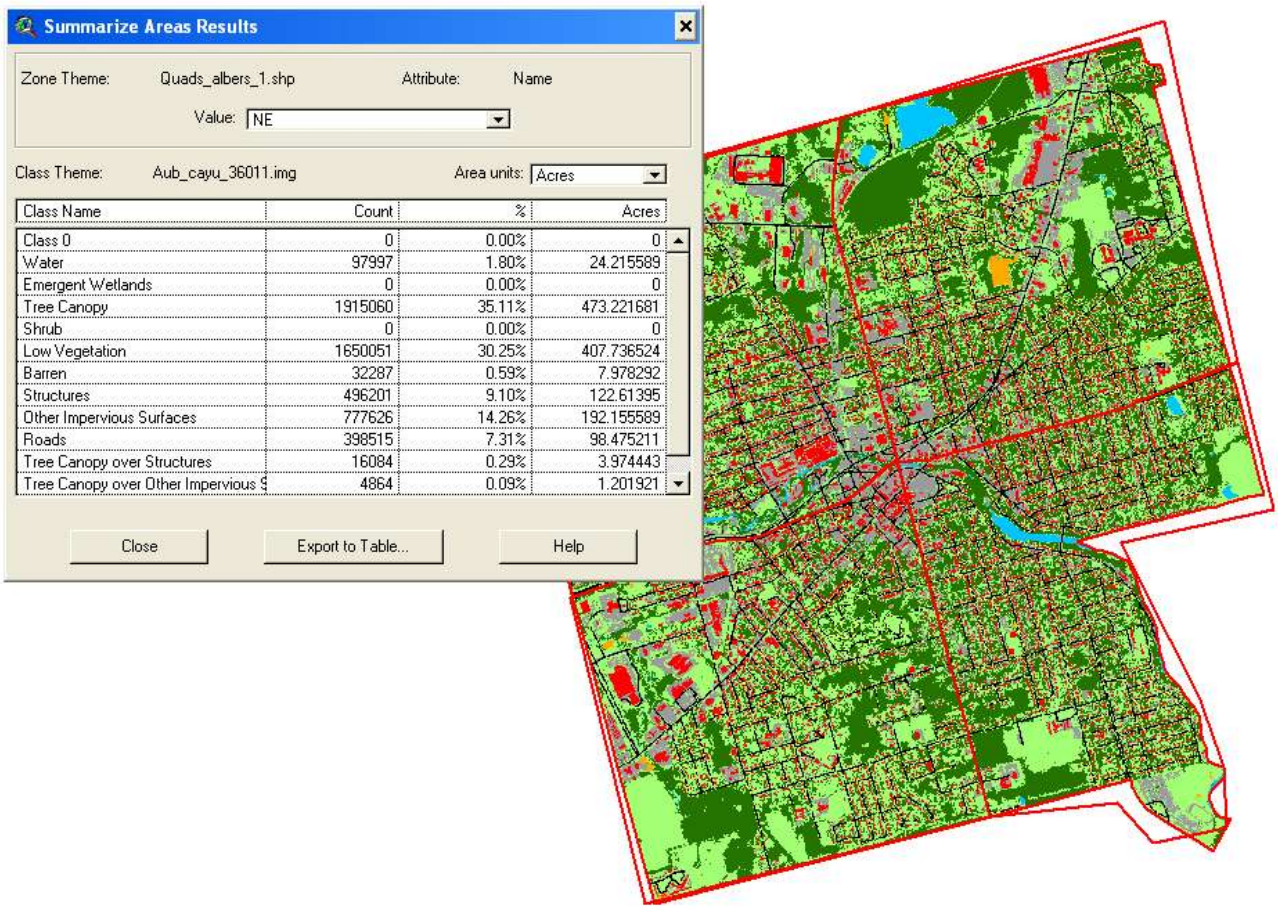
Data analysis suggests an increase in canopy cover from 2005 to 2013, with a sudden loss in canopy after 2013 with the arrival of the Emerald Ash Borer.

As shown in the table and graph above, Auburn's urban tree canopy was growing until sometime around 2013. It is difficult to be precise when comparing spatial data derived from different imagery over time (remotely sensed imagery is derived from a variety of instruments mounted on orbiting satellites) but the decline after 2013 coincides with noticeable tree removals on private residential lots, new commercial development, and especially, the arrival of the Emerald Ash Borer. Even with the uncertainties of comparing different data sources, the magnitude of the decline in Auburn's urban tree canopy is particularly clear with the advent of the 2018 LiDaR data. The following three images show examples the spatial analysis affoded

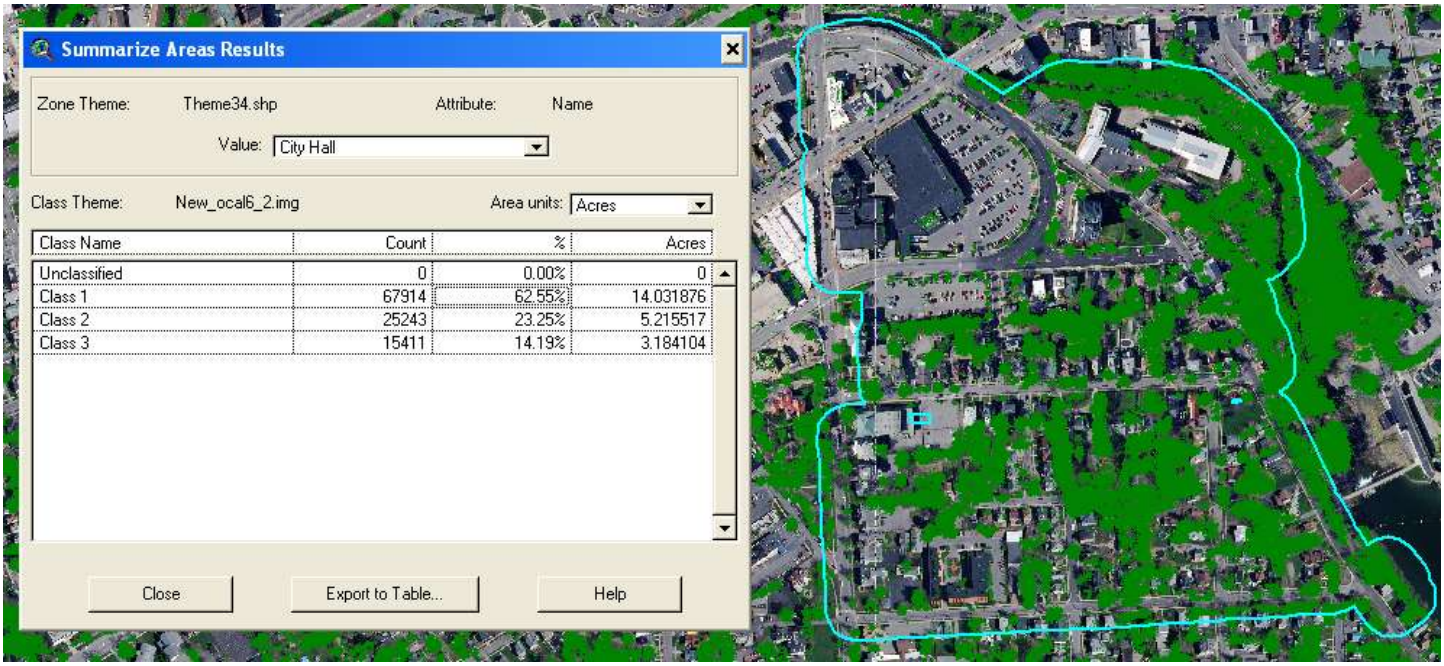
by the three imagery datasets available to the City of Auburn: the 7 August 2005 QuickBird Multispectral satellite imagery, the 2013 Chesapeake Conservancy Land Cover Data, and the 23 April to 2 May 2018 LiDaR data for the City of Auburn, taken at 1 Meter resolution.



Screen shot of 2005 QuickBird Data Analysis in ArcView. Green areas depict tree canopy cover over 2.4-meter cell sized satellite image. Inset graphic displaying summarized pixels over space included to illustrate the software analytical techniques used to quantify 2005 percent tree canopy.



Screen shot of 2013 Chesapeake Conservancy Land Cover Data Analysis in ArcView. Land cover categories depicted to illustrate the the software analytical techniques used to quantify the 2013 percent tree canopy.



Screen shot of 2018 LiDaR data Analysis in ArcView. Inset graphic displaying summarized pixels over space included to illustrate the software analytical techniques used to quantify 2018 percent tree canopy.

As implied in the preceding image showing 2018 LiDaR data analysis, tree canopy can be assessed closer to home: at the neighborhood level. Using the 2015 US Census Block Data, 29 neighborhoods were identified to assess canopy cover at the street level (see example below)

Lots (blue) in the Park N Lewis neighborhood outlined in green, with original US Census Block outline in red.

in the areas in which people live and carry out their business. For the purposes of this plan, the census block numbers were replaced with a local name based on local history, place names, or identifying streets. To facilitate the spatial analysis in a meaningful way to residents, each block was modified based on a 100 foot buffer around the residential lots in each.

The neighborhoods and their associated changes in tree canopy over time are as follows:

Neighborhood/Data	2005 2.4M QuickBird	2013 1M Chesapeake	2018 1M LiDaR	2022Calc Canopy
Clarksville*	44.12	45.20	35.97	35.45
Casey Park	36.54	31.93	30.37	29.95
Van Anden - Shevchenko*	25.12	27.82	27.48	26.67
Cross - Union	14.96	24.78	23.00	21.74
Steel Mill*	26.82	29.64	24.87	24.53
West End*	21.27	23.95	26.64	25.86
Wall - Genesee*	16.60	20.81	19.56	16.72
Standart Woods*	27.10	32.10	27.02	25.91
North Street - Flummerfelt's	35.82	33.19	28.73	28.04
Seminary	21.63	27.82	27.58	26.57
Holland Stadium	29.26	36.36	29.30	28.73

Franklin - Capitol	38.96	45.60	35.77	34.83
Lafayette - Hardenburg*	15.37	18.55	21.97	21.36
Fort Hill	33.68	34.15	32.74	31.97
Lexington - Arch	29.98	30.09	26.86	25.88
Mercy - Melone*	17.82	19.72	16.71	15.67
Quill's Hill*	51.73	53.79	44.06	42.87
Meadowbrook	27.41	33.05	23.83	22.85
East Hill*	21.10	26.17	25.51	25.04
St. Alphonsus	26.75	33.54	25.81	24.62
Herman Elementary	32.11	39.59	31.31	29.95
East Genesee - Walnut*	28.23	36.55	29.04	27.67
City Hall*	31.50	34.79	34.40	33.82
Walnut - Havens*	25.76	33.43	23.64	22.87
Hoopes Park	34.06	41.30	30.55	29.63
Case - McDougal*	32.08	38.48	32.96	31.26
Clifford Field - Lake Ave.	27.37	35.40	27.50	26.23
Tubman - Seward	36.79	44.07	33.33	32.63
Throop Ave.	31.79	35.26	23.96	22.99
Downtown		12.83	11.17	9.93

An analytical unit for Downtown Auburn was also created to help reveal the impact of the decline in the City's tree canopy in the City's center. Although it does not conform to a US Census block, it does help reveal and explain the impact of having so few trees downtown, where the canopy cover has dropped from 12.83% in 2013 to 9.93% today.

Recommendations for percent urban tree canopy (UTC) in urban areas have changed over the last decade. American Forests, "a nonprofit conservation organization established in 1875 and dedicated to to protecting and restoring healthy forest ecosystems" (www.americanforests.org) once prescribed a 40% urban tree canopy goal, but since 2017 this figure has been tempered by the variability in local conditions and priorities. Guidelines over these decades set the following goals:

- 15% UTC in downtown and industrial districts
- 25% UTC in urban residential neighborhoods and light commercial areas
- 50% UTC in suburban neighborhoods

The current guidelines from American Forests are much more flexible and are meant to foster a process of tree canopy goal-setting that reflect local conditions based on what is physically possible and socially preferable; together these criteria are determined by the availability of potential plantable space.

2021 Street and Park Tree Inventory

Over the years, the City's Department of Public Works has supported field data sampling around random City blocks to derive statistically sound estimates of the City's street tree population. While helpful as a guide, a random sample is no substitute for a complete census. After several attempts to get funding, in 2020 the City's Department of Engineering Services

Street trees and planting spaces in green, park and open space trees in red.
City-owned Soule Cemetery to the East of Auburn also represented.

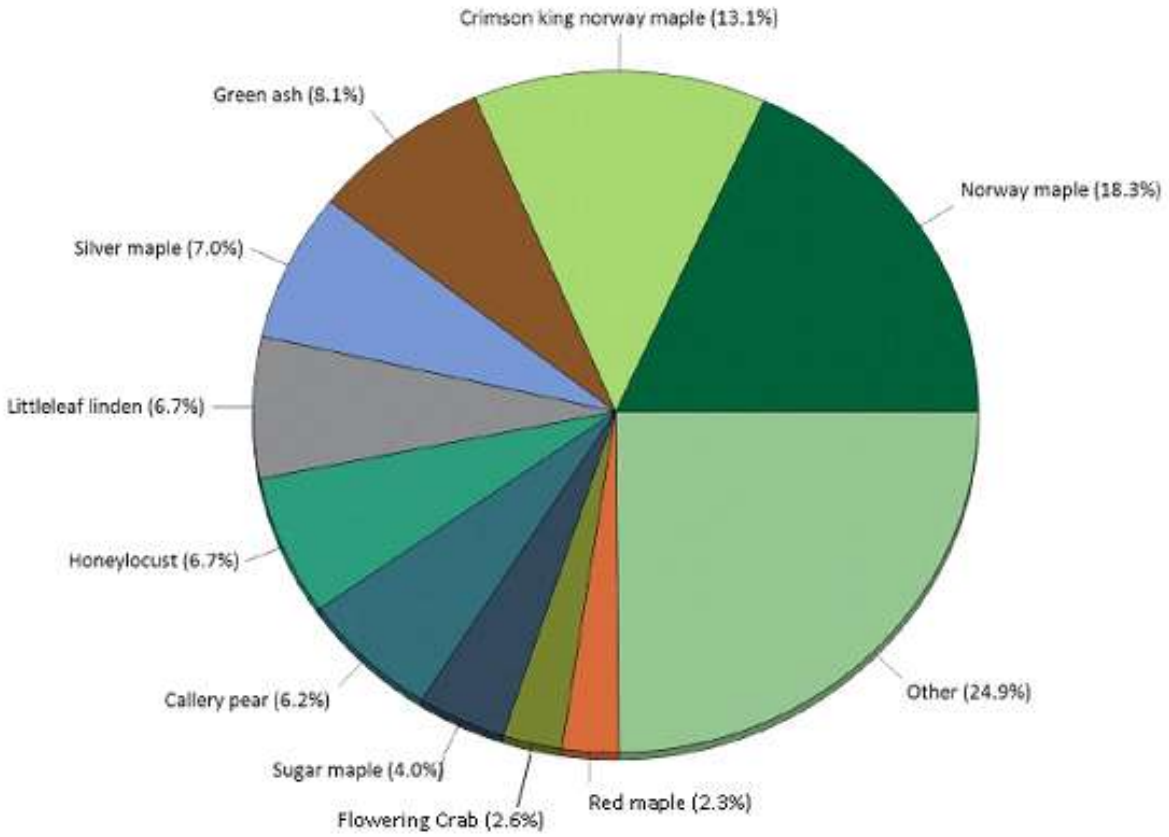
successfully obtained funding from the NYS Department of Environmental Conservation's 2019 Urban and Community Forestry Grant Program to conduct a City tree inventory. Thus, in 2021 trees and potential planting sites along all the City streets were located, identified, measured and described. As part of this work, the trees in City parks and open space areas were included. Site conditions and the presence of nuisance (think Poison ivy) and/or invasive plants (European buckthorn and Japanese knotweed, for example) were also noted. As per NYS DEC, tree inventory data must be analyzed and presented with i-Tree software. (i-Tree is a collaborative product of the i-Tree Cooperative, consisting of the USDA Forest Service, Davey Tree Expert Company, the Arbor Day Foundation, the Society of Municipal Arborists, the International Society of Arboriculture, Casey Trees, and the SUNY College of Environmental Science and Forestry.) When Auburn's 2021 street and park tree inventory data is analyzed by

i-Tree ECO software, the specific benefits provided by street and park trees are revealed, and the contributions these trees make to the forests of the entire city is possible.

As i-Tree ECO notes "[u]nderstanding an urban forest's structure, function and value can promote management decisions that will improve human health and environmental quality". i-Tree ECO assessed the "vegetation structure, function, and value" of the "[d]ata from 7,367 trees", summarized as follows:

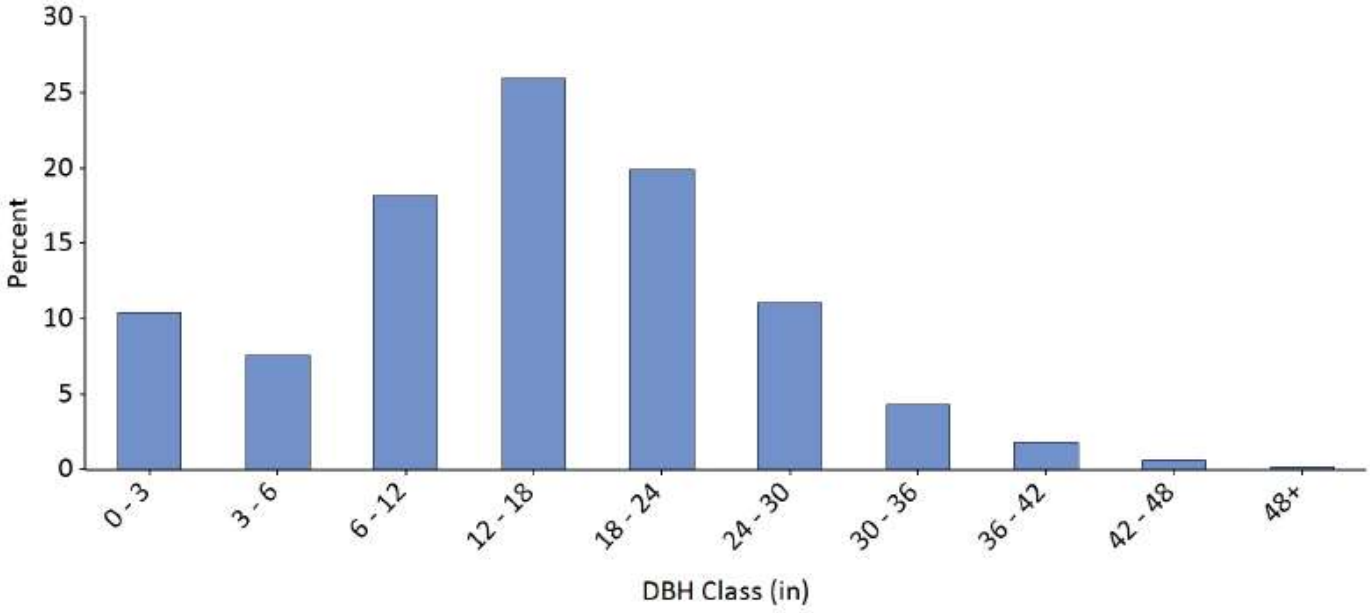
- Number of trees: 7,367
- Tree cover: 2.1 %
- Most common species of trees: Norway maple, Crimson king Norway maple, Green ash
- Percentage of trees less than 6" (15.2 cm) diameter: 18.0%
- Carbon storage: 6.506 thousand tons ($1.11 million)
- Carbon sequestration: 103.1 tons ($17.6 thousand/year)
- Oxygen production: 274.9 tons/year
- Avoided runoff: 242.8 thousand cubic feet/year ($16.2 thousand/year)
- Replacement values: $18.7 million

Three-quarters of Auburn's street tree population is comprised of only ten tree species: Norway maple, the popular cultivar of Norway maple called the Crimson king, Green ash, Silver maple, Littleleaf linden, Honeylocust, Callery pear, Sugar maple, Flowering crab, and Red maple. The i-Tree ECO software presents the break-down of the City's street tree species composition and size class distribution is shown in the following charts.



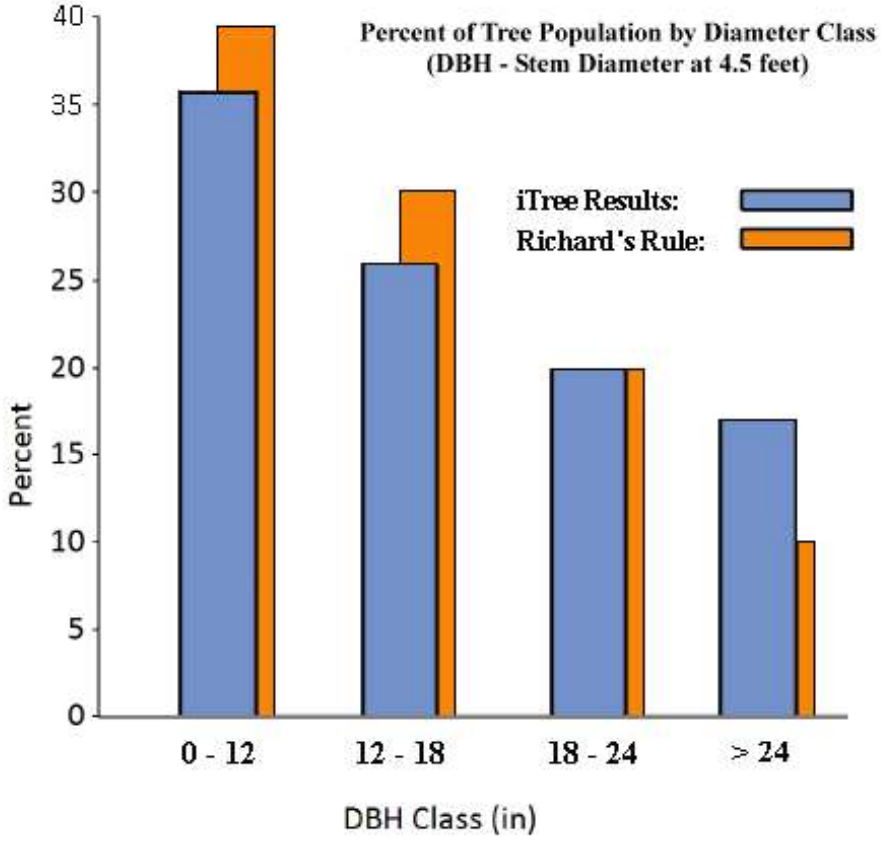
Tree species composition in 11Jan22

Percent of Tree Population by Diameter Class
(DBH - Stem Diameter at 4.5 feet)



How can we make sense of these numbers? In percentage terms, Auburn's low street tree species diversity is compounded by an unsustainable size-class distribution. Dr. Norm

Richards, Professor of Forestry at the SUNY College of Environmental Science and Forestry, has noted the ideal distribution of street trees by size class, suggesting a theoretical distribution of 40% of trees in the 3 to 6" DBH class, (diameter measured at breast height, 4.5' above the soil), 30% of trees in the 12 to 18" DBH class, 20% in the 18 to 24" DBH class, and only 10% in the largest, 24 to 30" size class. When Richard's Rule (in orange) is compared with the i-Tree results (in blue) in the chart below, Auburn is close to matching the prescribed size-class distribution:

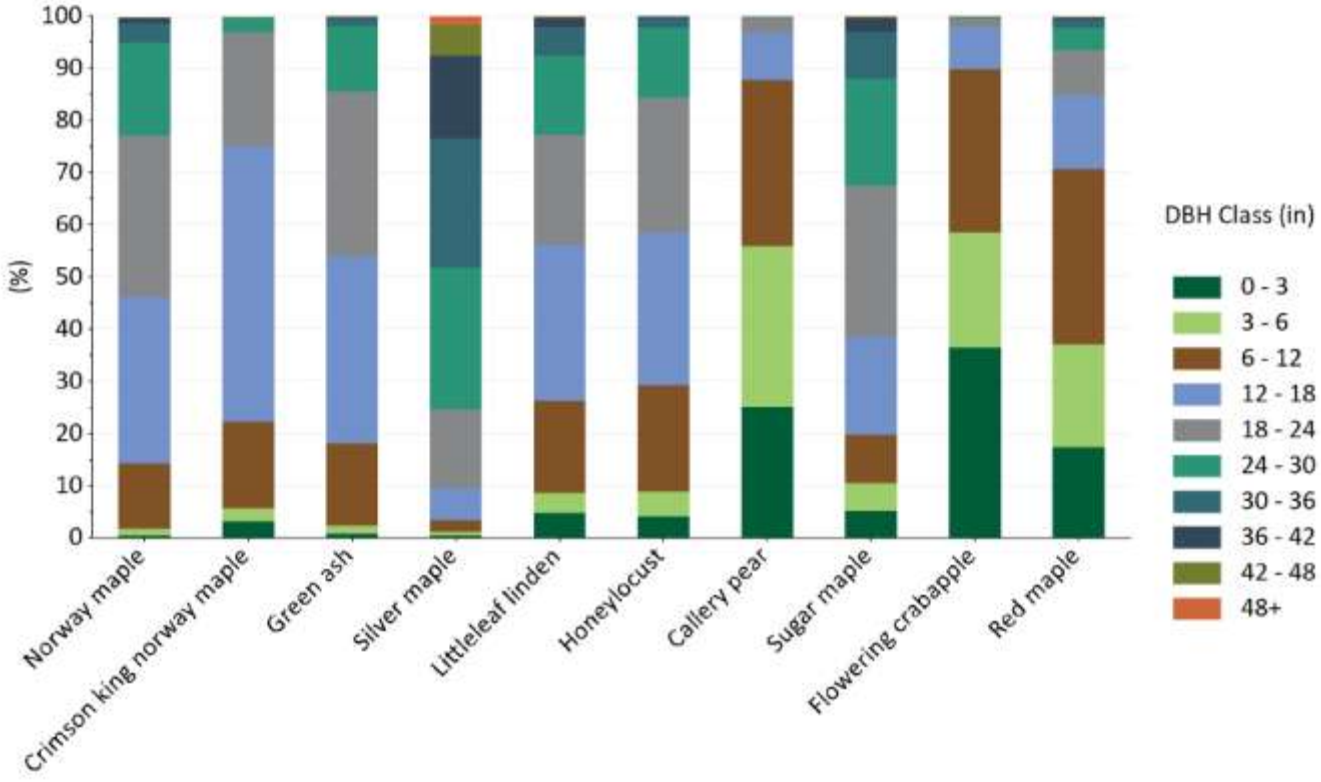


However, Auburn shows too few small trees and nearly twice as many trees over 24".

