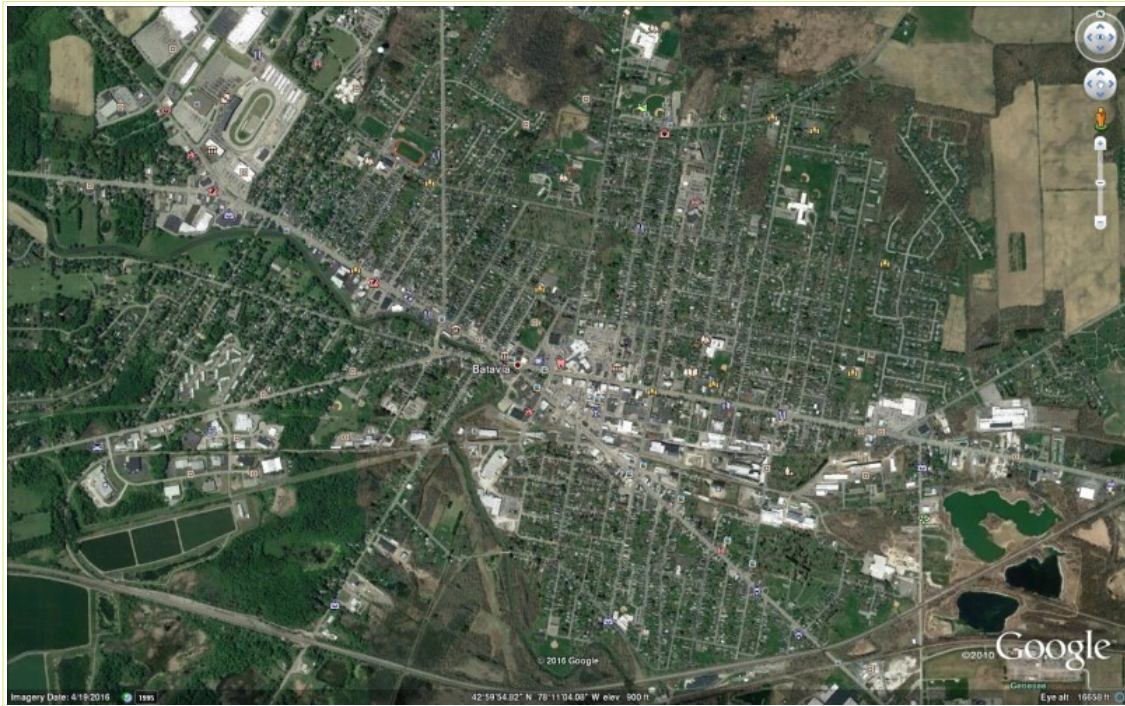


**City of Batavia**

# **Tree Management Plan**

**Final**

<http://bit.ly/2locX5V>



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**Urban Forest Analytics LLC**

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**Credits.** Figures 1, 6, 7, 11: Genesee Citizens for the Environment;<sup>1</sup> other photos by author.



# Batavia Tree Management Plan

## 1. Introduction

### 1.1 Batavia's Urban Forest

The word “urban forest” refers to all publicly and privately owned trees within an urban area—including individual trees along streets and in backyards, as well as stands of remnant forest.<sup>2</sup> This Tree Management Plan is restricted to the public portion of that forest, yet it hopes to persuade owners and managers of other portions to join in a common effort to improve the quality of life in the City of Batavia. It documents the steps necessary to increase the canopy cover of Batavia's urban forest to a sustainable level that will expand its benefits and assure they are available to all city dwellers. The development of this Plan is supported by a 2015 grant (Rnd12-CMP-58) from the NYS Urban and Community Forestry Council.



**Figure 1. Rejuvenation: challenges and opportunities.** Note the second tree on the right in very poor condition, and the available planting sites in the background.

## 1.2 Public Forest Inventory Results

What do we actually know about this public urban forest? Over the last five years, a number of complementary inventories of the public trees have been made:

- Street trees
  - Full Inventory 2011-2014 by Cornell University's Student Weekend Arborist Team (SWAT) under the local direction of Fred Cowett and the general oversight of Prof. Nina L. Bassuk.<sup>3