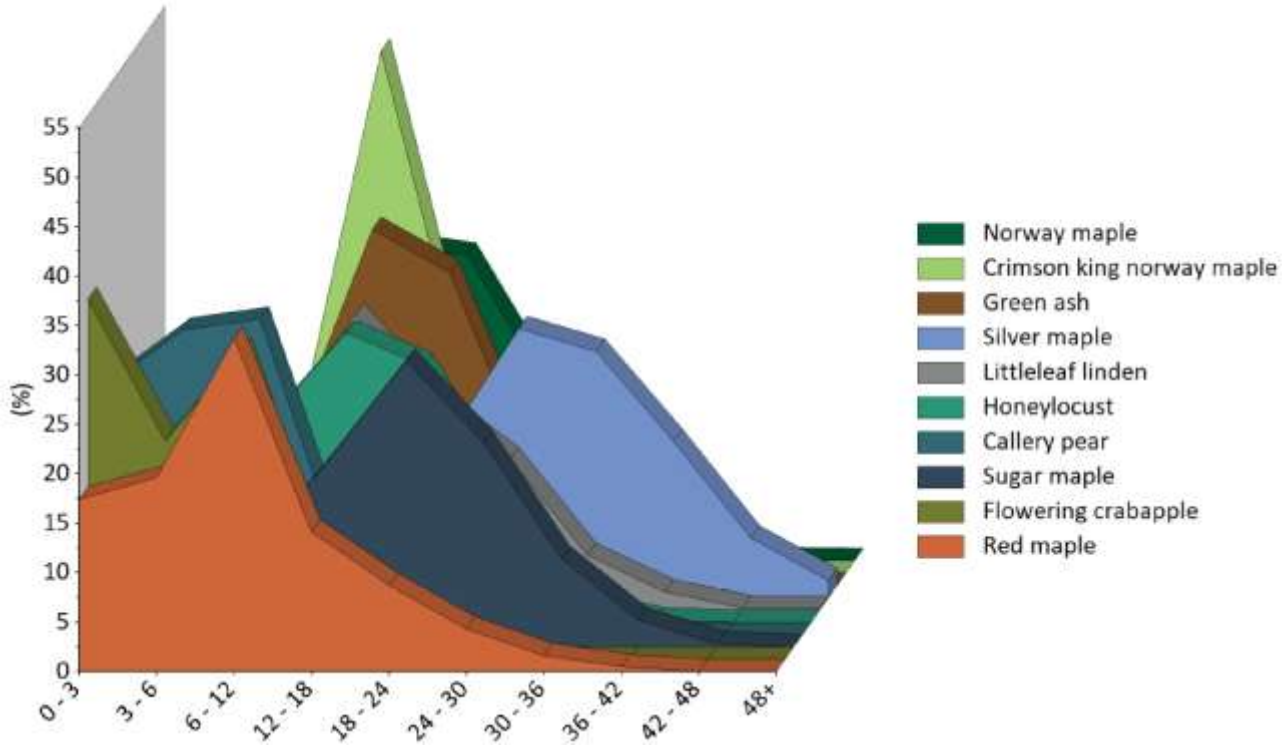
Richard's Rule helps describe the sustainability of an urban tree population. In this perspective, a larger portion of younger, smaller trees can help managers compensate for the loss of trees after planting, and accordingly this portion should be 40% of the total. Trees larger than 24" DBH should ideally be only 10% of the population. Richards' rule clearly identifies the basic community forest management problem facing Auburn: plenty of large trees of too few species, and far too few young trees to replace them.

Richard's general tree diversity rule is to limit any one species to only 10% of the total population. This perspective has evolved due to a growing understanding of and appreciation for how tree diversity provides ecological resilience. In short, a diverse forest has a better

chance of withstanding periodic impacts from insects and disease. Also, DBH size class distribution impacts the benefits trees provide to a community and also directly inform the sustainability of the overall tree population. The closer a community's street and park tree population is to the ideal size class distribution, the more likely it has a larger proportion of smaller trees than larger trees. The ideal distribution allows managers to proactively direct a steady flow of resource benefits and allows the Auburn Public Works Department to more predictably schedule operations and expenditures over the long term. Our most numerous trees can be further explored by means of the following graphics depicting the ten most common street trees in Auburn displayed by DBH size class, (diameter at breast height):



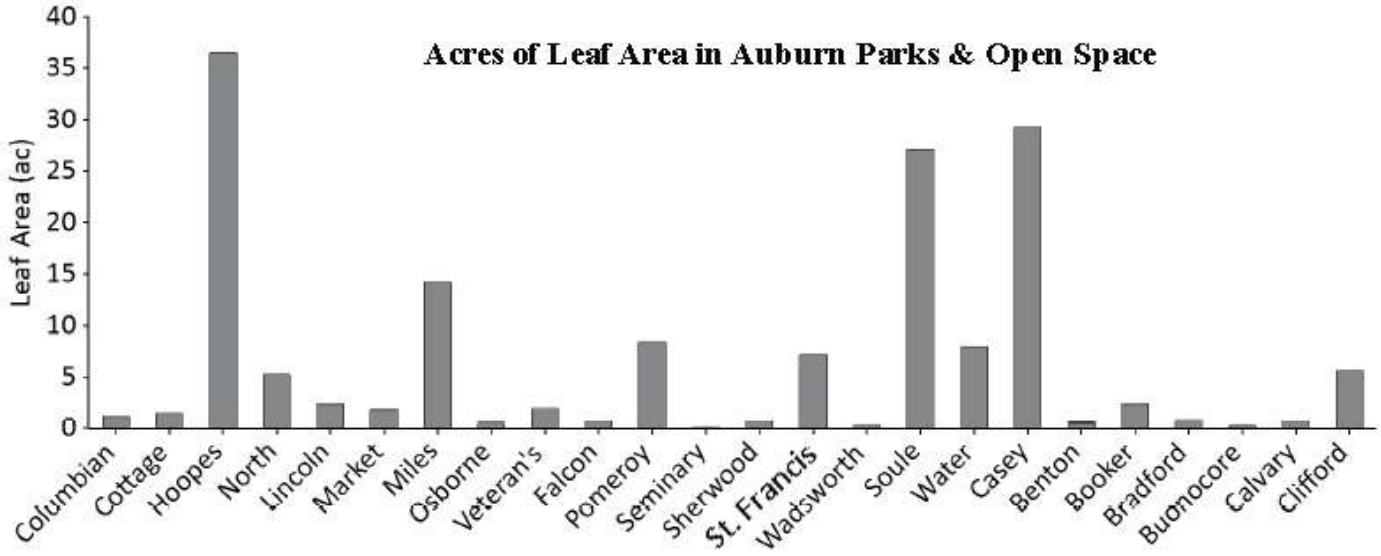
Percent size class distribution for the ten most common street trees in Auburn.

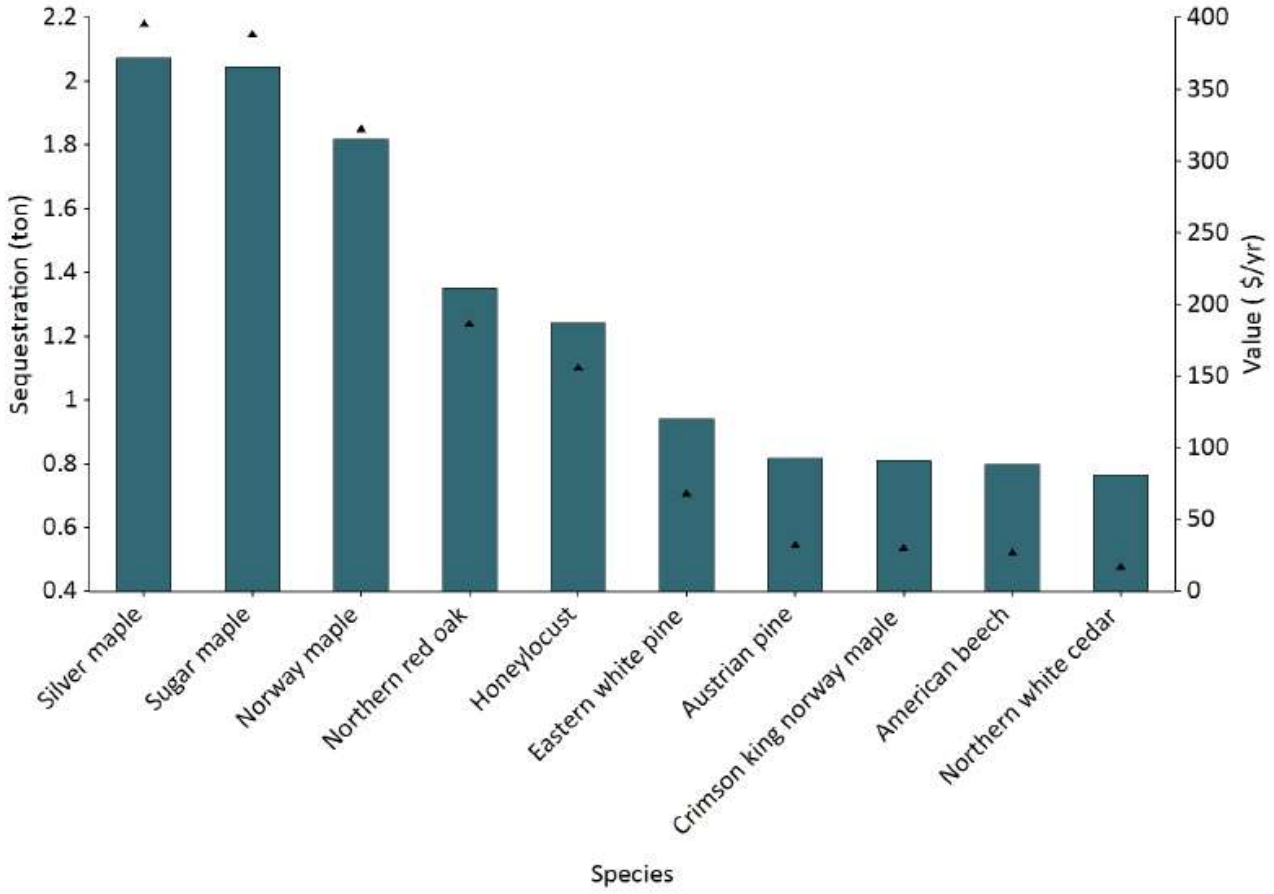


Percent of size class distribution for the ten most common street trees in Auburn.

The first of these two charts illustrates how the decision to abandon Norway maple and Silver maple as good new street trees for planting in the last two decades has resulted currently in a smaller proportion of small (young) trees of those species. Note that large Silver and Sugar maples are particularly significant in their contribution to the top-heavy distribution of tree biomass and especially significant in their contribution to Auburn's urban tree canopy.

i-Tree also allows detailed analysis of Auburn's park trees. In the following charts, i-Tree benefits for Auburn's parks and open space resources are presented. The first shows modeled





Estimated annual gross carbon sequestration (points) and value (bars) for urban tree species with the greatest sequestration, aub_parks

leaf surface area and the second illustrates how much carbon Auburn's park and open space trees are soaking up each year.

The Consequences of Canopy and Tree Population Change

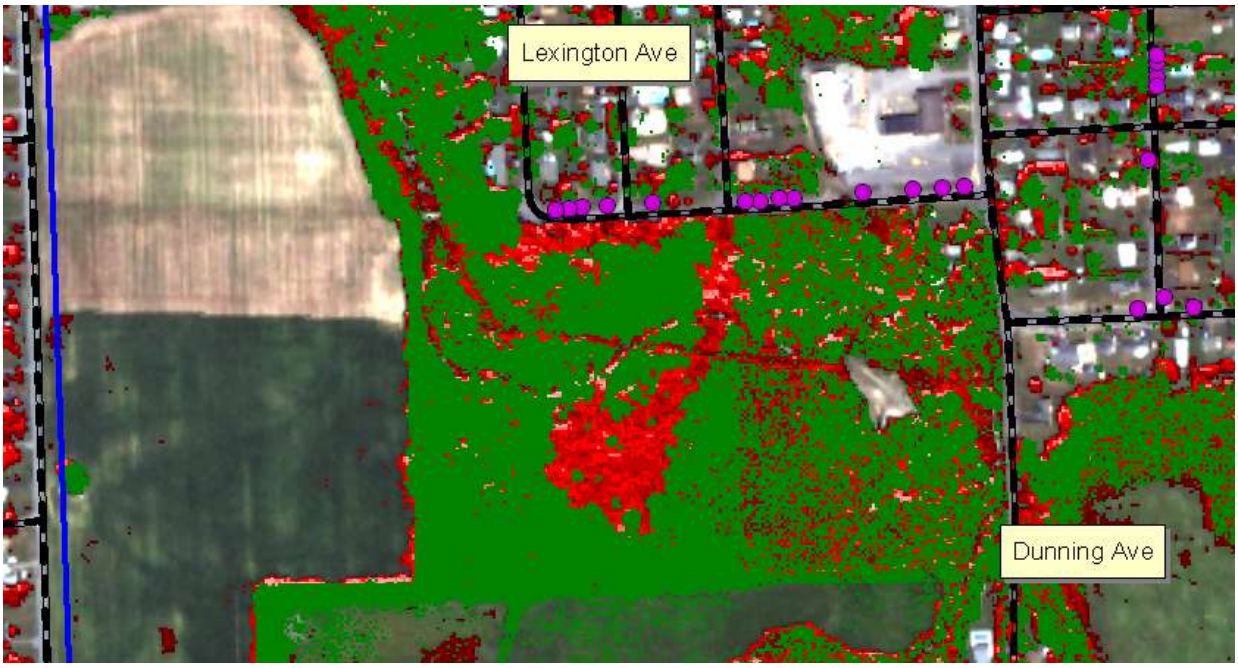
How do changes in Auburn's tree canopy cover - as well as the distribution and condition of street and park trees - bear on the sustainability of Auburn's forest? And, looking forward, what are the consequences of inaction in the face of these changes? To address these questions, we should first take a closer look at what is driving recent changes in canopy cover, and then take a closer look at the tree inventory data. Beginning with changes in canopy cover since 2005, there are three major factors driving canopy loss:

- Removal of canopy during development. Examples include: Housing project West of Belmont Ave.; Senior housing at Flummerfelt's; Car wash development on Grant Ave.; Land clearing and retention basin construction North of Middle School lot; Land clearing behind industrial lots on York St.; Warehouse development along Wright Ave.; Clearing next to NYSEG transformer station along Wright Ave.; Drug store development on SW

corner of Columbus-Dunning and Genesee; Land clearing South of West Clymer St.; and development along North Seward Ave.

- Large tree removals, and,
- Canopy loss from the Emerald ash borer.

The following images illustrate canopy loss after 2005. The first shows impact in the SW



2005 forest canopy in red, 2018 forest canopy in green.

corner of the City where land has been cleared. The second illustrates canopy change along Wright Avenue and Genesee Street:

2005 forest canopy in red, 2018 forest canopy in green.

Auburn's Green ash trees (*Fraxinus pennsylvanica*) have been devastated by the Emerald ash borer (EAB), *Arrilus planipennis*, an exotic insect that feed on all species of ash trees. As no ash native to North America evolved with this type of boring insect, infected trees typically die within a year or two of infection. In assessing canopy change in Auburn over the past 17 years, we must note the impact of the EAB on Auburn's ash tree population (see chart inset, below). As mentioned above, a number of random sampling efforts were performed over the years along Auburn's blocks. Data from that sampling estimated approximately 1,100 ash trees along Auburn's streets. Later, these figures were borne out by an ash census undertaken in the Summer, 2014 by Corinne Murray, a student at Le Moyne College. Ms. Murray located and mapped the occurrence of ash trees on Auburn's streets and in City parks. Her results spurred the priority removal of ash along City streets in anticipation of the arrival of the EAB in Auburn.

At that time the impact of EAB was clearly evident in Western New York. It was hard to miss all the dead ash in Buffalo at that time, and Rochester was beginning to show the impacts of the infestation. The Eastward progress of the insect was painfully evident along the NYS Thruway,

and this was not lost on the forest management network in Auburn. By 2018 ash the insect was in Auburn killing trees, although initially most people did not notice the damage to the trees. Who remembers when the County removed the first dead ash growing in front of the Cayuga County office building on Genesee Street? The point is that by 2018 our ash - 8% of our street trees - were only beginning to show City-wide decline, and this is borne out by layering tree inventory data over the 2018 LiDaR imagery. For example, see the Lincoln Playground at "Peacock Park":

2018 forest canopy derived from LiDaR data, showing locations of stumps from regular removals and locations of ash trees that were failing at that time but are dead or nearly dead now.

When the data on the ash illustrated in the map above was gathered in the summer of 2021, some 740 ash trees remained on our City streets. Hundreds were removed that summer by City crews and contractors, and indeed, the removals continue to this day. As many homeowners are now aware, tree service providers are extremely busy and like many other services the costs for removal have become much more expensive. All this due to a tiny green insect.

Like most upstate New York municipalities, Auburn has elected to cut down their remaining ash trees rather than embark on treatment, and at this point the number of standing (albeit dead)

Forty Year Overview of Ash Trees in Auburn's Urban Forest

Year	Method	Total	Ash	Comments
Dec. 1980	Survey	3,367	114	City Parks Dept. - bad st trees only
Oct. 2002	Random Sample	8,227		Walt & BOCES (streets only)
Nov. 2012	Random sample	8,189	1,016	Walt & DPW (streets only)
June 2014	Survey		1,043	Corrine Murray city-wide ash survey
May 2015	Field trip			Dead ash all over Buffalo, NY
Sept. 2016	Field trip			Dead ash on Rt. 90 50 mi from Auburn
Sept. 2019	Field trip			many dead ash in Auburn
Sept. 2020	Field trip			dead ash in Auburn very noticeable
May. 2021				Ash decline obvious to all
Spring-Fall 2021	Inventory (street)	6,694	740	
Spring-Fall 2021	Inventory (parks)	1,383	80	

Results

Based on a spatial comparison of the 2014 and 2021 data, Auburn had 1,212 ash in parks and along streets.

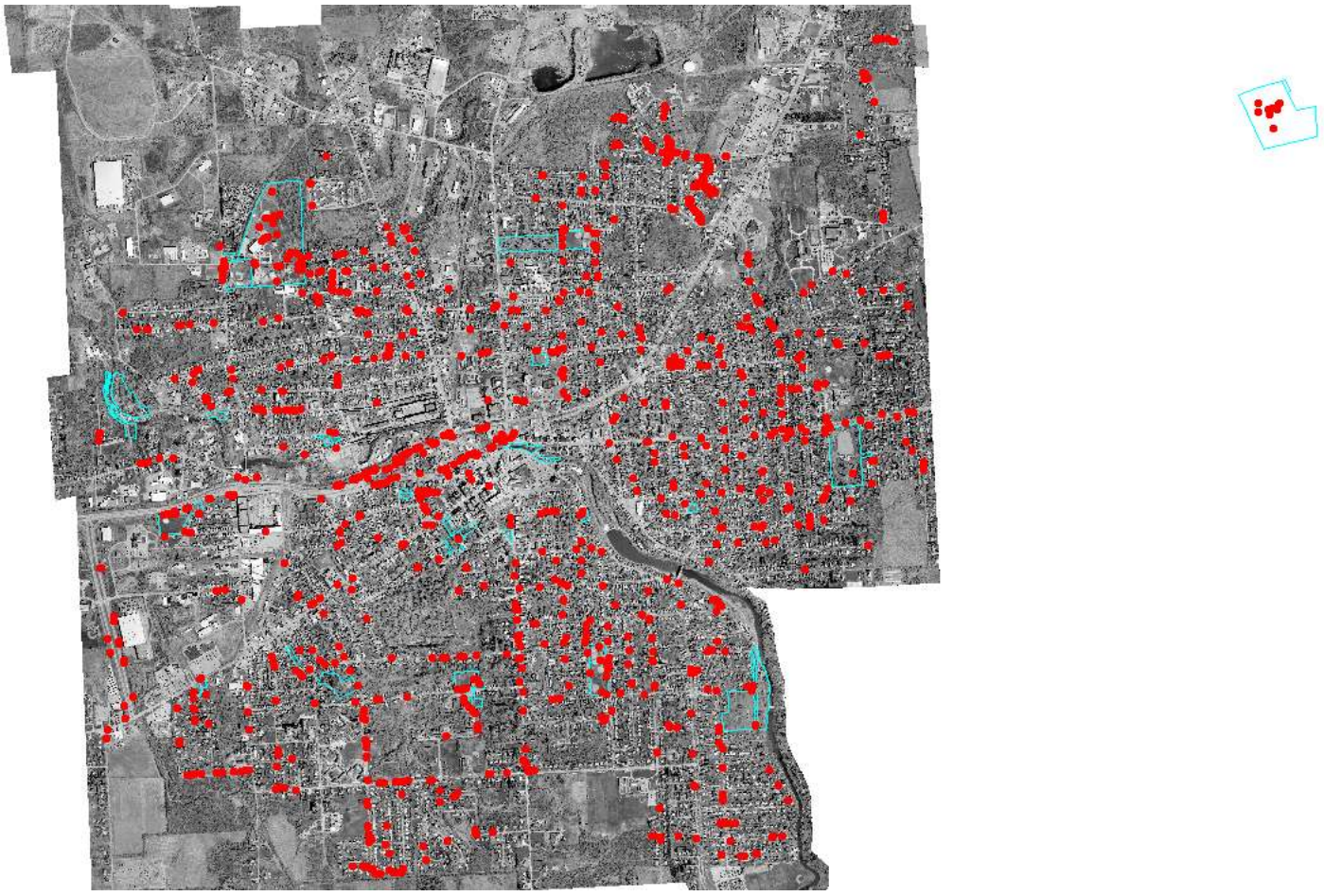
With these figures in mind: Auburn cut 472 ash between 2014 and 2021. Ash removals intensified in 2021 and continue.

In summary, between Oct. 2002 and Oct. 2021, Auburn lost 1,500 trees in the City's street and park tree inventory, about 1,200 of them ash.

Losing our ash is a big factor in driving the decline of our tree canopy.

ash along City streets is estimated to be 593 trees. The overwhelming majority of these trees are Green ash, though Auburn does have one dead White ash, *Fraxinus americana*, as a street tree growing on Baker Avenue, and there are also a few European ash, *Fraxinus excelsior* and some of the single-leaf cultivar of *F. Excelsior*, "Hessei" as well (cultivar = cultivated variety). The European ash appear to be somewhat more resilient to the EAB than our native Green and White ash trees, but all are either dead or show signs of immanent death. Due to the hazard

these trees pose to residents and visitors, the City has one contractor in the field cutting ash and expects to resume cutting with their own crew this summer.



Ash trees and stumps.

Dead and dying Green ash along the North side of Richardson Street, looking West.

i-Tree provides a particularly useful bit of analysis called an RPI, a "Relative Performance Index," that allows us to determine how a tree is performing relative to all the trees that grow in Auburn. The calculation is based on the share of good quality trees of one kind compared with all the good quality trees in the City. Since our ash are doing so poorly - indeed, nearly all are dead - their RPI is only 47 out of 100; a sad fact when you consider we had so many. This devastating situation is not only a direct loss for our community, it has significantly delayed many difficult forestry management decisions that remain. This alone is a clear - albeit regrettable - example of how a reactive management does not serve the goal of a sustainable forest. The stories about the rest of our trees in Part 2 bring this message fully home.

Part 2. The street trees in our community: challenges and opportunities

The Red oak on South Street.
©Tom Hussey, 2022.

Life is difficult for Auburn's street trees: narrow tree lawns provide very little soil; utility contractors carve out tree canopies to make way for power lines; salt is applied to our roads and parking areas in winter; and the same paved surfaces, sidewalks, and buildings absorb considerable quantities of heat in summer. These difficult growing conditions are taking a toll on our street trees, and we must give careful thought to choosing street trees that are suitable to the growing conditions if we wish to cultivate a healthy urban forest over the coming decades. This section of the management plan summarizes the performance characteristics of the ten most common street trees in Auburn within the context of the site conditions along our streets - where they grow. In addition to the ten most common street trees in the City, alternative trees

that may prove to be useful additions to the City's future urban forest are presented as well. Finally, there is a brief look at how microclimate conditions can impact our urban forest.

Our most treasured trees - like the Cayuga Museum's Ginkgo depicted by Arthur Hutchinson that appears next to Bobbie Panek's poem "Auburn's Oldest Resident" in this plan's first two pages - are well known to many of us. They are our neighbors; we see them as we go about our errands and meet for social events. We also connect with other large specimen trees, like the White oak depicted by Tom Hussey on the cover, and Tim Tucker's, below. By and large these tree treasures are remnants of older times, trees lucky enough by genetics and circumstance to have survived salt, automobiles, utility clearing and of course, wind. But these trees are also important lessons of what endures. They are, in short, minorities: examples of trees that are *not* as common along our streets as the most numerous top ten trees. They are the standouts.

The Seymour Street Sycamore.
©Tim Tucker, 2022.

Comparing tree performance in Auburn.

As described above, the relative performance of the most numerous street trees in Auburn can be tabulated. The comprehensive - if complicated - results appear as follows:

Relative Performance Index by Species

Location: Auburn, Cayuga, New York, United States of America
Project: 11Jan22, Series: Auburn, Year: 2022
Generated: 1/11/2022

" . . . a comparison of the overall condition of each species to all the others. Values higher than 1 indicate a species has a proportionally better condition rating"

Species	Excellent (%)	Good (%)	Fair (%)	Poor (%)	Critical (%)	Dying (%)	Dead (%)	RPI	# of Trees	% of Trees
Norway maple	0.0	17.7	58.8	14.3	8.7	0.0	0.6	0.97	1,347	18.3
Crimson king norway maple	0.0	48.3	41.4	8.7	1.5	0.0	0.1	1.09	962	13.1
Green ash	0.0	0.8	8.8	3.0	75.9	0.0	11.4	0.47	594	8.1
Silver maple	0.0	20.2	60.9	13.9	5.0	0.0	0.0	1.01	519	7.0
Littleleaf linden	0.0	50.6	39.9	5.7	3.4	0.0	0.4	1.09	494	6.7
Honeylocust	0.0	50.7	44.4	4.3	0.6	0.0	0.0	1.11	491	6.7
Callery pear	0.0	66.4	29.3	2.4	1.5	0.0	0.4	1.13	458	6.2
Sugar maple	0.0	30.6	44.0	12.4	12.4	0.0	0.7	0.98	291	4.0
Flowering crabapple	0.0	32.8	48.2	12.3	4.6	0.0	2.1	1.02	195	2.6
Red maple	0.0	57.1	33.2	4.9	4.3	0.0	0.5	1.09	184	2.5

This data is useful, certainly, but it is a challenge to unravel. Based on percent canopy of each tree's data, i-Tree summarized the top ten trees. For example, you can tease out that as of January 2022, more than three-quarters of the Green ash in Auburn were in "Critical" condition, and barely 9% were in "Fair" condition. These figures are the basis for the i-Tree assessment of the Green ash Relative Performance Index as 0.47, or 47%. Figures like this are informative, but they do not always motivate us to confront what is happening to our trees. It is pretty easy to see why: experience shows that we are rarely moved by statistical information; we humans like a story. An image of one tree in awful condition, with broken limbs, ugly fungal conks, large cracks, and festering wounds is more difficult to dismiss than an abstract list of numbers. And when the painful details of a prototypical Norway maple are pointed out to us, we will get a better idea of what is troubling our City's street trees.

i-Tree's "Relative Performance Index by Species" provides a handy basis to compare our street trees, and we can better judge our best growers by factoring in additional details from our street tree inventory. To look within each species category, the RPI of Auburn's street trees was adjusted with an algorithm based on factors observed in the field including a tree's woody

condition: large wounds and cracks; rot; wet or sappy wounds; fungal conks or strange growth; decaying branch stubs; broken or dead limbs, bad or overextended branches, and; if cavities, seep holes or evidence of insect activity suggests the tree is hollow. Additional deductions to the RPI were made when a tree demonstrated certain types of growth habits that

Glimpse of Norway maples on Auburn streets.

can be problematic, such as strangling roots and codominant stems. Finally, a tree's final "grade" was also determined by the many human factors that can handicap a tree's performance, such as overzealous mulching, delivery truck damage, snowplow or automobile damage, damage from sidewalk work, and "rodeo mowing", i.e., when people run the steel edge of a mowing deck against a tree trying to cut every last blade of grass growing near a stem.

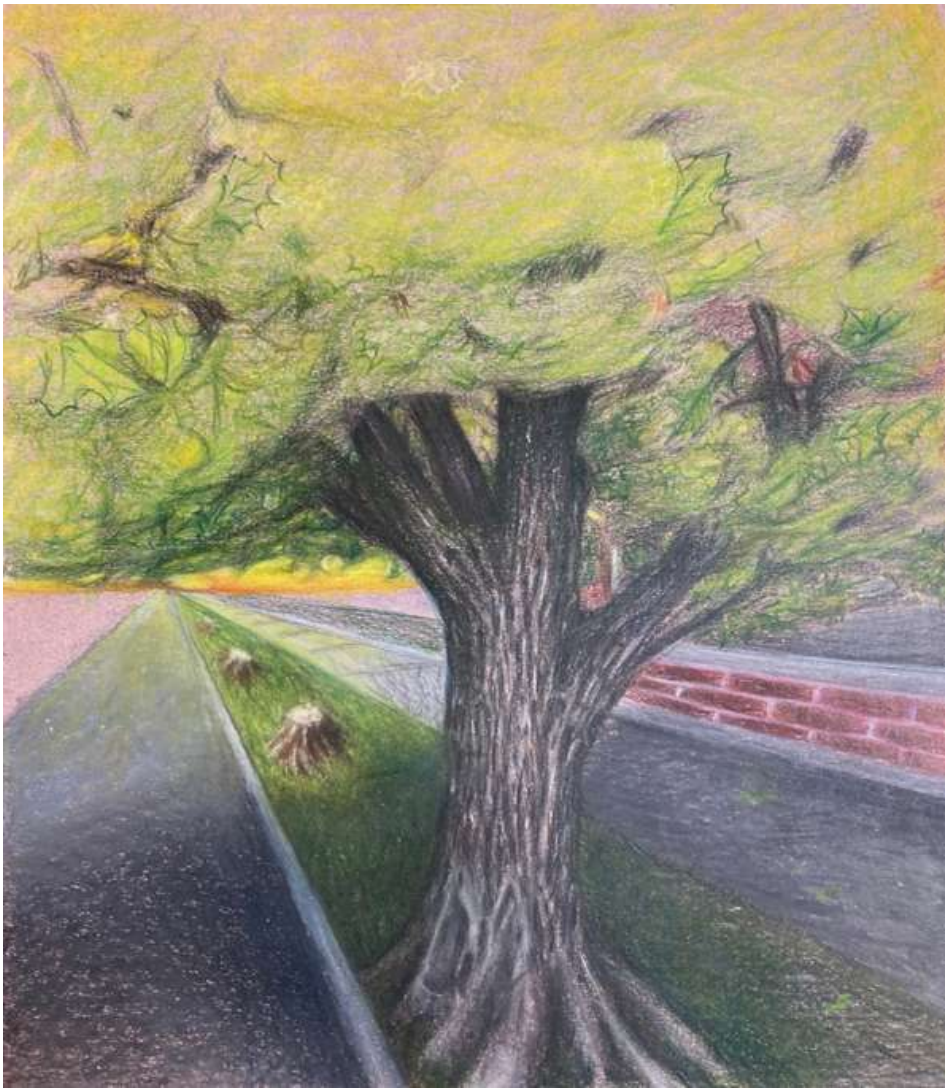
The next nine most common street trees in Auburn

Norway maple. After considering Green ash, we turn now to Norway Maple, *Acer platanoides*, the most common street tree in Auburn. Together with the popular cultivated variety Crimson king, they make up nearly a third of Auburn's street trees. Despite being very common along streets in every city in New York State, their performance is not praiseworthy. With a base grade of 97%, Norway maples are true survivors. Their endurance under difficult growing conditions is admirable, despite the mess they regularly leave after even average rain and snow storms. With their typically terrible condition (see photo montage above) they best fit Peter Wohlleben's term for tough urban trees: they are "street kids" growing up without the parental support of a nurturing forest, in poor soil, regularly dumped with winter road salt and baked in the summer heat. Although all cultivated varieties of Norway maple are a regulated invasive species in New York State, the Crimson King cultivar is highly favored in Auburn. It greatly outperforms its precursor Norway maple, although like all maples planted as a street tree it is very sensitive to external threats.

A look at Auburn's 2021 tree inventory data also informs our understanding of these changes in canopy cover. 31.4% of Auburn's street trees are Norway maples: 18.3% Norway maple (*Acer platanoides*), and 13.1% the popular "Crimson King" cultivar of Norway maple. Norway maple is widespread in New York State and is a designated invasive species. Most yards, empty lots and unmanaged park spaces in Upstate New York are readily colonized by Norway maple. Each Spring, untold millions of Norway maple seedlings begin to grow under residents' trees and shrubs and along the edges of their property. As a regulated plant species in NYS, nurseries are discouraged from selling it. Most state and federal funding will not support purchasing, planting, or cultivating Norway maple; rather they are more inclined to fund removal and eradication efforts. Although it is probably the most common street tree in Upstate New York, it has lost favor among arborists, foresters, public works employees, and biologists. For appraisal purposes, as a designated invasive plant it has a 100% value deduction factor; that is to say, it has no commercial replacement value.

Auburn has more than 3,500 maple trees growing alongside City streets. Together with the Norway maples, these also include the better-known Sugar and Silver maples, but also include

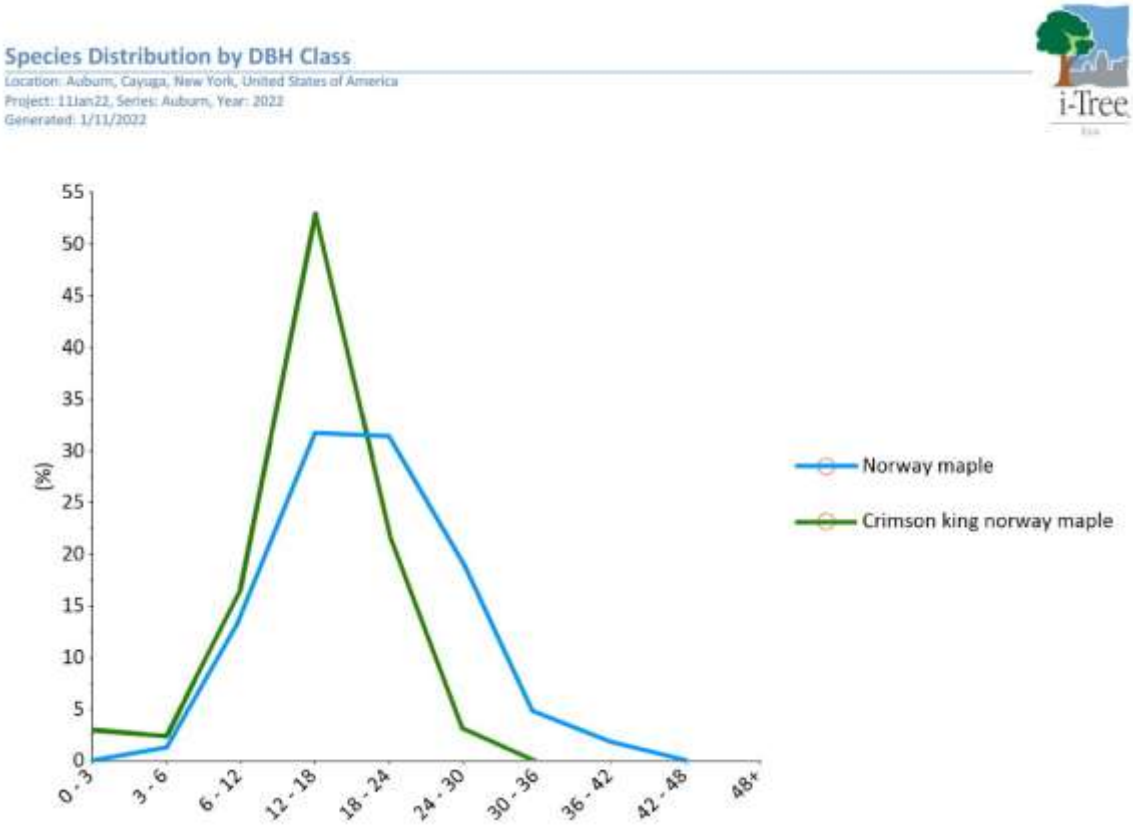
the lesser known Freeman maple, Amur maple, Boxelder, Hedge and Sycamore maples, as well as Japanese and Paperbark maples. These latter species of maple number only 224 trees. Generally speaking, none are living to their potential and in the case of Silver and Sugar maples, are not well suited to our City's growing conditions.



A Norway maple Street Kid on Auburn streets.
© Joshua Ely, 2022.

Of the 1,335 Norway maples growing along our streets, nearly a quarter are in poor condition with barely half their canopy intact, or worse, in failing condition with much less than half their canopy intact. 186 of our Norway maples are in such poor condition they should be removed, and at the very least undergo a Level 2 tree risk assessment - a thorough, certified examination of the risk a tree may pose to people and surrounding property. Silver maples (*Acer saccharinum*), make up 7% of Auburn's street tree population and nearly 100 of those are in a similar state.

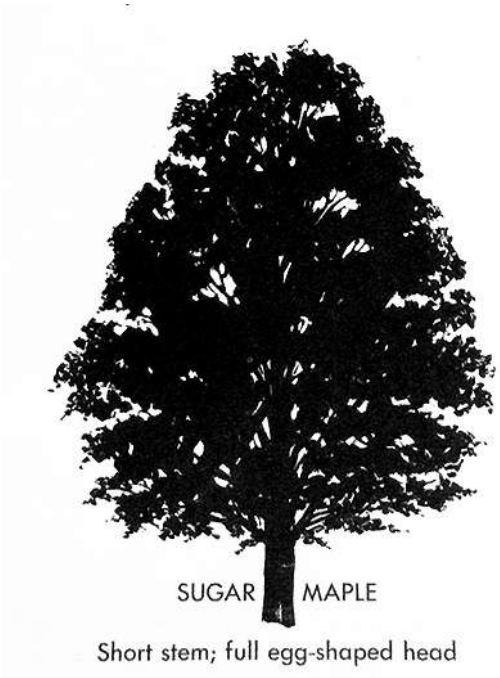
Norway maples in Auburn: Norways in Red, Crimson kings in Green.



DBH Class of Norway and Crimson king maples in Auburn.

Sugar maple. Sugar maple (*Acer saccharum*) may only be 4% of the City's street tree population, but they are having a very difficult time growing in Auburn. Sadly, Sugar maples are not very resilient and can take very few of the everyday impacts city life imposes on a street tree. They are not tolerant of soil compaction, stem damage of any kind, root damage of any kind, or the pruning forced on them by necessary utility line clearing. Our Sugars are also among our larger street tree, with an average diameter of 20". Like their poor-condition Silver and Norway maple counterparts, 23% of Auburn's Sugar maple trees should be removed, and at the very least undergo a more advanced tree risk assessment. And 21% of Auburn's Sugar maples require priority pruning. Taken together, the decline in Auburn's maple tree population contributes to the overall canopy loss that has been underway since 2013.

The Sugar maple, *Acer saccharum*, produces attractive wood and sweet sap making it one of our more valuable forest trees. Also, the form of the tree grown outside of forest conditions also make it one of the most widely recognized trees anywhere. Brilliant Fall color and attractive bark adds landscape value to its commercial impact, making it the official



Profile of a field-grown Sugar maple. From Petrides, 1958, A Field Guide to Trees and Shrubs.

state tree in New York. Unfortunately, Sugar maples are not generally successful in urban settings, and indeed, they are in trouble. In general it is best to think of Sugars with little resilience in Auburn as they follow a three-strike impact pattern: they enter a death spiral after only the third insult to their integrity. Given their intolerance to salt impact on soil and foliage, they begin with one strike. They require deep, rich, well-drained soil and in our city, few of our street tree planting sites off such bounty, resulting in strike two. Any one insult beyond these

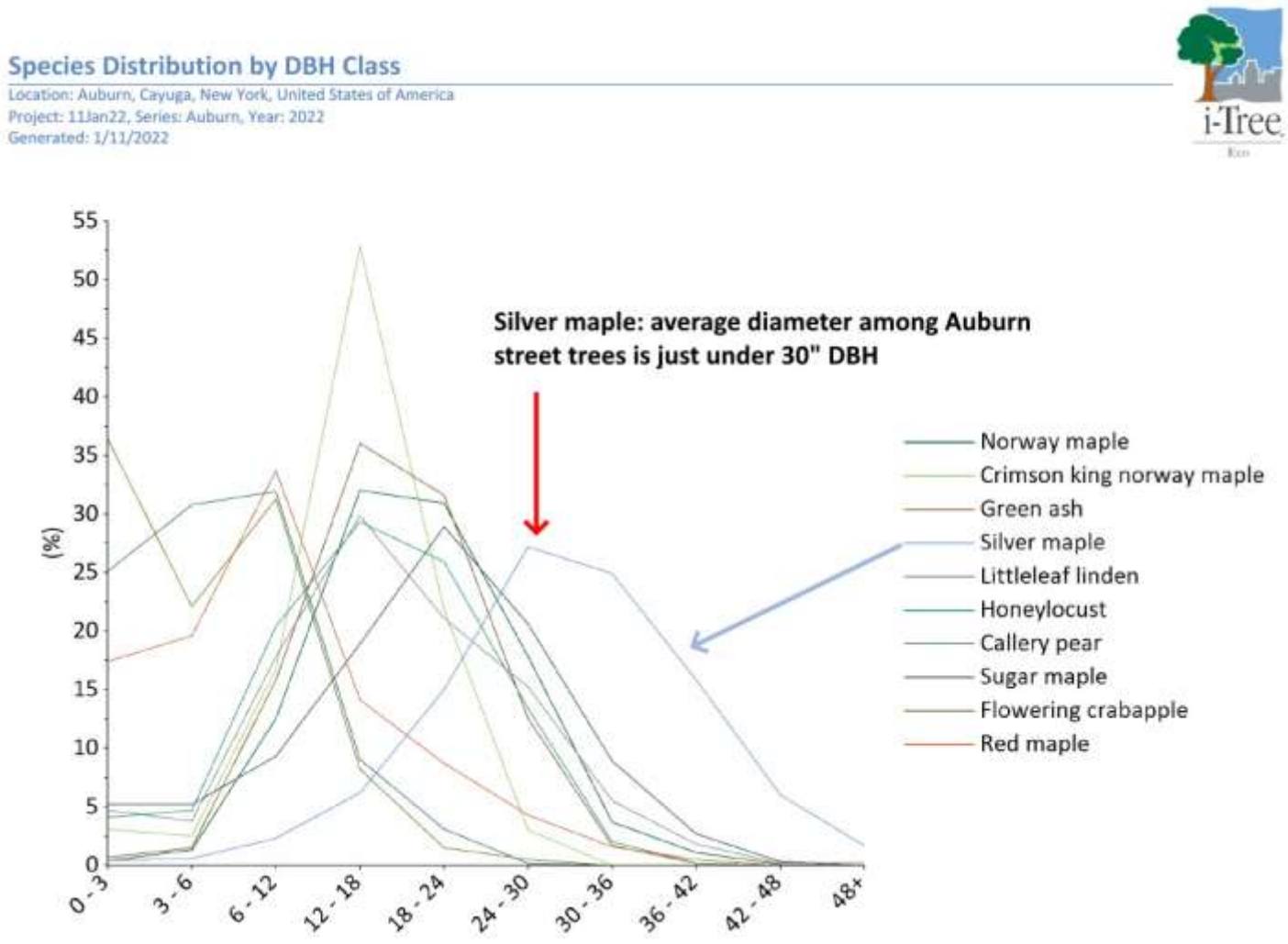
base line challenges, such as bark damage from sidewalk construction or rodeo mowing,in appropriate mulching, or fungus, means our Sugars are having a difficult time in our City.

Sugar maples in Auburn.

Sugar maple on S. Seward with *Pleurotus ostreatus* sap rot.


One of the lucky few: Sugar maple along Metcalf looking SSW across South Street to Clymer.

Silver maple. Silver maple, *Acer saccharinum*, are among the largest of Auburn's street trees. Their durability and tolerance of tough urban conditions render an i-Tree performance rating of 101%. However, when all the defects observed in the field are factored into their performance their average RPI drops to 98.7%. Since it has such a poor reputation as a street or ornamental tree, it is rarely planted by choice. Arguably, most of the Silver maples in Auburn were planted soon after the loss of our American elms, *Ulmus americana*, to the Dutch elm disease in the 1960s. Their fast growth to a large, tall tree was an advantage for earlier circumstances, but has come at a present cost. Faster growing trees are frequently weaker wooded, and the growth habits of Silver maple lead to structural problems. Chief among these is the trees' tendency toward growing codominant branches, i.el, two or more branches of similar diameter arising from the same location. Those codominant branches with V-shaped unions that have bark included within the contact zone of the branches are often the weakest, and these are found commonly among Silver maples.



Highlighting Silver maple within the species distribution by DBH class in Auburn, source is i-Tree Eco.

Silver maples in Auburn.

Typical Silver maple on an Auburn street. Note the codominant branches starting at ~ 6 ft. from the ground and the effects of trimming for utility lines.

Littleleaf lindens. Lindens have been cultivated for centuries and Littleleaf linden, *Tilia cordata*, is the most common species of Linden planted in residential settings. It is a fast - growing tree with relatively soft wood, and, like other Lindens, it may sucker profusely (i.e., shoot out numerous young sprouts) from the root collar - especially when it is young. Lindens also develop codominant braches with included bark that, when they fail, leave dramatic wounds.

Branch failure on a Littleleaf linden.

As an advantage for street use, Littleleaf Lindens are a reliable transplant and they quickly establish shade.

Littleleaf lindens in Auburn.

Honeylocust. Cultivated forms of Honeylocust, *Gleditsia triacanthos*, are the 6th most numerous street tree in Auburn. As a desireable urban landscape tree variety, the tree has been cultivated to limit its native thorns and seed pod production. But as it ages or when it is under stress, Honeylocust can revert to inherited traits, especially seed pod production. This trait, and its numerous delicate leaf stems and leaflets produced each Fall have given the tree a bad maintenance reputation to the extent that many homeowners want them removed. This is most unfortunate as the tree is a successful grower and a reliable transplant. Unlike Norway maples, very rarely do these trees demand managerial attention or drop limbs during storms.

Honeylocust in Auburn.

Crabs. Flowering crabapples, *Malus spp.*, are among the toughest, most resilient and reliable trees for Auburn's most unforgiving planting and growing sites. Their modest foliage, low stature, and unremarkable form are overlooked in favor of their colorful Spring flowers and Fall fruit. Like other Upstate New York cites, Auburn does not conduct a consistent pruning effort. If we did, we would probably enjoy these trees much more than we currently do. Auburn's tree ordinance allows the planting of such low-growers under power lines and over gas and water mains, and furthermore permits them to be planted within 20 feet of one another, making *Malus* spp. a highly desireable tree, especially in the largely impermeable landscapes of the downtown and heavily commercial neighborhoods. .

Flowering crab trees in Auburn.

Red maple. The tenth most common street tree in Auburn are cultivars of the Red maple, *Acer rubrum*. With excellent Fall color and good drought tolerance, Red maples are a reliable tree in Auburn on the right site. Red maples tend to grow codominant stems at an early age, and without corrective pruning they will develop poor form in advancing years. Under power lines, Red maples do not perform well.

Red maples in Auburn.

Ornamental pears. Cultivated varieties of Callery pear, *Pyrus calleryana*, have surpassed Crimson king Norway maples as the most asked-for tree in Auburn. Now recognized as one of the largest introduction blunders of the last century, this hardy tree was cultivated in the 1950s using seed collected in the early 20th century from pears native to the arid mountains of Southern China. Like a Trojan Horse, the secret of this invasive nightmare lies within: while the scion (the stem and branches) of each cultivar are genetically identical clones bred to grow sterile, male-only flowers, the root stock on which they are grafted is not. When scions failed and root stock successfully suckered and blossomed, they would cross their genetics with the scion stock to produce trees with undesirable features: tough, poorly formed trees with dramatic thorns. Later cultivars developed during the 1980s were based on more fertile scions that readily cross-fertilized into the aggressive tree that is now engulfing countless acres. As noted above, Callery pears are good performers in Auburn: they have the best average crown condition and even under wires they have relatively high performance grades. Their reliable Spring flowers and good Fall colors make them a popular tree, though more and more Auburnians are complaining about the fragrance from their numerous flowers. Well recognized

Fruiting pear tree on Jefferson Street.

Callery pears in Auburn.

for their ease in transplant, they have been planted in some of the toughest sites in the City. However, like the Cities of Ithaca and Syracuse, Auburn has recognized its invasive habit and no longer purchases Callery pears.

The problem of invasive species

The havoc invasive organisms such as Norway maple and Callery pear are wrecking in our ecosystems is becoming more broadly understood. Callery pears have been called a "nightmare tree", something "worse than murder hornets" (Higgins, 2018 and McConnaughey, 2022, respectively). As mentioned above, Norway maple is a Regulated Invasive Species in New York State, and as such cannot be "knowingly introduced into a free-living state". Prohibited Invasive Species include the Amur cork tree (*Phellodendron amurense*) of which Auburn has 47 growing on tree lawns, which "cannot be knowingly possessed with the intent to sell, import, purchase, transport or introduce." Invasive organisms reach such a status when they easily take up residence within our growing spaces, so successfully they seem to be invisible to our native insects and diseases. As there is no check on their growth and expansion into our habitats, they can easily usurp our native species of trees and shrubs. Certainly these trespassers *do* provide ecosystem services, but they do so at a great cost to local biodiversity and the persistence of native species.

The principal invasive plants encroaching in Auburn include the Tree-of-heaven, European buckthorn, Norway maple, Japanese knotweed, Multiflora rose, Phragmites, Pale swallow-wort, Border privet, Amur cork tree, Black locust, and Poison ivy. Even native species of plants (like Black locust and Poison ivy) can assume a powerful role in a locality such that they dominate management regimens and consume labor and budgets. Four of these Auburn problems are discussed in some detail: European buckthorn, Japanese knotweed, Ailanthus, and Poison ivy.

European buckthorn. Buckthorn is ubiquitous in Cayuga County, and Auburn is no exception. It is readily spread when birds consume the dark berries in the late Fall and Winter seasons, the last fruit they prefer. The species name for this member of the buckthorn family is "*cathartica*" is so-named because it will induce wildlife to rapidly and ferociously defecate. It is especially common along older Sugar and Silver maple trees in Auburn's NW quadrant. It can be managed with mechanical pulling or the early Fall application of glyphosate herbicides to freshly cut stems.

Invasive Ailanthus along Auburn's Railroad Tracks, just off the East end of Van Anden Street.
© Jennifer Duke Anstey, 2022.

Autumn fruit on a European buckthorn. Note sub-opposite leaves.

European buckthorn in Auburn.

Japanese knotweed. Among our invasive plants in Auburn, none is spreading as fast as Japanese knotweed. Japanese knotweed has been in Auburn for at least 50 years, but is now spreading beyond its domestic role as an historic garden accent into a full-blown invasion. Now found in every quadrant of the City, Japanese knotweed is poised to become the dominant vegetation along the banks of the Owasco River, along the Arterial roadway, in many backyards, and most of our public properties. Almost 3 acres of public property host large stands of Japanese knotweed, and there is a large stand of nearly 4 acres on mostly private land between North Division Street and the Chase Street Extension. In addition to these large stands, there are numerous smaller clumps scattered across the City, including two troublesome locations: in the Owasco River corridor at the Mill Street Dam and at a disturbed construction company site on North Division Street. Left unchecked, Japanese knotweed will out-compete and force out the remaining native vegetation in our community and become an even more serious and expensive public and private control problem in decades to come.

Japanese knotweed foliage.

Some Japanese knotweed stands in Auburn.

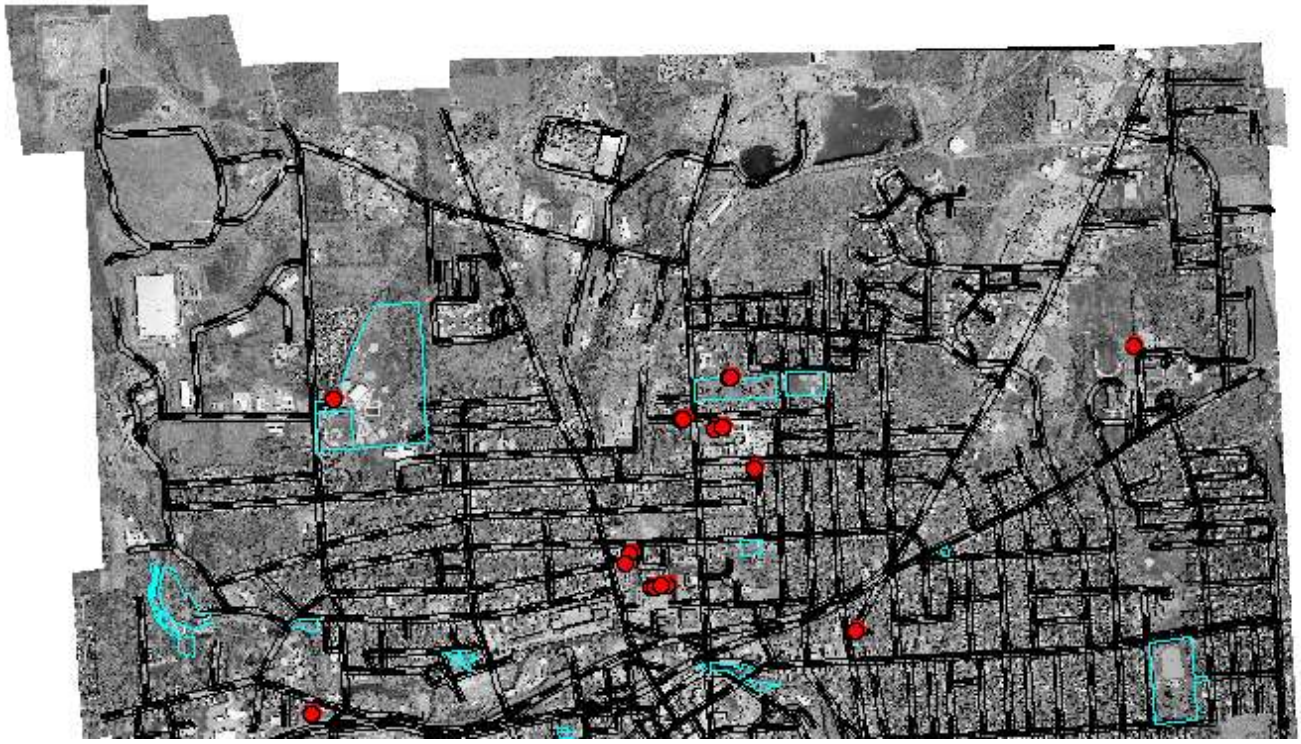
To demonstrate the efficacy of a modified stem-injection treatment of Japanese knotweed, trial plots were established at the former Dunn & McCarthy site, at the City landfill, and at the City-owned Soule Cemetery. At Summer's end, stems were cut and a 47% solution of surfactant-bearing glyphosate was injected into the plants. The following Spring the stands exhibited up to 97% reduction in knotweed regeneration. The approach is labor intensive and must employ the services of a NYS certified applicator. Given the costs of the approach, as well as the requirement to apply herbicides under NYS certification, an experiment is underway in Owasco to manage knotweed with a kill-screen. Imported from the United Kingdom, the idea is to lay ¼" hardware cloth over a cut stand of knotweed, preferably in March. As new growth from the plant's rhizomes emerges it will grow through the openings of the screen and become girdled, forcing cyclical regrowth from the rhizome that will eventually exhaust and kill the knotweed. The material and labor costs of this approach are less expensive than repeated treatment with herbicides, making this approach a practical and cost-effective option.

Tree-of-heaven. Ailanthus, a.k.a. "Tree-of-heaven," is an import from Southern Asia. It is a fast-growing, tall tree that can adapt to some of the worst urban conditions. If you notice a tree with enormous

Pulling Ailanthus in the North Street Cemetery. 35 plants in one hour.

compound leaves growing from the depths of a New York City subway track you can be certain it is Ailanthus. The plant exudes a powerful aroma reminiscent of turpentine and has a

A single Ailanthus leaf stretched across the hood of a mini-van. Inset of leaflet with tell-tale notch.



Ailanthus in Auburn.

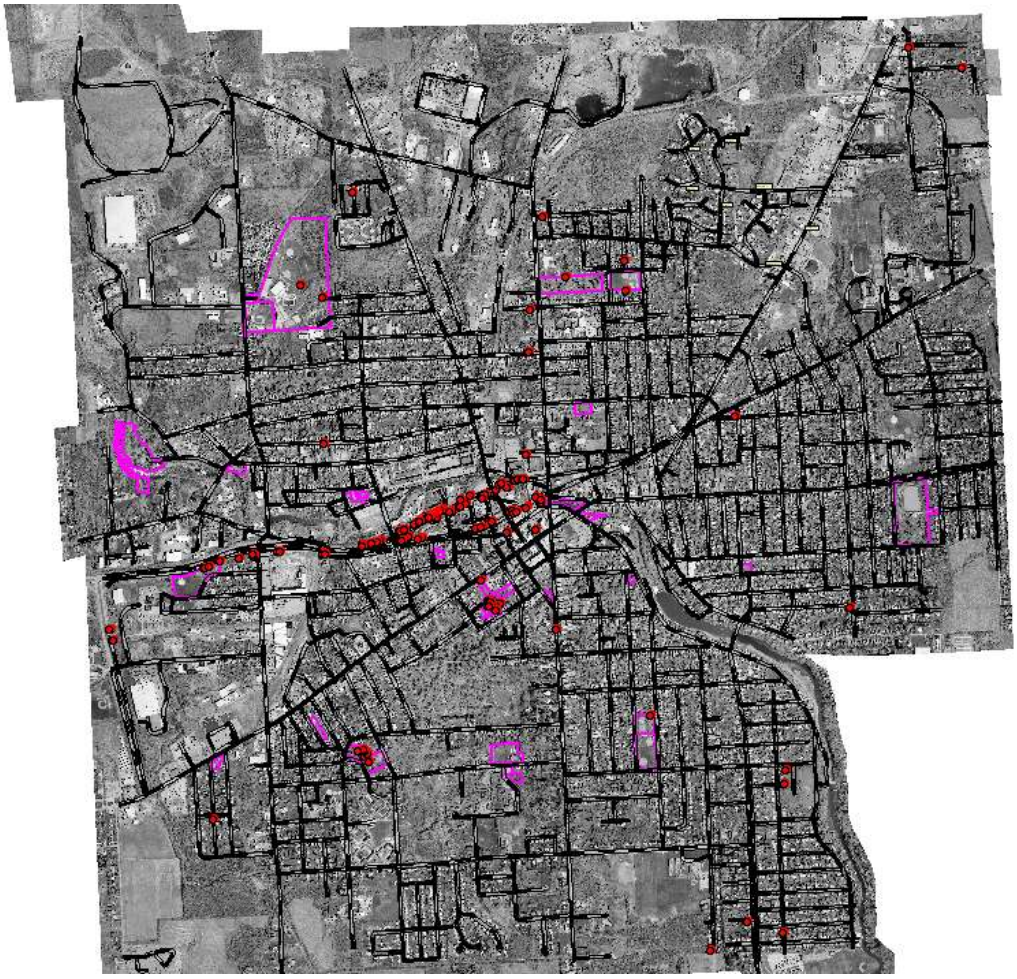
characteristic salmon-colored pith. The tree is dioecious, which in botanical terms means it typically grows female and male flowers on separate trees.

It is likely the tree has been in Auburn for some time. One large specimen was found growing behind the old Waite building, killed in the fire that destroyed the property over two decades ago. The tree's location - growing from along the foundation next to a brick wall - suggested it was a weed. Two specimens growing near the corner of Seymour and Division Streets were cut down more than a decade ago, but their locations suggests the tree was introduced, or at least tolerated there, as street trees. Like any temperate flowering annual, it can be killed with herbicides: indeed, late Fall stump-application of a surfactant-bearing glyphosate after removal of large trees is recommended. Younger trees can be pulled and dug up.

Poison ivy. Finally, Poison ivy. The Latin name of the plant, "*Toxicodendron radicans*" - is derived from the role of the plant as a poison tree with rooting stems. It readily roots and can remain close to the ground until it finds a sturdy surface to climb where it can grown into a very large vine. As mentioned above, while Poison ivy is not an *exotic* invasive plant, it is a sufficient nuisance to warrant concern when it gets out of hand; and it has reached that stage in Auburn. It is growing in or next to 129 street locations and at 34 sites in our parks, although it is far more extensive than this in the City. Along the Arterial corridor and in Downtown Auburn, there are Poison ivy stands that are considerable: they are engulfing tall trees and covering walls. Many of these plants are female, because like Ailanthus, Poison ivy hosts male and female flowers on separate plants. Mechanical or herbicide management of this plant

should begin with these plants as jays and crows will spread the white berries far and wide once Winter arrives.

Poison ivy on the right. Note characteristic notched, three-leaved foliage.



Poison ivy growing in or next to Auburn's street & park trees.

Looking forward: planning our urban forest.

Our top ten most numerous street trees make up three quarters of our total street tree population, some 5,600 trees. Considering that 8% of our tree population has been lost to the Emerald ash borer over the last decade, and in view of the poor performance many of these top ten provide, we must look to a new range of trees for growing our forest. Beginning with our current top ten, only four remain as viable options for Auburn's future forest: Lindens, Honeylocust, Flowering crabs, and Red maples. Norway, Silver,and Sugar maples, along with pears, are not good candidates to consider for future tree-planting efforts, for the many reasons stated earlier in this plan. Happily, there are thirty-odd other trees we can plant to restore our forest canopy, many of which are low and slow growers. These are listed by common name in the table below.

Every tree on this list is growing in Auburn, and many show excellent promise. A number of them, such as Coffeetree and Sweetgum, have been cultivated into seedless varieties that are worth a try in Auburn. Key among the trees on this list are the white oak group. These oaks -

with species like English, Swamp white, White and Bur oaks - are increasingly being used in urban forestry applications. They are slow growers, giving municipal arborists time to manage

Common Name	Best Application	Special Needs / Concerns
Serviceberry	Wide sites, wires OK	
Cherry	Any sites, wires OK	Short lived tree, requires pruning
Japanese tree lilac	Wide sites, wires OK	
Hedge maple	Wide sites, wires OK	
Scholar tree	Wide sites, wires OK	Hard to source
Hophornbeam	Wide sites, wires OK	Very promising
Blue beech	Wide sites, wires OK	Very promising
Yellowwood	Wide sites, wires OK	
Kousa dogwood	Wide sites, wires OK	
Goldenrain tree	Wide sites, wires OK	Hard to source
Black tupelo	Wide sites, wires OK	Difficult transplant, but worth it
London plane tree	Wide sites, no wires	Some residents object to bark
Sycamore	Wide sites, no wires	Some residents object to bark
Ginkgo male	Wide sites, no wires	
Freeman maple	Wide sites, no wires	
Red oak	Wide sites, no wires	
English oak	Wide sites, no wires	
Swamp white oak	Wide sites, no wires	
White oak	Wide sites, no wires	Very slow grower
Bur oak	Wide sites, no wires	
Cornell oak	Wide sites, no wires	Under development - keep watching
Japanese zelkova	Wide sites, no wires	
Hackberry	Wide sites, no wires	
Sweetgum	Wide sites, no wires	Some residents object to seeds
Tuliptree	Wide sites, no wires	Very tall, very large tree
Horsechestnut	Wide sites, no wires	Some residents object to seed pods
Red horsechestnut	Wide sites, no wires	Some residents object to seed pods
Magnolia	Wide sites, no wires	Needs protection from winter winds
Kentucky coffeetree	Wide sites, no wires	Look for "Espresso" cultivar
Elm	Wide sites, no wires	"Liberty" cultivar has had success

an effective pruning rotation. They are strong, resilient trees that have a long and storied history in our region. Oaks do present an interesting challenge in urban forestry applications, however. They are difficult to clone, making them somewhat problematic when searching for a consistent grower in a City setting. The good news: help is on the way.

As any gardener can tell you, some plants are easier to propagate than others. Oaks are among plants that are considered “recalcitrant” i.e., difficult to propagate through vegetative methods.

Dr. Nina L. Bassuk of the Cornell University Urban Horticultural Institute is the leading scientist pioneering the creation of new white oak cultivars and cultivation techniques. In fact,

White oak leaves. © Rhonda Stanford-Zahn. 2022.

five such cultivars from the white oak group grown and planted by Dr. Bassuk and her colleagues are being tested in Auburn.

One of Cornell's White oak cultivars growing on the Lake Avenue median.

Young oak trees on Orchard Street, view to East.

With this new pallet of tree species and cultivars we can plant, replace, and grow a forest into the coming century. With this optimism and perspective our current City-wide consideration of Auburn's forest, it is time to look at trees at the neighborhood level.

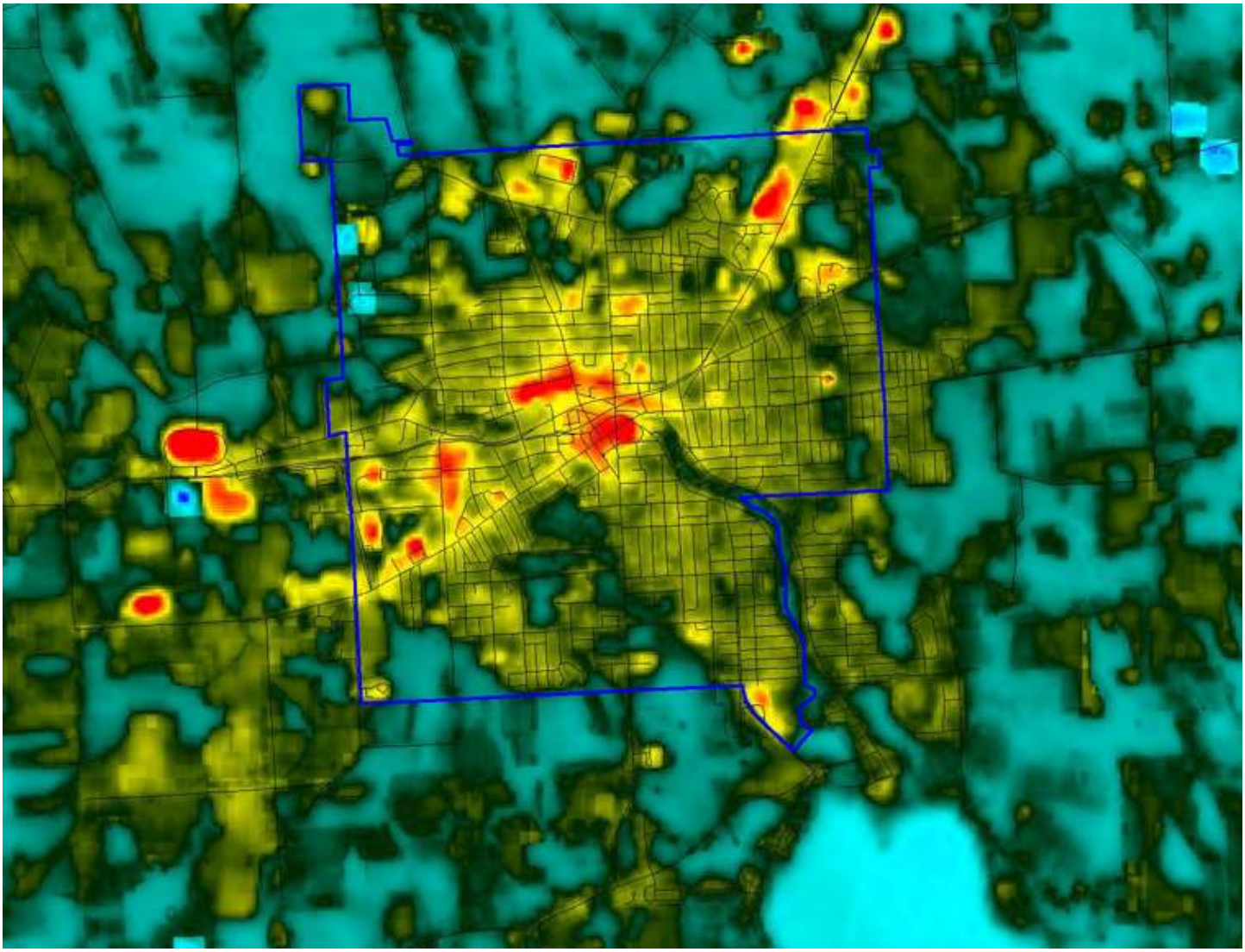
Port Orford Cedars in Fort Hill.
© Jennifer Duke Anstey, 2022.

Part 3. A neighborhood-level view of Auburn's Forest

Urban Heat Island Effect in Action: Very hot, tree-killing, South-facing growing site at the corner of Wall and North State Streets, summer 2021. These Honeylocusts did not survive.

Our urban spaces get very hot in the summer season as concrete, pavement, and building surfaces absorb heat from the sun. When heat builds up in developed landscapes the concentration of energy is called the "urban heat island effect". Burning fossil fuels in our cars adds heat as well, and as we run our air conditioners we also remove heat from our homes and vent it into the local environment. Add all these heat sources together and urban environments are much hotter than their rural counterparts. Thanks to an invitation from NASA's Applied Remote Sensing Training Program (ARSET), we can get a comprehensive overview of the urban heat island effect in Auburn (see image, below). The open-source code for Land Surface Temperature estimation from Landsat satellite imagery by Sofia Ermida and her colleagues makes this possible (Ermida et. al, 2020).

The map shows the land surface temperatures on July 5th, 2017. The red areas are the hottest, and it is easy to locate the parking lots at the Finger Lakes Mall, the Auburn Correctional



Land Surface Temperatures in Auburn, July 2017.
Hot spots in Red ~ 118° F; Yellow ~ 94° F; Green ~ 84° F; and Blue ~ 79° F

Facility,downtown, and the Grant Ave. shopping areas. Around the hottest areas are yellow-to-green areas where vegetation begins to mitigate built-up surface temperatures. To investigate how the heat island effect is impacting our neighborhoods, the tree canopy and the built-up surfaces of each neighborhood were analyzed at the Census Block level to derive a sense of where and by how much our forest helps us mitigate the summer heat island effect. The spatial analysis was confined to an area reaching out 100 feet from residential lots to locate the greatest need for tree shade and cooling. With a buffer of this distance, many of the shading and cooling needs and benefits will be shared by adjacent neighborhoods. This is necessary because heat will not respect an imaginary line running down the center of the street, no more than it will matter how hot it is along the road in front of the landfill when your house is over a mile away.

Building on local place names, each of 29 U.S. Census Blocks in the City have been named for use as neighborhood units of analysis for forestry planning and management. There are two

good reasons for this: first, the scale of the areas is large enough to make decisions practical and sustainable, and; second, state and federal urban forestry funding is linked to community characteristics - especially income - that are expressed at the Census Block level. Each Census Block is tagged with a unique geographic identifier, a GEOID, that is a string of numbers linked to each polygon in the United States. Auburn's Census Blocks were renamed according to local place names and streets to facilitate discussion about the needs, challenges, and opportunities of Auburn's urban forest with community members and residents. The table and map below identify these neighborhoods. These are followed by enlargements of each of the neighborhoods, with details regarding 2018 tree canopy extent, existing street trees, available planting sites, and trees in parks and public open spaces.

Statefp	Countyfp	Tractce	Blkgrpce	Affgeoid	Geoid	Aub_ID	Name
36	11	41300	5	1500000US360110413005	360110413005	1	Clarksville
36	11	41300	4	1500000US360110413004	360110413004	2	Casey Park
36	11	41300	3	1500000US360110413003	360110413003	3	Van Anden - Shevchenko
36	11	41300	2	1500000US360110413002	360110413002	4	Cross - Union
36	11	41300	1	1500000US360110413001	360110413001	5	Steel Mill
36	11	42100	2	1500000US360110421002	360110421002	6	West End
36	11	42100	3	1500000US360110421003	360110421003	7	Wall - Genesee
36	11	41400	1	1500000US360110414001	360110414001	8	Standart Woods
36	11	41400	2	1500000US360110414002	360110414002	9	North Street - Flummerfelt's
36	11	41400	3	1500000US360110414003	360110414003	10	Seminary
36	11	41400	4	1500000US360110414004	360110414004	11	Holland Stadium
36	11	41500	1	1500000US360110415001	360110415001	12	Franklin - Capitol
36	11	42100	1	1500000US360110421001	360110421001	13	Lafayette - Hardenburg
36	11	41800	2	1500000US360110418002	360110418002	14	Fort Hill
36	11	41800	3	1500000US360110418003	360110418003	15	Lexington - Arch
36	11	41800	4	1500000US360110418004	360110418004	16	Mercy - Melone
36	11	41800	5	1500000US360110418005	360110418005	17	Quill's Hill
36	11	41800	1	1500000US360110418001	360110418001	18	Meadowbrook
36	11	41500	4	1500000US360110415004	360110415004	19	East Hill
36	11	41500	3	1500000US360110415003	360110415003	20	St. Alphonsus
36	11	41500	2	1500000US360110415002	360110415002	21	Herman Elementary
36	11	41600	1	1500000US360110416001	360110416001	22	East Genesee - Walnut
36	11	41700	1	1500000US360110417001	360110417001	23	City Hall
36	11	41600	3	1500000US360110416003	360110416003	24	Walnut - Havens
36	11	41600	2	1500000US360110416002	360110416002	25	Hoopes Park
36	11	41700	2	1500000US360110417002	360110417002	26	Case - McDougal
36	11	41700	3	1500000US360110417003	360110417003	27	Clifford Field - Lake Ave.
36	11	41700	5	1500000US360110417005	360110417005	28	Tubman - Seward
36	11	41700	4	1500000US360110417004	360110417004	29	Throop Ave.

Auburn's 2015 Census Blocks, showing their GEOIDs, local Aub_ID number and names.

Auburn's Community Forestry Management Neighborhoods.

Making sense of neighborhood-level data.

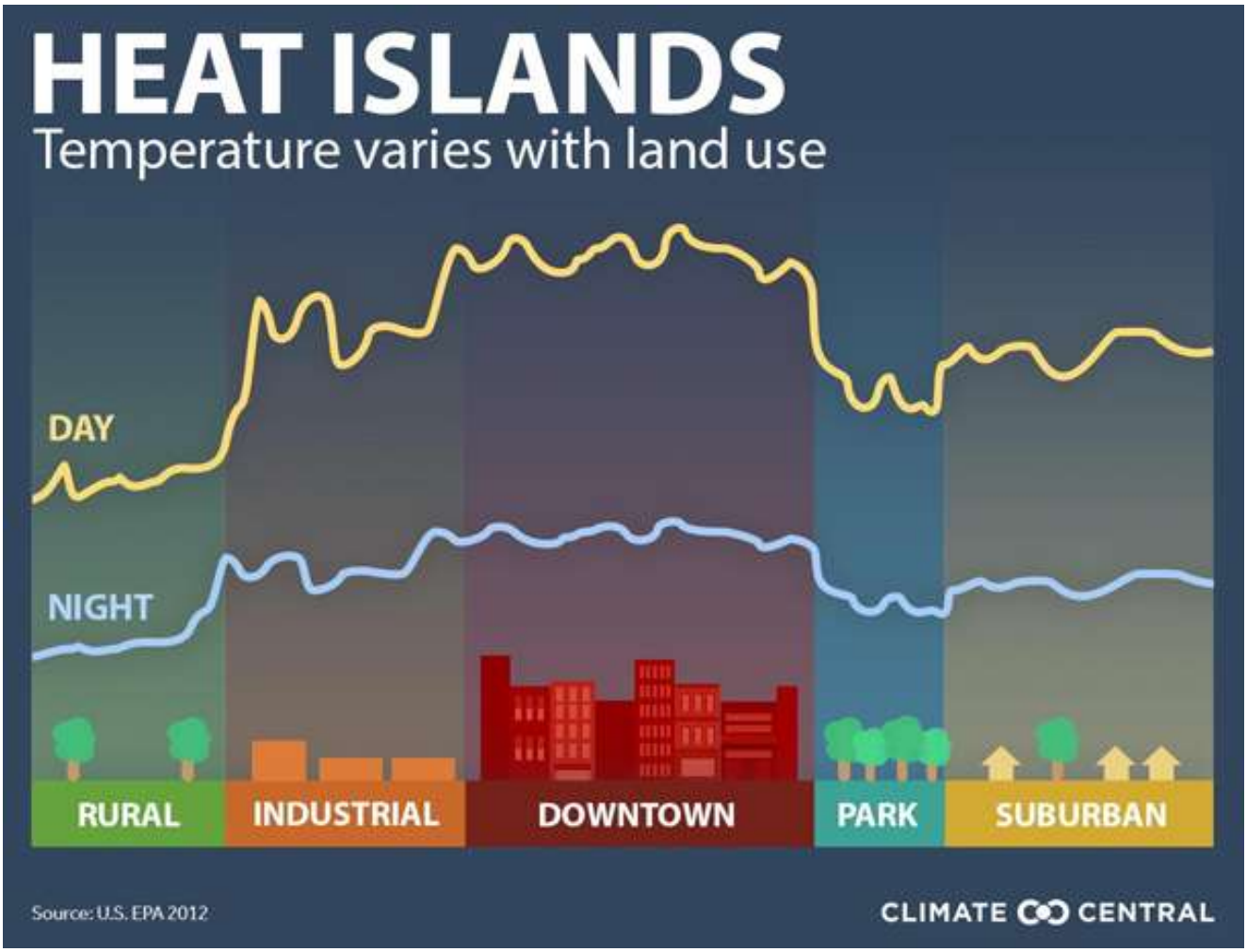
Each map alone (all neighborhood maps are in the appendix) does not convey the respective forestry challenges and opportunities within that specific neighborhood. For this, we have to consider how hot the land surface gets in each area and then, determine where we can best enhance vegetation's role in cooling down our neighborhoods. The neighborhoods' forest resources are summarized in the following table, noting the ratio of developed, heat-island-inducing surfaces to tree canopy and the weighted average land surface temperatures:

Percent Urban Tree Canopy & Potential Heat Island Surfaces in Auburn Neighborhoods									
* indicates a Low-Mod Income Census Block									
Neighborhood/Data	**2018 1M LiDaR**	**2022 Calc Canopy**	**% Pot. Heat Island**	**# Close Trees**	**# Planting Spaces**	**# Dead Trees & Stumps**	**Total Planting Spots**	**Ratio HI to Canopy**	**Avg. Land Surf. Temp °F**
Clarksville*	35.97	35.45	20.09	143	37	40	77	0.54	96.78
Casey Park	30.37	29.95	20.30	193	49	41	90	0.63	95.60
Van Anden - Shevchenko*	27.48	26.67	33.12	69	47	25	72	1.24	95.89
Cross - Union	23.00	21.74	47.78	169	128	51	179	2.20	99.48
Steel Mill*	24.87	24.53	38.59	164	128	28	156	1.57	98.25
West End*	26.64	25.86	44.54	240	46	33	79	1.72	96.77
Wall - Genesee*	19.56	16.72	59.69	398	64	28	92	3.57	102.27
Standart Woods*	27.02	25.91	34.51	249	56	103	159	1.33	97.39
North Street - Flummerfelt's	28.73	28.04	34.82	222	74	34	108	1.24	95.61
Seminary	27.58	26.57	49.51	186	63	42	105	1.86	99.73
Holland Stadium	29.30	28.73	30.78	237	63	64	127	0.90	96.94
Franklin - Capitol	35.77	34.83	25.53	248	50	59	109	0.73	94.86
Lafayette - Hardenburg*	21.97	21.36	46.14	399	111	51	162	2.05	99.24
Fort Hill	32.74	31.97	40.49	372	126	37	163	1.06	97.24
Lexington - Arch	26.86	25.88	33.33	450	110	87	197	1.29	96.55
Mercy - Melone*	16.71	15.67	27.02	98	38	29	67	1.72	95.90
Quill's Hill*	44.06	42.87	16.64	131	55	53	108	0.39	98.31
Meadowbrook	23.83	22.85	21.73	326	47	63	110	0.95	96.08
East Hill*	25.51	25.04	55.13	285	59	24	83	1.76	98.90
St. Alphonsus	25.81	24.62	41.43	152	50	48	98	1.68	96.74
Herman Elementary	31.31	29.95	28.25	200	54	46	100	0.94	94.06
East Genesee - Walnut*	29.04	27.67	38.53	229	145	55	200	1.39	95.73
City Hall*	34.40	33.82	47.75	215	53	13	66	1.20	98.69
Walnut - Havens*	23.64	22.87	38.95	189	131	35	166	1.70	96.32
Hoopes Park	30.55	29.63	24.82	499	92	42	134	0.84	95.14
Case - McDougal*	32.96	31.26	35.48	203	92	58	150	1.14	95.51
Clifford Field - Lake Ave.	27.50	26.23	36.65	263	153	47	200	1.40	95.64
Tubman - Seward	33.33	32.63	24.78	344	96	40	106	0.76	94.52
Throop Ave.	23.96	22.99	31.07	540	175	68	143	1.35	95.59
Downtown	11.17	9.93	88.83	638	55	102	157	7.28	104.35

Neighborhoods with an average land surface temperature over 98° F include:

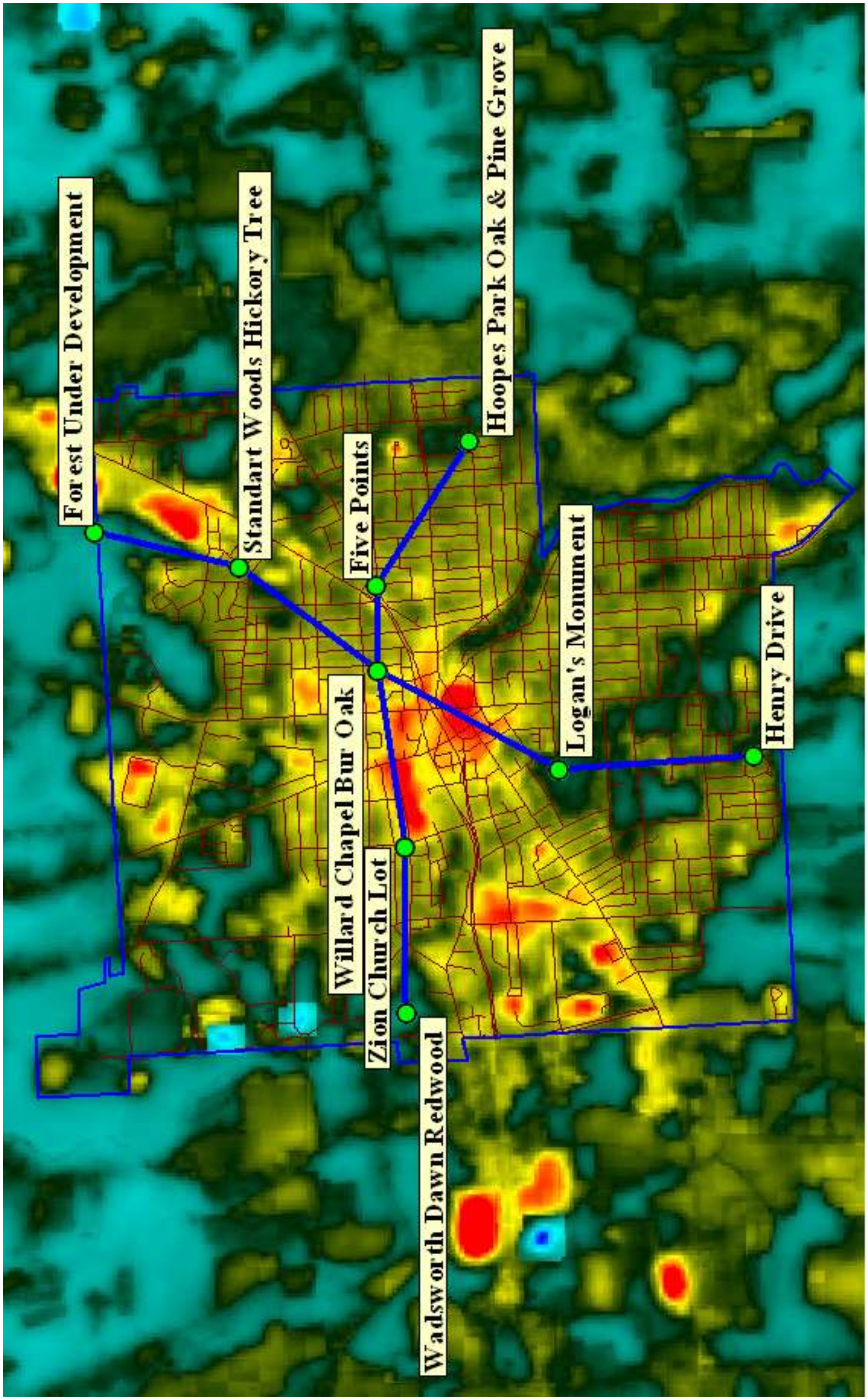
Cross - Union:	99.48
Steel Mill:	98.25
Wall - Genesee:	102.27
Seminary:	99.73
Lafeyette - Hardenburg:	99.24
Quill's Hill:	98.31
East Hill:	98.90
City Hall:	98.69
and Downtown:	104.35

As seen in the "Land Surface Temperatures in Auburn, July 2017" map above, there is considerable variation in land suface temperature, especially for residents who live close to the edge of one of our hot spots. Indeed for those who live sandwiched between two hot spots, the Genesee and Orchard Streets neighborhood for example, the impact is considerable. The general concept of how these changes express themselves at the street level is illustrated by the following graphic from ClimateCentral.org:

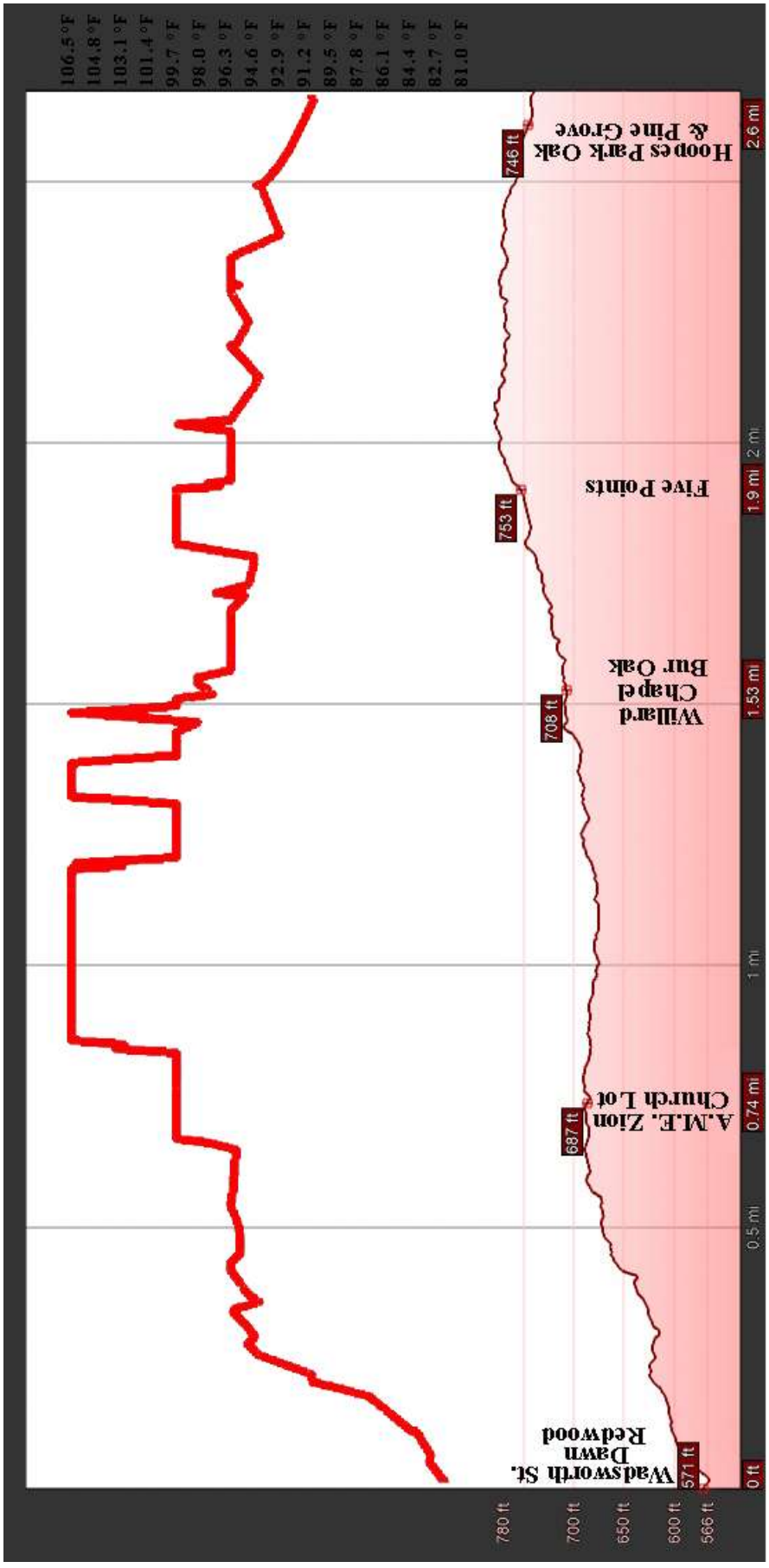


ClimateCentral.org

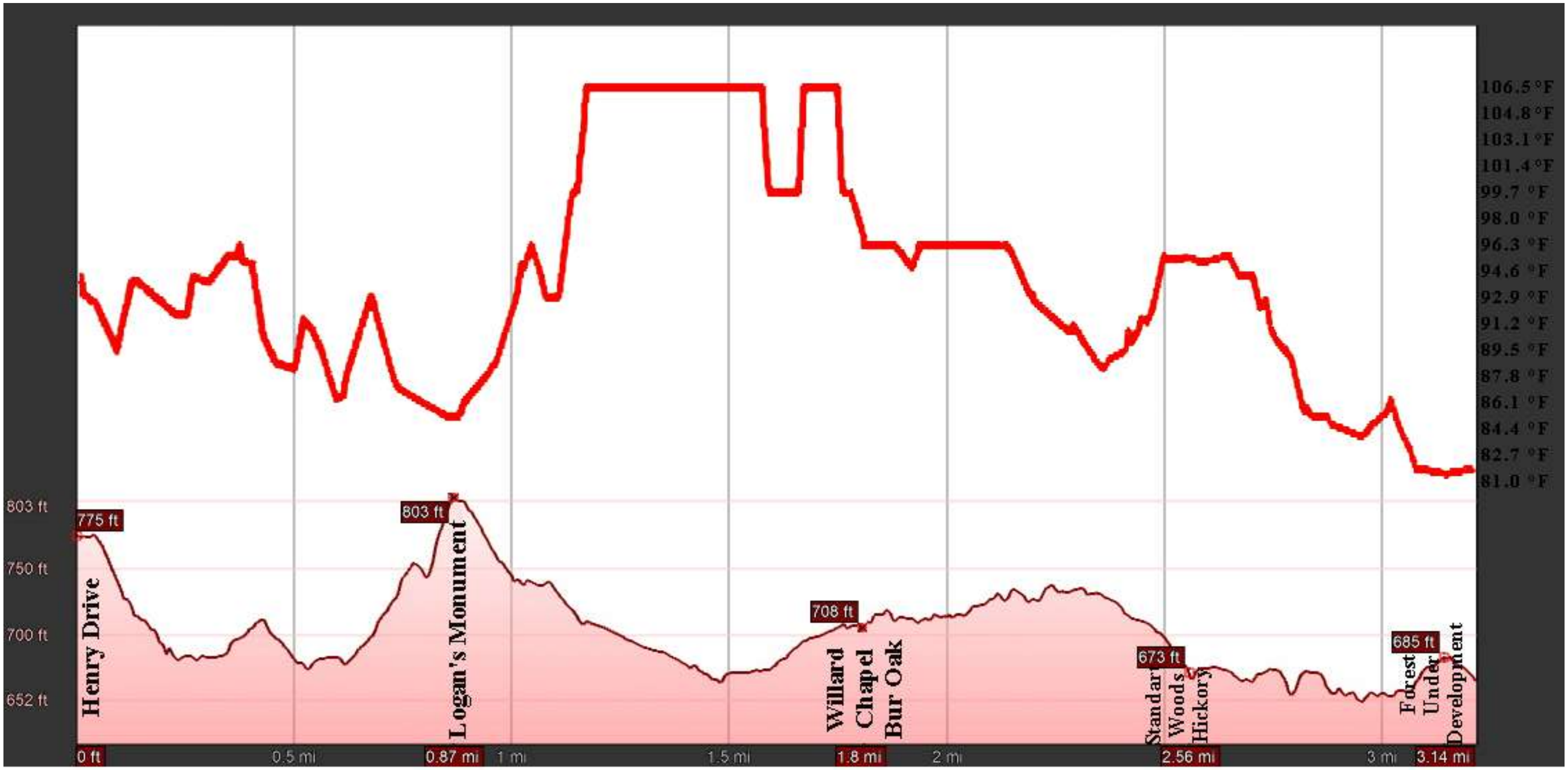
To illustrate these changes in Auburn, two profiles from nine control points were created to show how land surface temperatures change across the City. The East-West profile is drawn from the Oak and Pine grove at the Southern end of Hoopes Park, through the Five Points, over to the big Bur oak at the Willard Memorial Chapel, then along Wall Street to the site of the former A.M.E. Zion Church, and finally over to the Dawn redwood tree along the shore of the Owasco River at the site of the old Wadsworth scythe factory. The North-South profile is drawn from the highlands at Henry Drive over to Logan's Monument at the Fort Hill Cemetery, then over to the Chapel's Bur oak, then to a Shagbark hickory tree- remnant of the Standart Woods, and finally to the location of a forest under development.



Reference map of two geographic profiles across Auburn LST map
showing nine Control Points



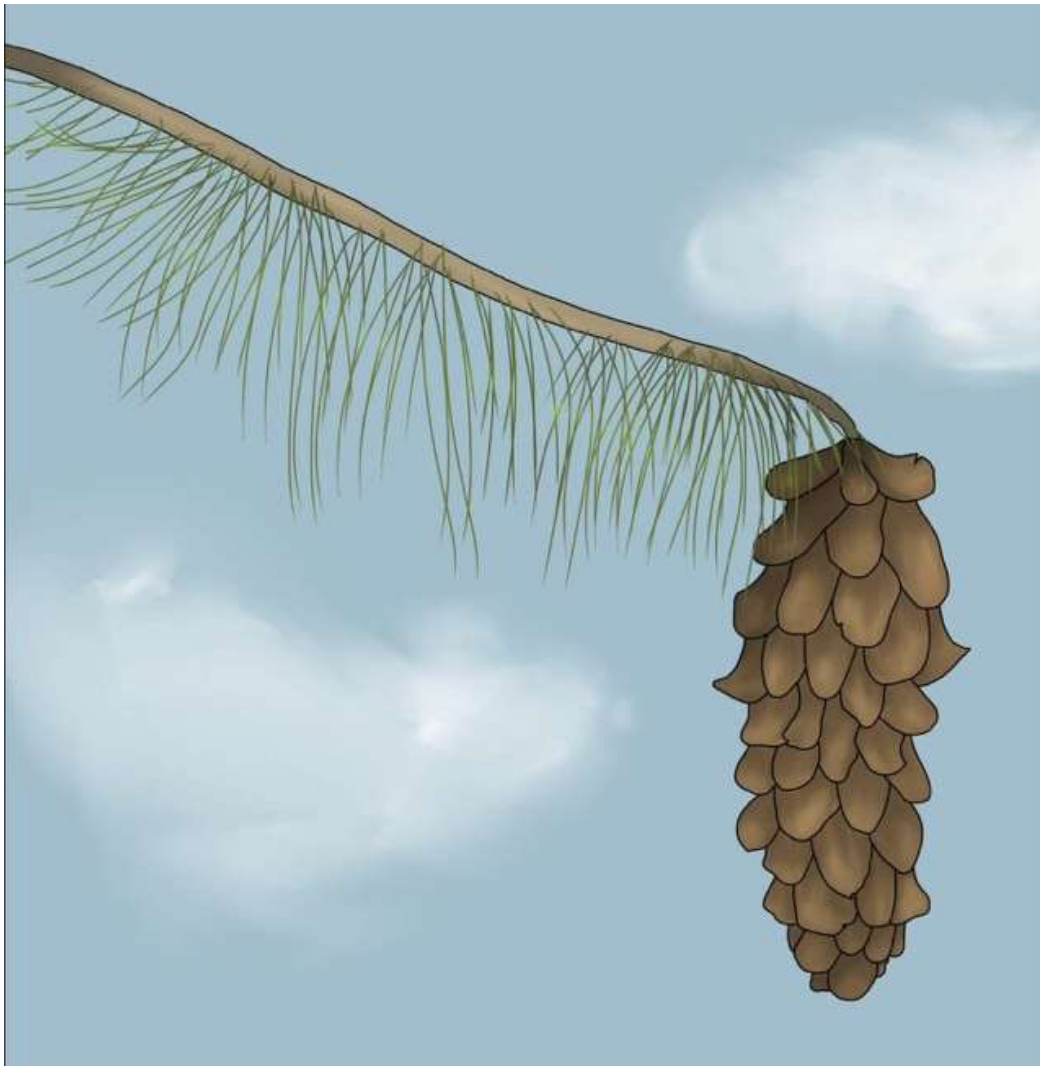
East - West Land Surface Temperature Profile in Auburn, NY.
From the Dawn redwood at the Wadsworth Site to the Oak & Pine Grove at Hoopes Park.



North - South Land Surface Temperature Profile in Auburn, NY.
From Henry Drive to the Forest Under Development along John Walsh Blvd.

Forest vegetation - trees especially - clearly make a difference in mitigating the urban heat island effect. How do they do it? Shade blocks the sun of course, and trees also use water as they metabolize nutrients through photosynthesis. Trees reduce air temperature through evapotranspiration; when they release water from their leaves into the atmosphere, the surrounding air is cooled as the water is transformed from liquid water into water vapor. By using available heat from the air to evaporate water, trees, in effect, act as air conditioners.

With the loss of our ash, change in our urban tree canopy is becoming increasingly evident to more City residents. It is not the only reason our canopy is degrading: many of our older trees are increasingly vulnterable to rising summer heat; residents are removing older trees near their homes; and development continues to gradually reduce forest cover. Clearly, we need to consider a new direction in forest management that fosters street and tree planting, the planting of mini-forests the size of six car spaces in heat-stressed neighborhoods, the conservation of existing forested areas, and the nurturing of our Owasco River corridor. These, together with additional necessary management steps are the focus of the follwing part of this plan.



An Auburn Park Pine Tree. © Peggy Pelletier, 2022

Part 4. A Program for Auburn's community forest

Charlie's Horsechestnut at Wall and Myrtle. © Gail Demi, 2022

Restoring Auburn's community forest requires an ambitious mix of tree planting, pruning, removal, invasive species management, and institutional reform. Key priorities include:

- Establishing and protecting trees in areas with declining tree canopy- especially in low-moderate income neighborhoods along streets & in yards adjacent to Auburn's hot spots;
- Setting contracted tree planting goals for each city department;

- The City should create an on-going tree planting reserve account to receive, spend, and account for donations to a dedicated tree purchasing fund. The fund can be dedicated in someone's name, if the community wishes it, so long as it follows NY State regulations.;
- It is vital the urban forestry funding line in the City Budget remain to ensure a minimal urban forestry management capacity. In future, the City should add an Arborist position and two laborers dedicated to forestry, and have a larger budget for securing contract services for removals and pruning.
- The City should participate in every round of Federal urban forestry funding administered by the NYS Department of Environmental Conservation. Given the disproportionate time demands placed on administrating these funds, careful consideration should be given to factoring consult fees into future proposals.
- Forming tree planting partnerships along key city corridors, and locating and establishing mini-forests in key areas where the city's hot spots are particularly troublesome;
- Systematic evaluation of all maple trees with poor canopy ratings to determine which trees may be saved with pruning and which must be removed;
- Systematic evaluation of all large trees - especially Silver maples - to prioritize removal;
- Selecting and implementing a tree management work-flow software platform, and;
- Reforming Auburn's current tree service request and care procedures to bring them into line with current state, national, and international operational standards.
- Create an Auburn Conservation Corps to introduce youth to conservation careers and bring them into tree planting, tree care, and the management of invasive species.

Habits of the Heart: Auburn's forest management culture.

These goals must be coupled with reform of our current system of forest management that responds to resident pressure on City staff and elected officials. Spend enough time on City streets discussing tree care with residents and most can recall a time when City employees would remove brush from their curb on a weekly basis. In those days everyone raked their leaves into a big pile at the curb every Autumn and they were picked up by the City without complaint or restraint, and the City removed any tree - for any reason - upon request. These practices were in full swing well into the 1980s, when City staff were still routinely prescribing "topping" for City street trees. And it was during those years the City planted hundreds of trees each season through a State - funded tree planting program. Employees from those days recall a train of trucks and men planting bare-root trees in every available planting location with no regard for utility conflict, curbing, signage, or corners. Auburn was not alone in this practice, and while the City did replace many of the 3,367older trees the "December 1980 City of

Auburn Parks Department Tree Survey" suggested for either topping or removal, it also inherited the management conflicts inherent in the approach.

When Auburn took up systematic tree care once again with the 1997 ordinance, tree planting was brought into the 20th Century with respect to tree lawns and utilities, in support of the urban forestry addage to plant "the right tree in the right place". Even with the new planting guidelines, overcoming resident frustration over the poor performance of our Norway maples and the legacy issues brought about by of some of our older street trees, residents are more often than not unwilling to want a tree in front of their home. When residents reflect on the conflicts they observe with the tree in their neighborhood - be it with sidewalks or bad limbs - and when they worry over raking and maintenance, they are increasingly demanding attention that also may not be warranted given the specific conidtion of the tree they are most worried about. Unless and until systematic arboricultural practices are placed ahead of resident pressure there is no way for the City of Auburn to recover the canopy lost through the EAB crisis and the expected aging of our street trees.

Thinking beyond the short term, each of these general goals are fleshed out in the following section, with attention to numbers, costs, and the changes required at an administrative level over a ten year time-frame. Beginning with tree planting, the heat island analysis of Auburn reports 2,447 available planting sites with an additional 1,446 planting opportunities provided by stumps and dead trees. Experience shows that planting sites where trees were growing may not be eligible for replanting, so this number was reduced by approximately 75% to 1,000 (75% of the stumps and dead tree numbers per neighborhood). Therefore, the total tree planting opportunities at this time are about 3,500 locations. Over time this will change as more trees are removed, but the number allows us to set a planting target of 350 trees per year over ten years.

Restoring Auburn's urban forest with tree planting.

To have a successful tree planting program, it is vital to temper our enthusiasm with the practicalities of marshaling funding and labor to ensure tree survival - what arborists call establishment. Trees are alive, and as such they must be planted with respect to availability, certainly, but also with an eye to site conditions and the seasons. Experience shows that overly ambitious tree planting efforts result in higher tree mortality. Based on 350 tree per-year target, the break down by city department is as follows:

- 100 balled-and-burlapped trees per year contracted through the Auburn Planning Department's Community Development Block Grant program;

- 100 balled-and-burlapped trees per year contracted through the Auburn Engineering Department's Road program;
- 100 balled-and-burlapped trees per year through the Auburn Department of Pubic Work's budget;
- 50 bare-root trees per year planted with volunteers through the Auburn DPW budget.

The 2021 average bare root tree cost is $90. With volunteers to help plant these trees, the average planting cost per tree is $67.50, so the total cost of planting a bare root tree is $157.50. This is consistent with 2021 figures reported by the Cities of Syracuse and Auburn. Balled and burlapped trees (B&B) cost more: the 2020 average B&B tree was $136.00. With public employee-only planting, the average planting cost per B&B tree is $90.00 per tree, so the total cost of planting a B&B tree is $226.00, more than 40% over the cost of planting a bare root tree. This is why most upstate NY municipalities plant about half their trees in the Fall season with bare-root trees, and the other half in the Spring season planted by contractors or public crews. Private contractor costs in Central New York average $575 per tree, depending on caliper. Fall planting with volunteers and Spring planting with contractors provides successful planting results since the easiest trees are planted in the Fall and the more difficult transplants are better established with Spring B&B planting. Based on these figures the costs break down as follows:

200 contract planted BnB trees	$115,000.00
100 DPW planted BnB trees	$22,600.00
50 DPW & volunteer planted bare root trees:	$7,875.00

As trees are planted in the coming decade, there are two new methods we can try to achieve these goals: strategic partnerships and mini-forests. First, we can create formal partnerships along key city streets to unite residents, commercial establishments, state and local agencies and non-profits behind tree planting. By inviting our business owners and organizations like the Auburn Enlarged City School District, the NYS Department of Transportation, Auburn Memorial Hospital, the Auburn Correctional Facility, the US Post Office, our faith organizations and our banks, we can establish trees along the following key corridors:

- Division Street
- The State Route Corridor created by Routes 5 & 20, the Arterial
- Columbus Street
- Lansing Street
- Seymour Street
- North Street

- South Street
- The Clymer - Metcalf corridor
- The Owasco River corridor
- Genesee Street
- Lake Avenue

In this vision, tree planting along these corridors will be compulsory. For locations where the tree lawns are not well-suited for trees - North Street quickly comes to mind - we can provide coupons for residents and absentee owners to purchase appropriate trees at particiating nurseries, and plant these trees on the owner side of the sidewalk. Donations secured through the on-going tree planting reserve account can be used to support this effort. Futhermore, streets with narrow tree lawns and overhead utility conflicts that also host large lots managed by potential partners can be planted with city funded trees arranged on a site-by-site basis. Planting on this basis is preferable to imposing tree planting and canopy requirements through the Plannig Board's Design and Review Committee and/or additional Zoning Board restrictions. Even so, landscaping plans submitted through the Planning Board site review process should emphasize tree conservation and protecting Auburn's tree canopy.

In addition to conventional street tree planting, we have a second innovation available to us: the Miyawaki Method (Lewis 2022). Dr. Akira Miyawaki pioneered the approach that establishes small stands of trees that would be made up of mature native trees of the climax forest - the species for that area that would, under normal ecological succession, become the dominant canopy in an otherwise undisturbed forest. By small, we are referring to a dense stand of trees that take up about the same area as six parking spaces; roughly the size of a tennis court. There are suitable lots in the City of Auburn where mini-forests could be established. One good example is the lot where the A.M.E. Zion Church once stood at the NW corner of Wall and Washington Streets. This location would help counter the large heat-island impact looming over the Auburn Correctional Facility.

Restoring Auburn's urban forest with tree pruning and removals.

Once our ash crisis is behind us, numerous planting opportunities will be presented as poor quality Norway maples and larger legacy trees in poor condition are removed. To realize these opportunites, we must systematically inspect all our maple trees to prioritize which trees may be saved through careful pruning and which must be removed. Along with this evaluation, we must similarly examine all our large legacy tree treasures - especially Silver maples - to prioritize removal. However, a review of our street tree inventory data provides some insight into the task before us. 652 trees should be considered for priority pruning, meaning there are

one or more branches that should be removed to leave the tree in a more manageable form. Not counting ash trees, there are 530 trees that should be removed. Note that 77% and 78% of these are maples, respectively.

Most of Auburn's street and park tree removals are performed by the Department of Public Works. Larger trees beyond the reach of the DPW's lift – especially those close to power lines – are removed by contractors working under County bid specifications. Safe tree removal is difficult and dangerous; and it is not inexpensive. Based on recent figures, large tree removal in Auburn averages $3,500 per tree. Removal of very large trees under emergency circumstances can cost much more, and due to liability insurance purposes the costs for removal of very large trees on private property are even greater. For the purposes of this plan, all trees recommended for removal larger than 30" in diameter (97 trees) are considered likely candidates for contractor removal. And unfortunately for Auburn, efforts to manage removals are dictated more often by insects, wind, and weather, and much less often by inventory work, lists, and maps. In other words, municipalities manage their forests reactively, not proactively. Should we move into systematic, proactive management, the costs for such an effort are approximately as follows:

Priority pruning of 652 trees at $750 per tree: $489,000.00

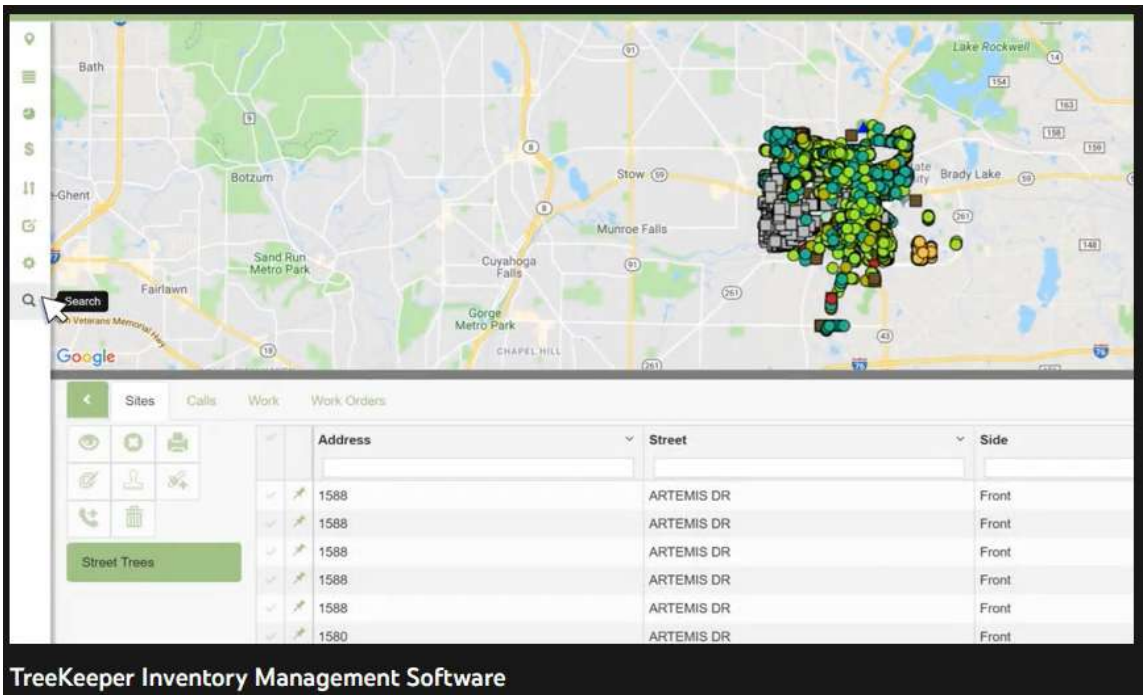
Removal of 97 trees at $3,500 per tree: $339,500.00

Obviously, the costs of the former can be avoided if the city's DPW crew is allowed to do the work. And, these figures assume the city's DPW crew will be allowed to remove the balance of the 530 trees that are currently recommended by the inventory for removal. These are not safe assumptions to make under the current reactive management mode. For this work to proceed based on the management priorities the trees present will require the City of Auburn adopt a new approach, one that changes how tree work is managed on the street *and* at the city management level. In the first instance, we need to select and implement a tree management work-flow software platform that will empower program managers and crews to record resident calls; document each contact; locate and record observations about the tree in question, and; rank a tree for care based on current arboricultural standards. In the second instance, we must reform Auburn's current tree service request and care procedures to bring them into line with current state, national, and international operational standards.

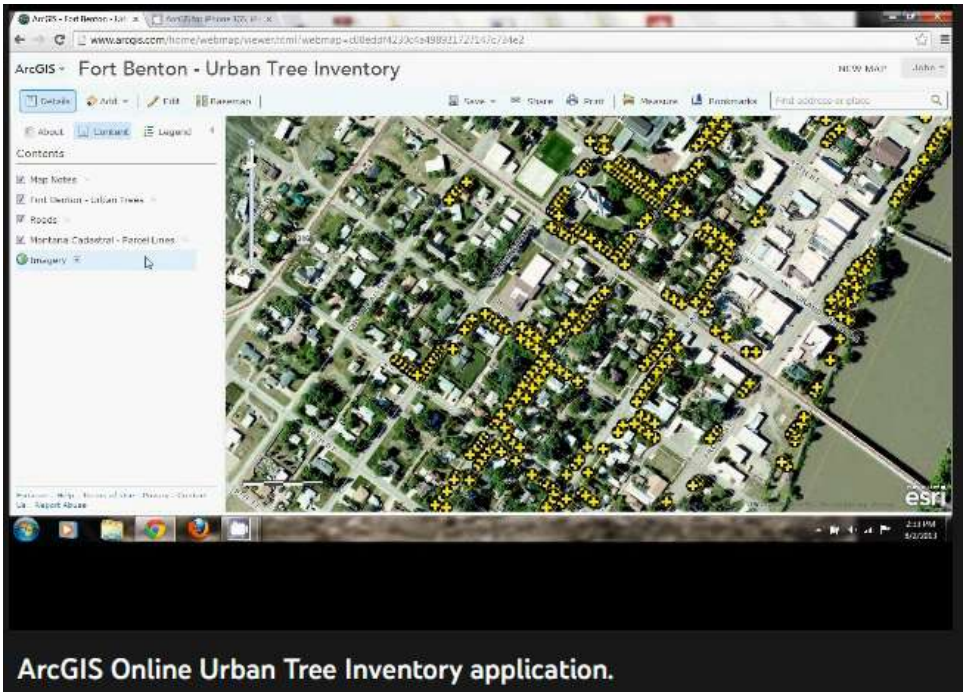
Restoring Auburn's urban forest through forest management.

An important innovation needed to help manage Auburn's forest resource is a new tree care work-flow management technology that can unify office and field operations. The candidate platform must allow for spatially-referenced tree data to be created, displayed, and interactively edited in the field as well as the desk. Two are under consideration: TreeKeeper software

developed by Davey Tree, and an ESRI ArcGIS platform that can be built on existing ESRI service contracts. The idea is that all tree records are managed in a data base that is spatially referenced, dynamic, and portable. Spatially referenced means that each tree record includes a reference that can be mapped to represent where the tree is actually growing. Each record will be dynamically updated as operations are performed so that records in the office will reflect changes on the ground. Finally, the database can be carried into the field either on a tablet.



Example of the TreeKeeper interface, showing data list and map view.



ESRI's Urban Tree Inventory application.

Restoring Auburn's urban forest with appropriate priorities.

When it comes to reforming Auburn's current tree service request and care procedures to bring them into line with current state, national, and international operational standards, we would be wise to note that our memories are intrepretations. They are carefully cultivated to sustain us and help us learn, change, and if possible, grow. This rings true for most of us. In public sphere of life this process generates plenty of heat since conflict emerges when our expectations differ with change. Losing our ash is a good example of how a sudden change can make adjusting shared norms challenging, especially since what we need from trees typically goes unspoken until something goes wrong. Many of us remember losing our American elms, and most of us remember what it was like after the Labor Day Storm of 1998. These dramatic events took place within a set of well-established expectations residents have over when street trees will be planted, pruned, and removed. If we are to bring Auburn's forest management in line with current standards we must begin with how we prioritize tree service requests.

The City's current approach to prioritizing tree care is based on a first-come, first-served model, and the approach is strongly favored by residents who dislike trees or feel threatened or inconvenienced by trees. While many removal requests are justified, many are not. The City's system begins when a resident call the DPW, reaches out to a member of City Council, or submits the following the form:

Department of Public Works
Urban Forestry Division

Request Form

I, _____, the undersigned, hereby petition the
(Name)

Department of Public Works for:
_____ Tree Removal
_____ Tree Trim
_____ Tree Planting
_____ Stump Removal
_____ Topsoil & Seed Request

of a (live) (healthy) (dead) (diseased) tree, (circle condition applicable)
situated within the public right- of- way in front of real property located at
_____, Auburn, New York.

The reasons for which the removal or trim of the tree is sought are as follows:

_____ Date:_____
Signature

_____
Address

_____
E-mail (preferred) or Phone #

Please Return form to: **Department of Public Works**
Memorial City Hall
24 South Street
Auburn, New York 13021

Public Works Use Only

Recommendation:

Signature: _____

Severity of Tree (circle): *(mild)* **1 2 3 4 5** *(severe)* Rev. 10/18

The system has two basic flaws: first, only after a request for removal is received is the tree's "severity" rating meant to be determined. In practice many residents go ahead and circle the rating they insist the tree holds; and second, the single-number system implies more confidence than it actually can provide. There are very good reasons for this, why such rating systems are a vestiage of older practices that do not match our current understanding of tree risk in urban conditions. They are inadequate because they: assesed trees based on a single overall rating that was static with respect to time; required removal as a default when many trees can be managed into a much more reliable form; were silent with respect to a tree's specific defects; ignored the nature of what the tree/tree part might strike, and; made no mention of the chances some part of the tree would fail. For all these reasons there is no rational basis to prioritize tree pruning or removal with such an approach, and this is the main reason why our current reactionary system predominates.

Happily, there is a much better approach, one that conforms with state, national, and international standards, the risk assessment procedure established by the International Society of Arboriculture as well as the § 277-12 B of the Auburn City Code. Internationally, it is understood that all trees present some degree of risk. As such, since any organization and/or municipality that has trees cannot eliminate risk, but must manage risk. The central concept of tree risk management is that tree risk can be qualified based on the careful assessment of nearby targets, the specific defects in a tree's crown and branches, the trunk, and the tree's roots and root collar. Once targets are defined and defects clearly identified, risk can be categorized

based on the likelihood of failure coupled with the consequences should failure occur. This approach requires advanced training and certification such that the findings and recommendations derived are reliable and consistent with internationally and nationally recognized standards. It has numerous advantages in that it is detailed, comprehensive, and time sensitive. The approach is dynamic respect to mitigation and residual risk and better dovetails into a systematic approach that priorities tree condition over resident complaint. The International Society of Arboriculture's Basic Tree Risk Assessment Form is as follows:

ISA Basic Tree Risk Assessment Form

Client _____ Date _____ Time _____

Address/Tree location _____ Tree no. _____ Sheet _____ of _____

Tree species _____ dbh _____ Height _____ Crown spread dia. _____

Assessor(s) _____ Tools used _____ **Time frame** _____

Target Assessment

Target number	Target description	Target protection	Target zone: Target within drip line	Target zone: Target within 1x Ht.	Target zone: Target within 1.5 x Ht.	Occupancy rate 1 – rare 2 – occasional 3 – frequent 4 – constant	Practical to move target?	Restriction practical?
1								
2								
3								
4								

Site Factors

History of failures _____ **Topography** Flat☐ Slope☐ _____% **Aspect** _____

Site changes None☐ Grade change☐ Site clearing☐ Changed soil hydrology☐ Root cuts☐ Describe _____

Soil conditions Limited volume☐ Saturated☐ Shallow☐ Compacted☐ Pavement over roots☐ _____% Describe _____

Prevailing wind direction _____ **Common weather** Strong winds☐ Ice☐ Snow☐ Heavy rain☐ Describe _____

Tree Health and Species Profile

Vigor Low☐ Normal☐ High☐ **Foliage** None (seasonal)☐ None (dead)☐ Normal _____% Chlorotic _____% Necrotic _____%

Pests/Biotic _____ **Abiotic** _____

Species failure profile Branches☐ Trunk☐ Roots☐ Describe _____

Load Factors

Wind exposure Protected☐ Partial☐ Full☐ Wind funneling☐ _____ **Relative crown size** Small☐ Medium☐ Large☐

Crown density Sparse☐ Normal☐ Dense☐ **Interior branches** Few☐ Normal☐ Dense☐ **Vines/Mistletoe/Moss** ☐ _____

Recent or expected change in load factors _____

Tree Defects and Conditions Affecting the Likelihood of Failure

— Crown and Branches —

Unbalanced crown ☐ LCR _____%
Dead twigs/branches ☐ _____% overall Max. dia. _____
Broken/Hangers Number _____ Max. dia. _____
Over-extended branches ☐
Pruning history
Crown cleaned ☐ Thinned ☐ Raised ☐
Reduced ☐ Topped ☐ Lion-tailed ☐
Flush cuts ☐ Other _____

Cracks ☐ _____ Lightning damage ☐
Codominant ☐ _____ Included bark ☐
Weak attachments ☐ _____ Cavity/Nest hole ___% circ.
Previous branch failures ☐ _____ Similar branches present ☐
Dead/Missing bark ☐ Cankers/Galls/Burls ☐ Sapwood damage/decay ☐
Conks ☐ Heartwood decay ☐ _____
Response growth _____

_____ Condition(s) of concern _____
_____ _____

Part Size _____ Fall Distance _____
Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐
Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

Part Size _____ Fall Distance _____
Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐
Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

— Trunk —

Dead/Missing bark ☐ Abnormal bark texture/color ☐
Codominant stems ☐ Included bark ☐ Cracks ☐
Sapwood damage/decay ☐ Cankers/Galls/Burls ☐ Sap ooze ☐
Lightning damage ☐ Heartwood decay ☐ Conks/Mushrooms ☐
Cavity/Nest hole _____% circ. Depth _____ Poor taper ☐
Lean _____° Corrected? _____
Response growth _____
Condition(s) of concern _____
Part Size _____ Fall Distance _____
Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐
Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

— Roots and Root Collar —

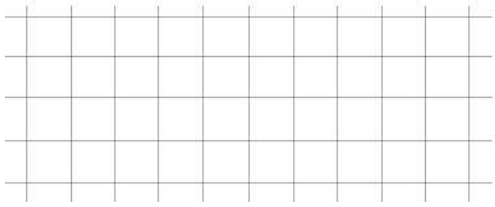
Collar buried/Not visible ☐ Depth_____ Stem girdling ☐
Dead ☐ Decay ☐ Conks/Mushrooms ☐
Ooze ☐ Cavity ☐ _____% circ.
Cracks ☐ Cut/Damaged roots ☐ Distance from trunk _____
Root plate lifting ☐ Soil weakness ☐
Response growth _____
Condition(s) of concern _____
Part Size _____ Fall Distance _____
Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐
Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

Risk Categorization

Target (Target number or description)	Tree part	Condition(s) of concern	Likelihood: Failure: Improbable	Failure: Possible	Failure: Probable	Failure: Imminent	Impact: Very low	Impact: Low	Impact: Medium	Impact: High	Failure & Impact (from Matrix 1): Unlikely	Somewhat	Likely	Very likely	Consequences: Negligible	Minor	Significant	Severe	Risk rating (from Matrix 2)

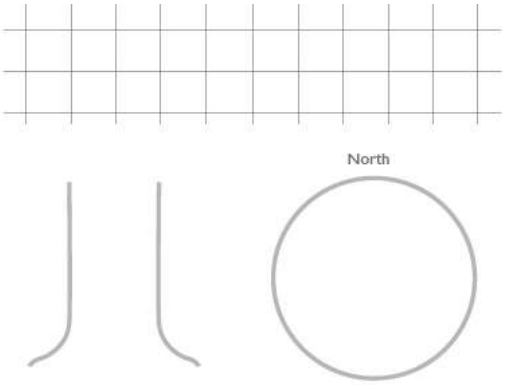
Matrix 1. Likelihood matrix.

Likelihood of Failure	Likelihood of Impact			
	Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely



Matrix 2. Risk rating matrix.

Likelihood of Failure & Impact	Consequences of Failure			
	Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low



Notes, explanations, descriptions

_____

_____

_____

_____

_____

Mitigation options

1. _____ **Residual risk** _____
2. _____ **Residual risk** _____
3. _____ **Residual risk** _____
4. _____ **Residual risk** _____

Overall tree risk rating Low ☐ Moderate ☐ High ☐ Extreme ☐

Overall residual risk None ☐ Low ☐ Moderate ☐ High ☐ Extreme ☐ **Recommended inspection interval** _____

Data ☐Final ☐Preliminary **Advanced assessment needed** ☐No ☐Yes-Type/Reason _____

Inspection limitations ☐None ☐Visibility ☐Access ☐Vines ☐Root collar buried Describe _____

This datasheet was produced by the International Society of Arboriculture (ISA) — 2017

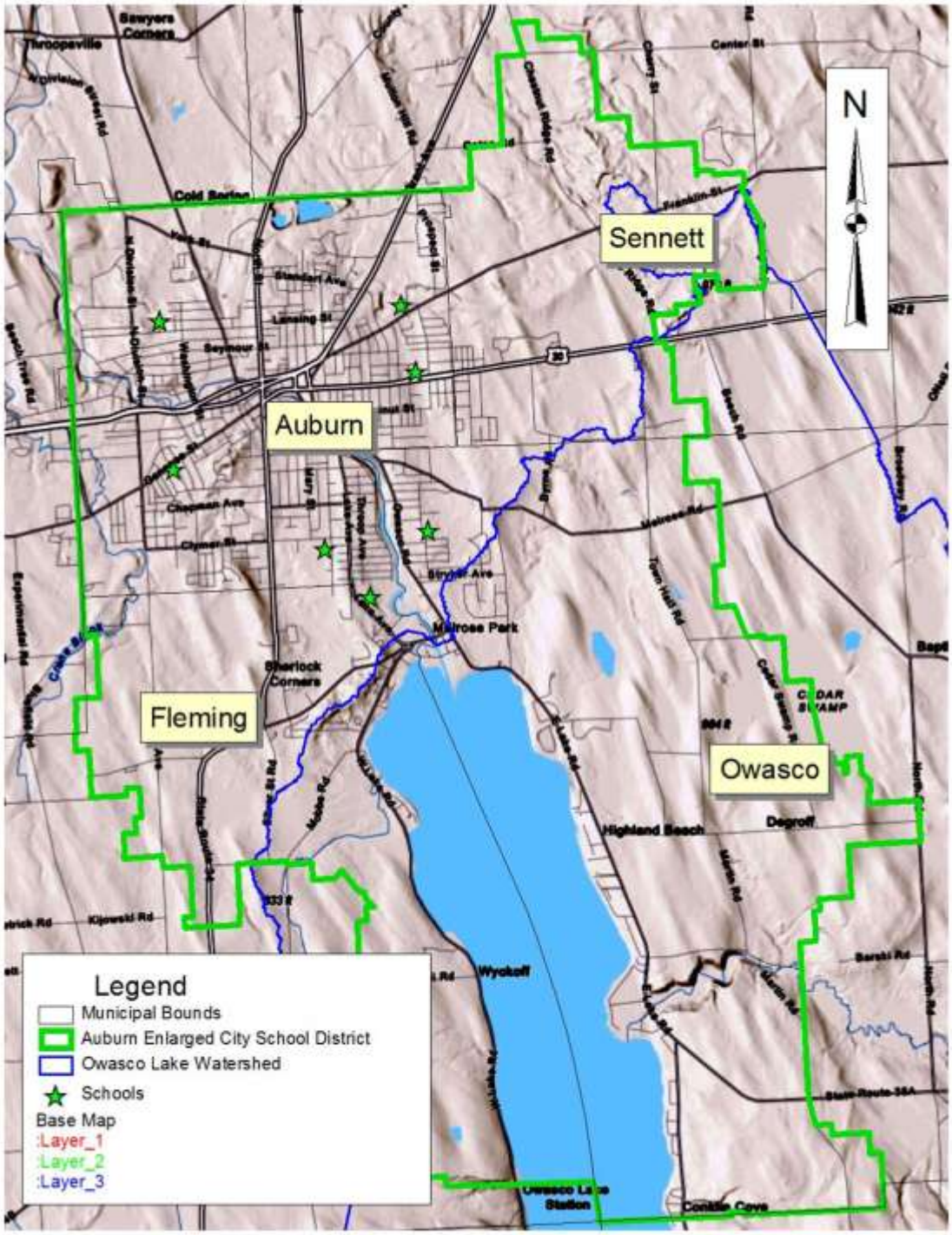
Page 2 of 2

Formalizing a risk management strategy is an essential step in advancing Auburn's urban forest program. Empowering staff to manage trees based on an assessment of their condition will necessitate some formal adoption to become part of the City's relationship with its forest.

Restoring Auburn's urban forest through education & community service.

Following through with these steps can make a huge difference in the condition of Auburn's urban forest, especially if we cultivate a tree-loving community to carry on the work. To this end we must foster an Auburn Conservation Corps, a service program to provide Cayuga County youth experiences in environmental resource conservation. Beginning with a summer program at Cayuga-Onondaga BOCES, students can learn about outdoor careers in arboriculture, forestry, watershed management, utilities management, soil conservation, wetland delineation, stream health monitoring, and wildlife habitat restoration through practical, hands-on experience. The Auburn Conservation Corps will be modeled on the premise that young people can participate in their own personal growth by working for the enhancement of their communities. Practical outdoor activities will introduce students to conservation professions and provide a bridge to gainful employment through occupational modeling.

The mission of this program is to engage and enrich young people through educational, civic-minded, hands-on experiences in outdoor natural resource conservation that will serve their communities by improving the social and natural environment.



Target service area for the Auburn Conservation Corps.

Students participating in this program will engage in a variety of skill-building field work activities, including:

- tree planting and care
- methods to measure and assess urban tree canopy

- the identification and management of invasive plants
- the installation and maintenance of invasive plant kill-screens
- the delineation and bio-blitz sampling of wetland habitat
- trail construction and maintenance
- stream monitoring and restoration
- the installation and monitoring of green-technology storm water infrastructure

Potential Partners include Cayuga-Onondaga BOCES, the Auburn Enlarged City School District, the City of Auburn, the Town of Fleming, the Town of Owasco, the Town of Sennett, the Owasco Lake Watershed Management Council, and the Owasco Watershed Lake Association.

Recovering our community forest will require a transformation of our commitment to it: how we care for it, where we plant, and who allocates our scarce forest management resources. If there is anything we've learned during our current ash crisis, is that scarcity in dollars, labor, and equipment compounds community stress. Through our shared experience in caring for our community forest we can build stronger relationships for more sensible and sustainable management. Reflecting on the shared experiences of successful tree planting offers up powerful lessons we can draw upon as we dig deep to rally ourselves for change.

Continued community education through tree planting events, on-going out-reach by the City's arborist to residents, schools, and non-profits, and the sustained commitment by City leadership are all necessary elements to maintaining our shared legacy in our forest. The more we build memories that conform to current conditions the more likely we are to build enduring program success. Coming generations engaging in a tree-oriented "Remember when . . . " exercise will call up the times they helped plant a tree in their neighborhood, how they worked with their classmates to keep a park's canopy intact, and how they made a difference in the world, one tree at a time.

Appendix 1

City of Auburn, NY / The Code / Part II, General Legislation. Chapter 277 Trees. HISTORY: Adopted by the City Council of the City of Auburn 9-4-1997 by Ord. No. 23-1997. Amendments noted where applicable.

§ 277-1 Definitions.

As used in this chapter, the following terms shall have meanings indicated:

PARK TREES

Trees, shrubs, bushes and all other woody vegetation in public parks and all areas owned by the City or to which the public has free access as a park.

STREET TREES

Shrubs, bushes and all other woody vegetation on land lying between property lines on either side of all streets, avenues or ways within the City.

§ 277-2 Official plan.

The Department of Public Works shall be responsible for developing, updating and administering a written plan for the inventory, care, preservation, pruning, planting, replanting, removal or disposition of trees and shrubs in parks, along streets and in other public areas. Such plan shall be presented to the City Council and, upon its acceptance and approval, shall constitute the official comprehensive tree plan for the City of Auburn.

§ 277-3 Official tree list.

A list of official tree species for the City of Auburn may change from time to time due to the introduction of new species and hybrids. The Department of Public Works is charged with creating and continually updating an official tree list of small, medium and large species appropriate for urban planning. As a long-term goal in protection against epidemic and widespread loss from ice storms, those species should represent no more than 10% of the total number of street trees and park trees owned by the City of Auburn.

§ 277-4 Spacing of street trees.

The spacing of street trees shall be in accordance with the species size classes developed in § 277-3 of this chapter, and no trees may be planted closer together than the following, except in special plantings designed or approved by a landscape architect:

A. Small trees: 20 feet.

B. Medium trees: 30 feet.

C. Large trees: 40 feet.

§ 277-5 Distance from curb and sidewalk.

The distance trees may be planted from curbs or curblines and sidewalks shall be in accordance with the three species size classes listed in § 277-3, and no trees may be planted closer to any curb or sidewalk than the following:

A. Small trees: one foot.

B. Medium trees: 11/2 feet.

C. Large trees: two feet.

§ 277-6 Distance from street corners and fireplugs, stop signs and streetlights.

No street trees shall be planted closer than 40 feet to any street corner, measured from the point of the nearest intersecting curbs or curblines. No street tree shall be planted closer than 10 feet to any fireplug, stop sign or streetlight.

§ 277-7 Distance from utilities.

No street trees, other than those species listed as small trees in § 277-3 of this chapter, may be planted over or within five lateral feet of any underground waterline, sewer line, transmission line or other utility.

§ 277-8 Public tree care.

A. The City shall have the right to plant, prune, maintain and remove trees, plants and shrubs within the lines of all streets, alleys, avenues, lanes, squares and public grounds as may be necessary to ensure public safety or to preserve or enhance the symmetry and beauty of such public grounds.

B. The City may remove or cause or order to be removed any tree or part thereof which is in an unsafe condition or which by reason of its nature is injurious to sewers, electric power lines, gas lines, waterlines or other public improvement or is infected with any injurious fungus, insect or other pest.

§ 277-9 Tree topping.

It shall be unlawful, as a normal practice, for any person or firm to top any street tree, park tree or other tree on public property. "Topping" is defined as the severe cutting back of limbs to stubs larger than three inches in diameter within the tree's crown to such a degree so as to remove the normal canopy and disfigure the tree. Trees severely damaged by storms or other causes or certain trees under utility wires or other obstructions or where other pruning practices are impractical may be exempted from this section at the determination of the Department of Public Works.

§ 277-10 Pruning.

Every owner of any tree overhanging any street or right-of-way within the City shall prune the branches so that such branches shall not obstruct the light from any streetlamp, obstruct the view of any street intersection or interfere with visibility of any traffic control device or sign and so that there shall be a clear space of 12 feet above the surface of the street or sidewalk. In the event that the owner fails to prune the offending branches after five days' written notice from the Department of Public Works, the City shall have the right, at its own cost, to prune the offending branches and remove the obstruction.

§ 277-11 Removal of dead or diseased trees on private property.

The City shall have the right to cause the removal of any broken or decayed limbs or any dead or diseased tree on private property within the City, when such tree or part thereof constitutes a hazard to life and property or harbors insects or disease which constitutes a potential threat to other trees within the City. The City will notify, in writing, the owners of such trees. Removal shall be done by said owners at their own expense within 60 days after the date of service of notice. In the event of failure of owners to comply with such provisions, the City shall have the authority to remove such trees and charge the cost of removal to the property owner. Said cost shall constitute a lien on the property upon which the tree is located and may be collected in the same manner as the collection of delinquent taxes.

§ 277-12 Removal of trees on public property; trimming of street trees.

A. An abutting landowner seeking removal of a dead, diseased, healthy or live tree situate on a public right-of-way shall file a petition with the Department of Public Works seeking permission for removal.

B. Petitions for removal of a healthy or live tree must demonstrate that removal will be of greater benefit to the inhabitants of the City than the existing tree or trees sought to be removed.

C. In determining whether removal of a healthy or live tree is in the best interest of the City, the Department of Public Works may recommend to the City Manager the removal of same if it determines that:

(1) Said tree is damaging public property and such damage cannot be permanently repaired save for tree removal; and

(2) Such tree is damaging abutting private property and such damage could result in liability to the City and such damage cannot be permanently repaired save for tree removal.

D. Trees that are ordered removed by the City Manager upon the recommendation of the Department of Public Works pursuant to this section must be replaced two trees for one.

E. No person or entity shall cut down any park or street tree, or cut any branch or limb therefrom, or otherwise disrupt or degrade tree form or health, without a written permit from the Department of Public Works arborist or his/her designee. [Added 4-13-2006 by Ord. No. 7-2006]

F. No public service corporation or agent thereof shall trim trees in or on City street rights-of-way or public places for overhead utility line clearance without a written permit from the Department of Public Works arborist or his/her designee. [Added 4-13-2006 by Ord. No. 7-2006]

G. Persons, entities and/or City departments conducting regular maintenance work on street trees and/or shrubs may be granted general permits to cover their work on a yearly basis. [Added 4-13-2006 by Ord. No. 7-2006]

§ 277-13 Penalties for offenses.

Any person violating any provision of this chapter shall be, upon conviction or a plea of guilty, subject to a fine not to exceed $500.

Appendix 2

Recommended Street, Park, and Public Cemetery Trees for Auburn, New York	
City of Auburn, Department of Public Works	
In use since 2003; updated October 2019	
Small Trees. Generally less than 25 feet tall	
Acer buergeranum	Trident maple
Acer campestre	Hedge maple
Acer griseum	Paperbark maple
Acer palmatum	Japanese Maple
Acer tataricum	Tatarian maple
Amelanchier arborea	Serviceberry
Asimina triloba	pawpaw
Betula populifolia	gray birch
Carpinus caroliniana	American hornbeam
Chioanthus virginicus	Fringe tree
Cornus alternifolia	alternate-leaf dogwood
Cornus kousa	Kousa dogwood
Cornus racemosa	Gray Dogwood
Cotinus spp.	Smoke trees
Carpinus caroliniana	American hornbeam
Crataegus inermis	Thornless hawthorn
Crataegus phaenopyrum	Washington thorn
Crataegus viridis	'Winter King' hawthorn
Franklinia alatamaha	Franklin tree
Malus varieties	apple, and crabapple cultivars
Ostrya virginiana	Hophornbeam
Prunus 'Accolade'	Accolade flowering cherry
Prunus serrulata	Kwanzan cherry
Pyrus spp.	Ornamental Pear cultivars; 'Bradford' not acceptable.
Sorbus intermedia	Swedish Mountain Ash
Sorbus thuringiaca fastigia	Oakleaf Mountain Ash
Stewartia koreana	Korean stewartia
Syringa reticulata	Japanese Tree Lilac
As per the Code of the City of Auburn, New York, Part II General Legislation,	
Chapter 277, Trees, Updated 3-25-2003, small trees can be planted on tree lawns	
no narrower than 2 feet, no closer than 20 feet to another tree, and are the only tree	
that “may be planted over or within five lateral feet of any underground waterline,	
sewer line, transmission line or other utility”.	

Medium Trees. Generally 25 to 50 feet tall.	
Abies concolor	White fir
Acer x freemanii	Freeman Maple
Acer truncatum	Shantung maple
Aesculus carnea	Red horsechestnut
Aesculus glabra	Ohio buckeye
Aesculus hippocastanum	Horse chestnut
Aesculus octandra	Yellow buckeye
Cercis spp.	redbuds
Cladrastis lutea	Yellowwood
Gleditsia triacanthos	Honeylocust
Halesia tetraptera	Carolina silverbell
Juniperus scopulorum	Rocky Mountain juniper
Koelreuteria paniculata	Goldenrain tree
Laburnum watereri	Chain tree
Nyssa sylvatica	Black tupelo
Pinus bungeana	Lacebark pine
Pinus cembra	Swiss stone pine
Platanus x acerfolia	London Plane Tree
Prunus sargenti	Sargent Cherry
Prunus subhirtella	Higan cherry
Prunus yedoensis	Yoshino cherry
Quercus bicolor	Swamp white oak
Quercus robur	English oak
Sorbus alnifolia	Korean Mountain Ash
Sorbus aucuparia	European mountain ash
Stewartia pseudocamellia	Japanese stewartia
Styrax japonicum	Japanese snowbell
Thuja occidentalis	Northern white cedar*
Tilia cordata	Littleleaf Linden
Tsuga canadensis	Eastern hemlock**
Ulmus parvifolia	Chinese elm
* This is a preferred browse species of white-tailed deer.	
** Consideration must be given due to the impact of the Hemlock woolly adelgid.	
As per the Code of the City of Auburn, New York, Part II General Legislation,	
Chapter 277, Trees, Updated 3-25-2003, medium trees can be planted on tree lawns	

no narrower than 3 feet, and no closer than 30 feet to another tree.	
Large Trees. Generally 50 to 75 feet or more tall.	
Acer rubrum	Red Maple
Acer saccharum	Sugar Maple
Alnus glutinosa	Black Alder
Betula nigra	Heritage River Birch
Carpinus betulus	European Hornbeam
Carya ovata	Shagbark hickory
Carya laciniosa	Shellbark hickory
Celtis occidentalis	Hackberry
Cercidiphyllum japonicum	Katsura Tree
Corylus colurna	Turkish Filbert
Fagus grandifolia	American beech
Fagus sylvatica	European beech
Ginkgo biloba	Ginkgo (Male suggested for street planting)
Gymnocladus dioicus	Kentucky Coffeetree
Juglans nigra	Black walnut
Larix decidua	European larch
Larix kaempferi	Japanese larch
Liquidambar styraciflua	Sweetgum
Liriodendron tulipifera	Tulip Tree
Magnolia acuminata	Cucumbertree
Metasequoia glyptostroboi	Dawn Redwood
Nyssa sylvatica	Tupelo; sourgum; black gum
Picea abies	Norway spruce
Picea omorilea	Serbian spruce
Platanus occidentalis	Sycamore
Quercus alba	White oak
Quercus Macrocarpa	Bur Oak
Quercus palustris	Pin oak
Quercus rubra	Northern Red Oak
Quercus schumardii	Shumard oak
Quercus velutina	Black oak
Sophora japonica	Scholar Tree
Taxodium distichum	Baldcypress
Tilia americana	Basswood
Tilea euchlora	Crimean linden
Tilia tomentosa	Silver Linden
Zelkova serrata	Japanese Zelkova

As per the Code of the City of Auburn, New York, Part II General Legislation, Chapter 277, Trees, Updated 3-25-2003, large trees can be planted on tree lawns no narrower than 4 feet, and no closer than 40 feet to another tree.

Trees Not to be Planted on Public Property:	
Acer negundo	Box elder
Acer platanoides	Norway maple
Acer pseudoplatanus	Sycamore maple
Acer saccharinum	Silver maple
Catalpa speciosa	CataIpa or Indian Bean
Fraxinus americana	White ash
Fraxinus pennsylvanica	Green ash
Ginkgo biloba	Ginkgo*
Juglans cinerea	Butternut
Populus deltoides	Cottonwood**
Robinia, all species	Black locust
Salix alba var. tristis	Weeping willow
Salix nigra	Black willow

* Female may be considered for parks and cemetery planting; male Ginkgo is preferred for street planting.

** All trees in the genus *Populus* may not be planted in the City of Auburn.

Sources:

Ithaca Tree Works Bare Root Tree Planting List.

City of Geneva's Official Tree List.

Dr. Don Leopold's ESF list, published after the 1998 Labor Day storm.

NIMO & NYSEG Lists.

NYS Department of Conservation

Appendix 3

3 February 2022 Tree Inventory Summary Report for

City of Auburn
Department of Engineering Services
24 South Street
Auburn, NY 13021

Street and Park Tree Data Collection Methodology

During the Spring, Summer and Fall of 2021, every street in the City of Auburn was walked to locate, identify, measure and describe each tree growing in the public right of way and to identify potential planting sites. Each tree in City parks and City-owned open space properties were examined as well. Two such properties - the undeveloped Wadsworth Street property and the North Street Cemetery were not fully sampled, but key trees and conditions there were noted and recorded. Areas of brush are noted where invasive plants are growing.

Street and Park tree data was collected in the field. Observations were recorded with hand-held tablets (an Apple iPad and a Samsung Galaxy tablet) loaded with a custom field-data collection forms created with a subscription software called PenDragon Forms. Trees were identified by species, their diameter was measured, and the percent of live canopy was noted. In addition to these basic data categories, the nature of defects and concerns were noted for each tree. Site conditions and digital photographs were recorded as well.

Data/column headings and description for street trees are as follows:

- *Address*. Street address location, as determined in the field and from the Cayuga County's D-GPS generated E-911 address database in NY State Plane 1983 coordinates. In the field, user prompts automatically entered data records via a custom look-up table containing all the street addresses and E-911 addresses coordinates in the City of Auburn. In the event an address identified in the field did not match the records from the E-911 data (most often from either new construction that post-dated the data, or from the use of addresses that are in common use but not recognized by E-911 administrators) the address in use was entered to be verified in the office.
- *GPS_ref*. GPS coordinates for each tree and potential planting site were determined with a Garmin GPSMAP 64x receiver. This point data was located with the 2018, 1 foot JP2 imagery available from the NYS GIS Clearinghouse, in NY State Plane 1983 coordinates.
- *Wires*: Binary data field to indicate if overhead electrical transmission wires are present.
- *Site_concerns*: At each location, one or more (if present) of the following site conditions were noted:
    - Overhead Utilities
    - Soil Compaction
    - Fire Hydrant
    - Storm Drain
    - Utility Pole
    - Parking or ruts on lawn
    - Heaving sidewalk
    - Water gas or signal hdware
    - Signage
    - Old stump
    - Poison ivy
    - Close to corner
- *Stump*: When a stump was observed at a location, it was categorized within one of the following size classes:
    - Small
    - Pole

    - Medium
    - Large
    - Very_large
- *Inv_plant*: When the most common and troublesome invasive plants in Auburn were observed, one or more of the following were included:
    - Buckthorn
    - Knotweed
    - Ailanthus
    - MF rose
    - Rose of Sharon
    - Pale Swallow Wort
- *Tree_lawn*: The presence, nature, and width of the tree lawn was noted as follows:
    - None
    - 0-2 Feet
    - 2-4 Feet
    - 4-6 Feet
    - 6-8 Feet
    - over 8 Feet
    - Pit
- *Tree_ref*: Like many cities in New York State, Auburn's urban forest is dominated by a handful of species. When these were encountered they could be noted quickly to facilitate efficient use of time in the field. Location and size of empty and/or potential tree planting sites/stumps appropriate to the Code of the City of Auburn, New York, Part II General Legislation, Chapter 277, Trees, Updated 3-25-2003, as well site-specific knowledge about how residents use a particular site – school children drop-off and pick-up for example. These most common reference trees are:
    - Open planting site
    - Norway maple
    - Crimson king
    - Sugar maple
    - Silver maple
    - Red maple
    - Honeylocust
    - Linden
    - Pear
    - Ash
- *Common*: Common name of the observed tree. In the field, user prompts automatically calls up records via a custom look-up table containing 94 records of trees by common and Latin names, as well as i-Tree Streets Species Code.
- *Scien*. Latin name by genus and species, including cultivar information, automatically entered based on user prompt.
- *Spcode*: Unique code provided by i-Tree Streets software.
- *DBH*. Measurement of tree DBH (diameter at about breast height) in inches and tenths-of-inches, determined by forester's diameter tape. Measurements were taken on the uphill side of the tree when possible, and in the data table these are noted as "MEAS". When measuring the tree was either too dangerous (ferocious dogs chained to the tree), too risky (on a steep slope, covered with Poison ivy), or too time consuming to gain access, the size of the tree was estimated to a precision that can comfortably place them in an appropriate size class, and in the data table these are noted as "ESTM". Finally, there were trees that for reasons specific to their nature could not be measured at 4.5'. Best examples of this

are: crabs with no stem at 4.5' were measured at the highest possible location; large lindens and Silver maples with multiple stems and/or massive, low growing branches; and crabs and serviceberries with very low branches. In these cases the best effort was made to obtain data at a height that did not exaggerate the tree's size; in the data table these are noted as "SPEC".

- *Cond_crown*: The condition of tree canopy was estimated and noted with respect to these categories:
    - Excellent 95%
    - Good 85%
    - Fair 75%
    - Poor 65%
    - Failing < 65%
    - Dead
- *Cond_wood*: Details about the condition of the larger woody portions of the tree were noted by checking one or more of the following categories:
    - Stem Damage
    - Large Wound
    - Large Crack
    - Rot underway
    - Wet or Sappy Wounds
    - Conks or Strange growth
    - Decaying branch stubs
    - Broken or dead limbs
    - Bad branch
    - Hollow
- *Tree_probs*: Problems observed at each tree were noted by checking one or more of the following categories:
    - Co-dominate branches
    - Multi stem
    - Strangling roots
    - Sprouting root collar
    - Sprouting bole
    - Loose bark
    - Lean
- *H_Factor*: This field refers to a special category of tree-related issues or concerns that are related to human behavior. One of more of the following categories may be selected:
    - Tree hit by utility
    - Overzealous mulching
    - Garden planting
    - Delivery truck damage
    - Snowplow or car damage
    - Damage from sidewalk work
    - Damage from curb work
    - Metal object in tree
    - Weed wacker
    - Rodeo mowing
- *Action*. Maintenance recommendation for each tree, if indicated, and includes:
    - Pruning

    - Staking
    - Protect stem
    - Mulching
    - Removal
    - Stump grinding
    - Add soil
    - Consult
- *Comments*. Additional details about trees, such as: resident concerns and/or questions; indications of parking on the tree lawn; evidence or presence of significant wildlife behavior including bee, hornet, or wasp activity; indications of incorrect or illegal waste disposal; poor pruning practices, including topping; and vandalism.
- *Pic*: Check box indicating when a digital photograph was recorded.

Data/column headings and description for park trees are as follows:

- *GPS_ref*. GPS coordinates for each tree were determined with a Garmin GPSMAP 64x receiver. This point data was located with the 2018, 1 foot JP2 imagery available from the NYS GIS Clearinghouse, in NY State Plane 1983 coordinates.
- *Infrastrct_near*: If present, Park and/or City infrastructure near each tree were characterized with one or more of the following categories:
    - Path or sidewalk
    - Bench
    - Play equip
    - Pavilion
    - Utility line or access
    - Fire hydrant
    - Drain
    - Signage
    - Street light
    - Power pole
    - Parking
    - Fence
- *Site_concerns*: At each location, one or more (if present) of the following site conditions were noted:
    - Soil Compaction
    - Overhead Utilities
    - Fire Hydrant
    - Storm Drain
    - Utility Pole
    - Parking on lawn
    - Poison ivy
    - Close to neighbor
- *Inv_plant*: When the most common and troublesome invasive plants in Auburn were observed, one or more of the following were included:
    - Buckthorn
    - Knotweed
    - Ailanthus
    - MF rose
    - Rose of Sharon

- *Tree_ref*: When the following park trees were encountered they could be noted quickly to facilitate efficient use of time in the field. These most common reference park trees are:
    - Norway maple
    - Sugar maple
    - Silver maple
    - Red oak
    - Shagbark hickory
    - Pear
    - Crab
    - Ash
    - Honeylocust
    - Stump
- *Common*: Common name of the observed tree. In the field, user prompts automatically calls up records via a custom look-up table containing 94 records of trees by common and Latin names, as well as i-Tree Streets Species Code.
- *Scien*. Latin name by genus and species, including cultivar information, automatically entered based on user prompt.
- *Spcode*: Unique code provided by i-Tree Streets software.
- *DBH*. Measurement of tree DBH (diameter at about breast height) in inches and tenths-of-inches, determined by forester's diameter tape. Measurements were taken on the uphill side of the tree when possible, and in the data table these are noted as "MEAS". When measuring the tree was either too dangerous or too risky (on a steep slope, covered with Poison ivy), or too time consuming to gain access, the size of the tree was estimated to a precision that can comfortably place them in an appropriate size class, and in the data table these are noted as "ESTM". Finally, there were trees that for reasons specific to their nature could not be measured at 4.5'. Best examples of this are: crabs with no stem at 4.5' were measured at the highest possible location; large lindens and Silver maples with multiple stems and/or massive, low growing branches; and crabs and serviceberries with very low branches. In these cases the best effort was made to obtain data at a height that did not exaggerate the tree's size; in the data table these are noted as "SPEC". In unmanaged groves in City Parks and Open Spaces, only trees > 4" DBH were typically measured.
- *Cond_crown*: The condition of tree canopy was estimated and noted with respect to these categories:
    - Excellent 95%
    - Good 85%
    - Fair 75%
    - Poor 65%
    - Failing < 65%
    - Dead
- *Cond_wood*: Details about the condition of the larger woody portions of the tree were noted by checking one or more of the following categories:
    - Stem Damage
    - Large Wound
    - Wet or Sappy Wounds
    - Conks or Strange growth
    - Decaying branch stubs
    - Hollow
    - Broken or dead limbs
    - Large crack or cracks

- *Tree_probs*: Problems observed at each tree were noted by checking one or more of the following categories:
    - Weed wacker
    - Rodeo mowing
    - Plow damage
    - Strangling roots
    - Co-dominant branching
    - Loose bark
    - Sprouts from root collar
    - Sprouts from bole
    - Lean

- *Action*. Maintenance recommendation for each tree, if indicated, and includes:
    - Pruning
    - Staking
    - Stump grinding
    - Removal
    - Protect stem
    - Add soil
    - Mulching
    - Consult
- *Comments*. Additional details about trees, such as: resident concerns and/or questions; indications of parking on the tree lawn; evidence or presence of significant wildlife behavior including bee, hornet, or wasp activity; indications of incorrect or illegal waste disposal; poor pruning practices, including topping; and vandalism.
- *Pic*: Check box indicating when a digital photograph was recorded.

Tree Data Review and Compilation

Field data collected on tablets was uploaded and transferred into a Geographic Information System (GIS) created for the project with ESRI ArcView software. Tree data was saved in shapefile format in NY State Plane 1983 coordinates, (NAD 83, NY Central, in feet), and located with 2018, 1 foot JP2 imagery available from the NYS GIS Clearinghouse.

Right of Ways in Auburn

The width of the public right of way from street to street is not consistent in Auburn. Trees planted in the tree lawn are invariably within the City's Right of Way, however there are places where the Right of Way is beyond the tree lawn and in what appears to be the resident's property. In circumstances where tree ownership of the street trees was not obvious from infrastructure, a note was made to confirm ownership with reference to 2019 GIS property bounds provided by the Cayuga County Planning Department.

Locating Trees, Stumps, Planting Sites, and Invasive Plants in Auburn

All trees, stumps, invasive plants and planting sites in the Right of Way were located with GPS coordinates and referenced to an address number and street name. Address number was determined in the field from posted house or business numbers, or if absent, deduced from adjacent property markings. All addresses in Cayuga County underwent a comprehensive address reassignment program in the early 2000s to ensure unique addressing for E-911 dispatch. During those years homes and businesses were quite diligent in marking buildings and lots, however the practice is no longer quite so universal. If no address could be determined while on a City street, it was later established in the GIS with spatial address matching using the 2019 Cayuga County tax parcel data.

Trees Growing in Medians or Along Large Unnumbered Lots

With the exception of the Rt 5 & 20 Arterial median and some new subdivisions in the City that do not have sidewalks, most of the trees inventoried are growing in the tree lawn between the curb and the sidewalk. However, there are about 3,000 locations in the inventory that did not have accurate addresses when identified in the field, and that for a variety of reasons are not practically referenced to nearby addressed structures. Reasons include: trees growing along NYS rights of way on Rt. 326 and Rt. 5, (the Auburn Arterial), trees growing along the Auburn Prison's Wall on Wall Street, trees growing in the industrial York Street corridor, and trees growing on unique medians and alongside large lots.

To address this issue, each of the trees in this category are spatially referenced to 65 "Special Management Zones" as follows:

- 365_Vet_Mem_PkWay_West
- 365_Vet_Mem_PkWay_South_East
- 365_Vet_Mem_PkWay_North_East
- Genesee_West
- Arterial_1_South
- Arterial_1_Median
- Arterial_1_North
- Arterial_2_Median_West
- Arterial_2_South
- Arterial_2_North_West
- Arterial_2_North_East
- Arterial_2_Median_East
- Arterial_3_Median
- Arterial_3_North
- Arterial_3_South
- Arterial_4_North
- Arterial_4_Median_North
- Arterial_4_South
- Arterial_4_Median_South_West
- Arterial_4_Median_South_East
- Arterial_5_North
- Arterial_5_Median_North
- Arterial_5_Median_South
- Arterial_5_South
- Arterial_6_Median
- Arterial_7_Median
- Arterial_7_South
- Arterial_8_Median
- Arterial_8_South
- Arterial_9_South
- Arterial_9_North
- Arterial_9_Median
- Arterial_10_North
- Arterial_10_Median
- Wall_Street_along_wall
- York_Street_South_West
- York_Street_North_West
- York_Street_North_East

- York_Street_South_East
- York_Chase_Streets
- York_Quarry_Streets
- Genesee_Street_Median
- Lake_Ave_Median_10
- Kearney_Ave_West
- Metcalf_Ave_South
- South_St_East
- Lake_Ave_Median_1
- Lake_Ave_Median_2
- Lake_Ave_Median_3
- Lake_Ave_Median_4
- Lake_Ave_Median_5
- Lake_Ave_Median_6
- Lake_Ave_Median_7
- Lake_Ave_Median_8
- Lake_Ave_Median_9
- Macinthosh_Apts
- Olympia_Apts
- Clifford_Field
- Water_Filter_Plant_Pulsifer
- Quill_Ave_Apts
- Seymour
- Genesee_Street_North
- Genesee_Street_South
- Clymer_Street_Extension
- South_Hunter_Ave_Median

Park and Open Space Data Considerations

The park and "open space" data is for trees that are growing on public lands in Auburn. Beyond Auburn's parks and playgrounds there are two public cemeteries, a water filter plant, and additional city-owned open space that are not currently a formal part of the city's park system. Each tree record in the park and open space inventory are spatially referenced to the name of the park or open space resource as follows.

- Benton Street Playground
- Booker T. Washington Playground
- Bradford Street Playground
- Buonocore Park
- Calvary Park
- Casey Park
- City of Auburn Water Filter Plant
- Clifford Field
- Columbian Playground
- Cottage Place Park
- Falcon Park
- Hoopes Park
- Lincoln Playground
- Market Street Park
- Miles Park & Lepak Park

- North Street Cemetery
- Osborne Park
- Pomeroy Park
- Seminary Park
- Sherwood Playground
- Soule Cemetery
- St. Francis Playground
- Veterans' Park
- Wadsworth Street Site

Tree Locations for Corner Lots and Side Streets

When the location of a tree growing on a corner lot did not match the address of the lot, the address listed for the tree is the address for the lot with the added note in the comment field indicating the tree is growing on that street. For example, if a tree is growing on the Metcalf Drive side of an address on Lake Avenue, the tree's address is the Lake Avenue address and "on Metcalf Drive side" is included in the comment field.

Relating Inventory Results to Management Practices in Auburn

During the inventory, the City of Auburn was actively removing the many dead or nearly-dead ash trees growing in City Rights of Way and in City Parks and Open Spaces. The inventory crossed paths with the one City crew in July, and by August was crossing paths with a private firm that had been retained to assist the City with ash removals. By Autumn, it was evident that data on ash trees collected earlier in the season as trees were now stumps, and the best effort was made to convert those records accordingly.

Experience over the inventory season highlighted the limitations of the current tree work flow management approach, and formal discussions between management staff of the engineering and public works departments took place to address these concerns. The City's ESRI-certified Geographic Information System consultant weighed in on these discussions, and together with staff identified a range of program changes that must be adopted to make tree management more effective and efficient, including the adoption of new spatially-empowered tree management software to bring the current work flow practices up to date.

During these conversations it was recognized that staff needs training when the City implements a new tree-management software platform that should to be tied to an on-going urban forest inventory maintenance project that includes a complete Level 1 tree inventory every ten years. Furthermore, these discussions about this tree inventory data - and how best to use it - revealed an additional limitation of the current work flow model: as of this date, trees in the City's work flow system are rated for pruning and/or removal based on an outdated risk assessment and management system that does not empower staff to make the best use of data and equipment when focusing limited City resources on tree management needs. To this end the City must consider adopting a new tree risk management strategy that integrates Level 2 tree assessment into regular tree work flows.

Respectfully,

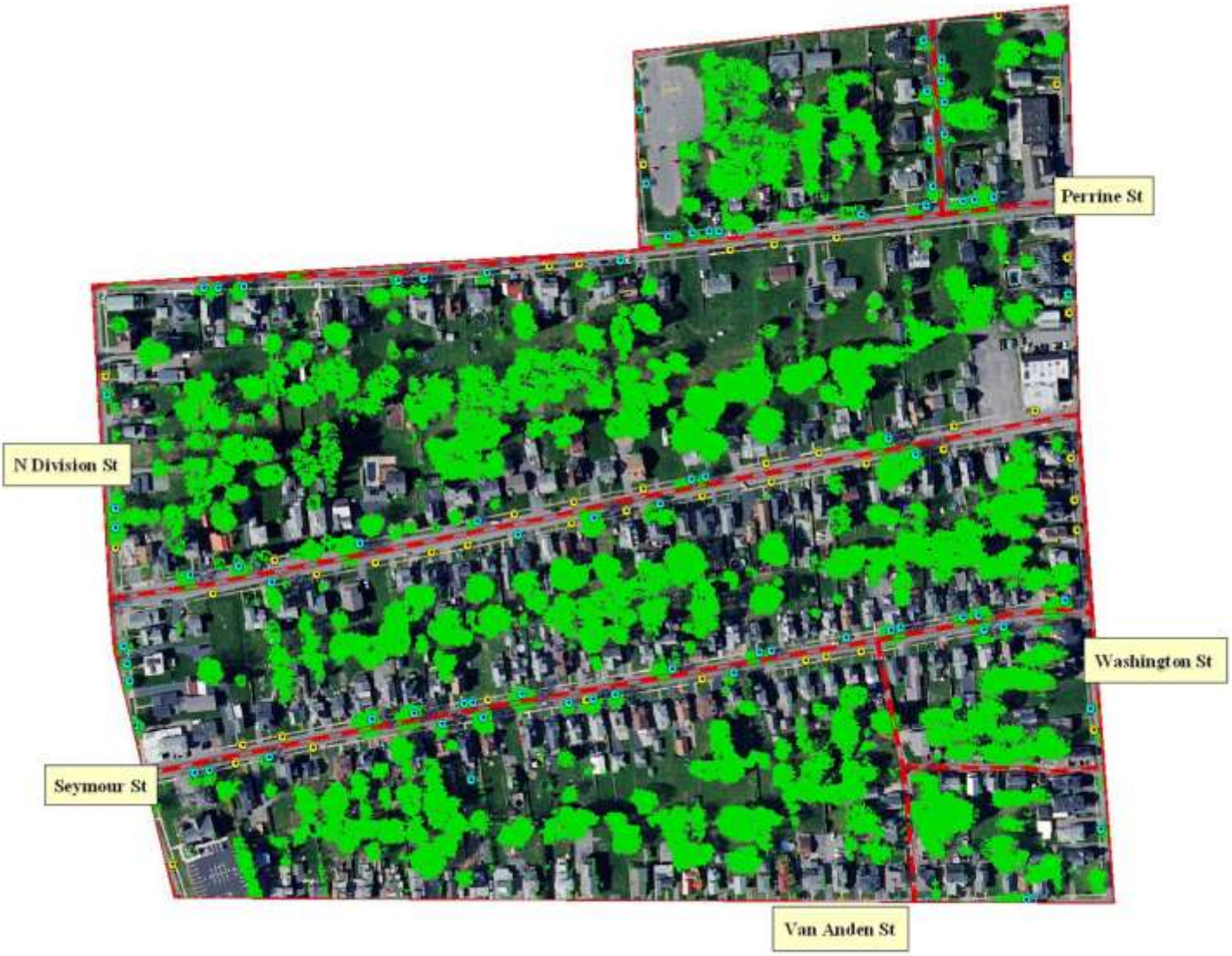
Walt Aikman, Ph.D.
ISA Certified Arborist®
NY-6444A

Appendix 4. Neighborhood maps

Clarksville
Casey Park
Van Anden - Shevchenko
Cross - Union
Steel Mill
West End
Wall - Genesee
Standart Woods
North Street - Flummerfelt's
Seminary
Holland Stadium
Franklin - Capitol
Lafayette - Hardenburg
Fort Hill
Lexington - Arch
Mercy - Melone
Quill's Hill
Meadowbrook
East Hill
St. Alphonsus
Herman Elementary
East Genesee - Walnut
City Hall
Walnut - Havens
Hoopes Park
Case - McDougal
Clifford Field - Lake Ave.
Tubman - Seward
Throop Ave.

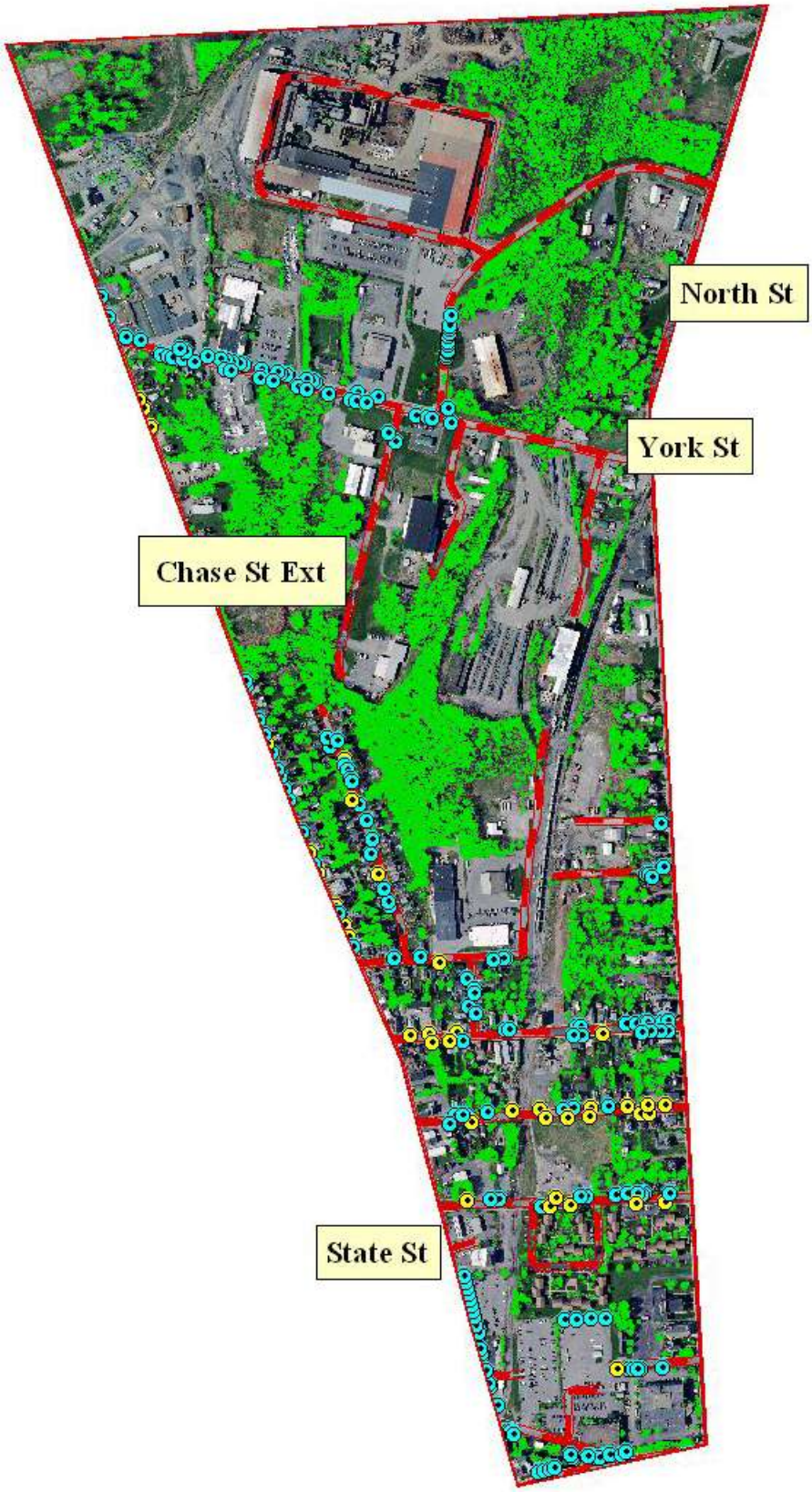
The Clarksville neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Casey Park neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.



The Van Anden - Shevchenko neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Cross - Union neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.



The Steel Mill neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The West End neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Wall - Genesee neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Standart Woods neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

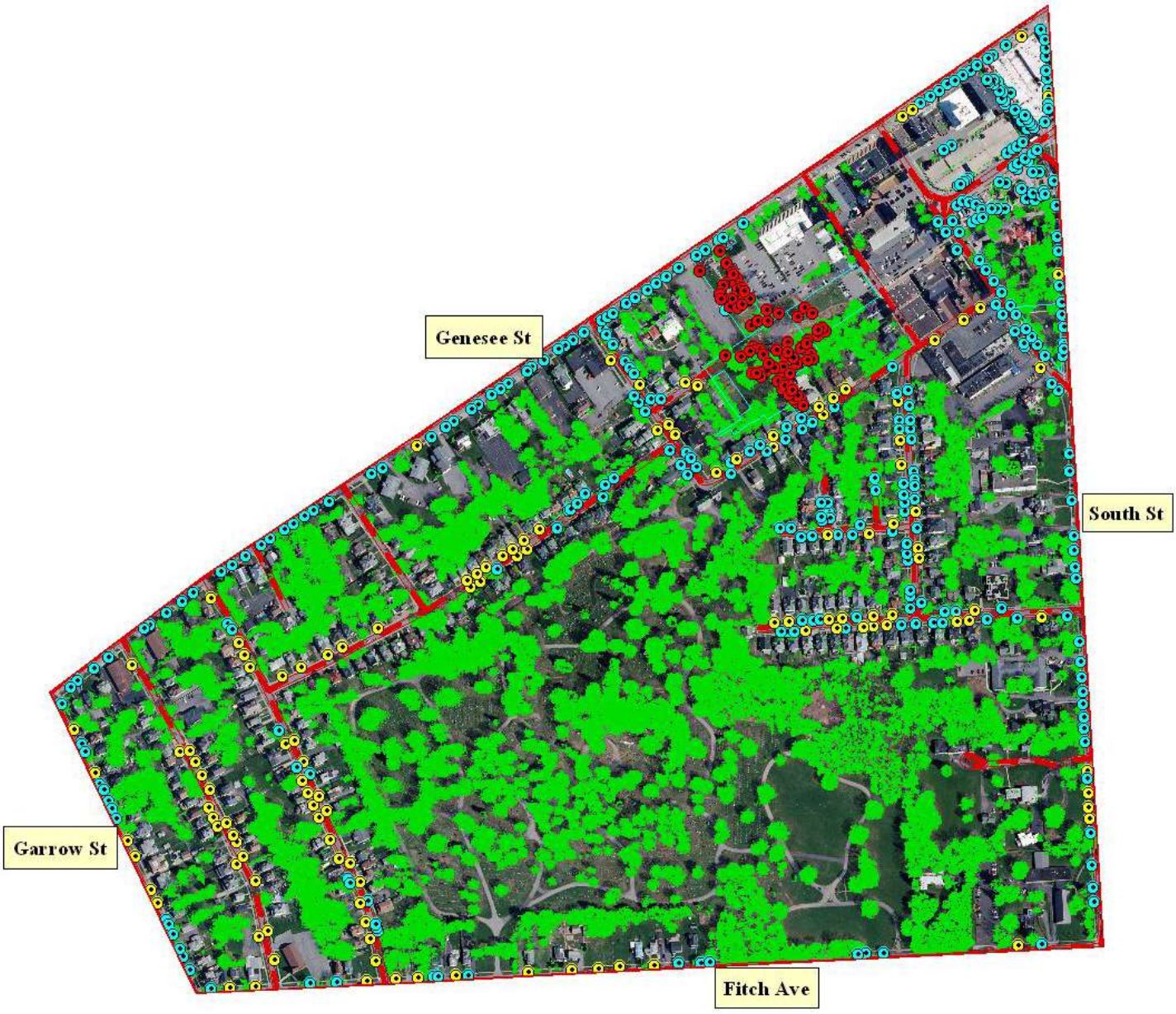
The North Street - Flummerfelt's neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Seminary neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Holland Stadium neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Franklin - Capitol neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Lafayette - Hardenburg neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.



The Fort Hill neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Lexington - Arch neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Mercy - Melone neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Quill's Hill neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Meadowbrook neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The East Hill neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The St. Alphonsus neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Herman Elementary neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The East Genesee - Walnut neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The City Hall neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

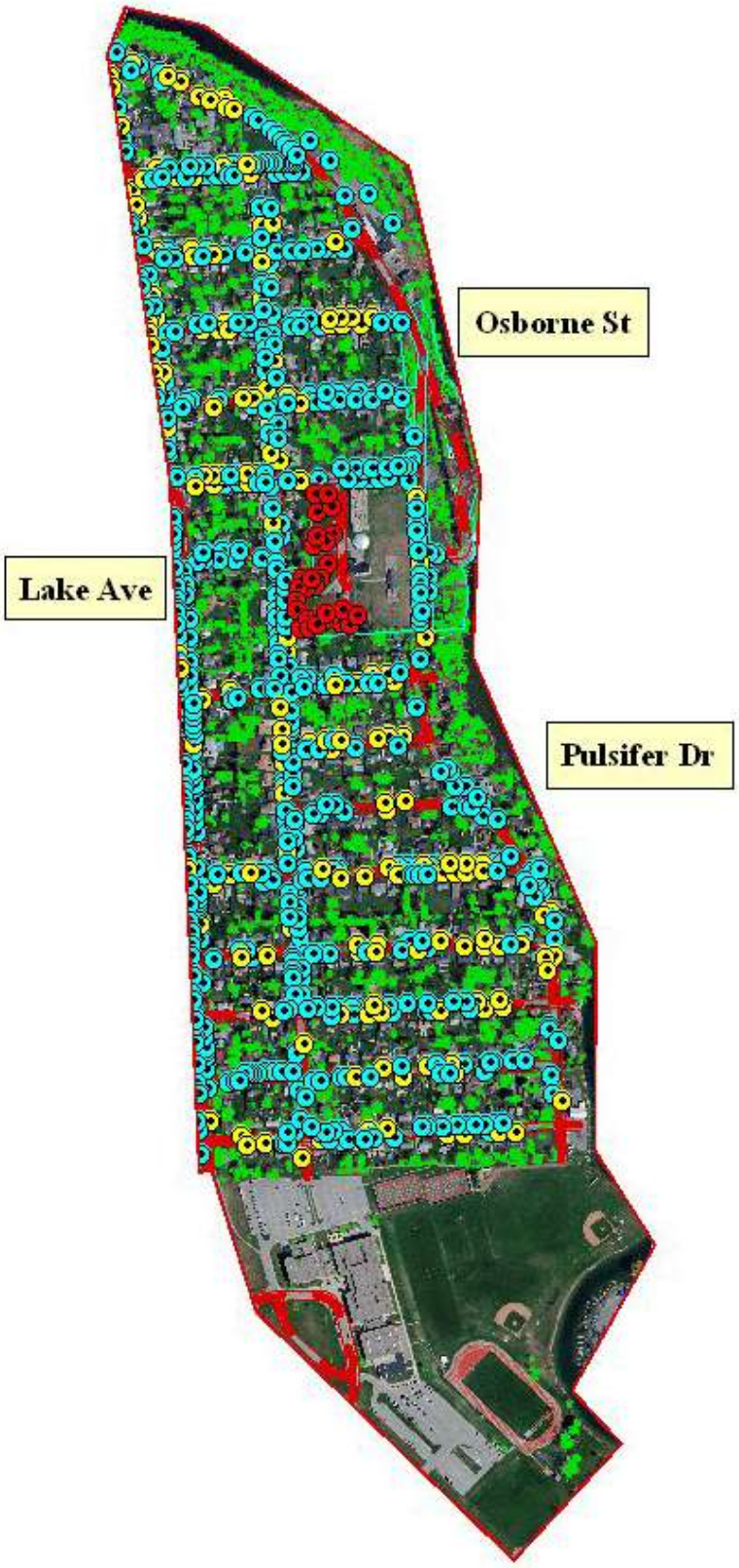
The Walnut - Havens neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Hoopes Park neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Case - McDougal neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Clifford Field - Lake Ave. neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

The Tubman - Seward neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.



The Throop Ave. neighborhood showing 2018 tree canopy in bright green, street trees in blue, available planting sites in yellow, and park and public open space trees in red.

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Tank Tree. Sycamore on Seymour Street, just East of State Street
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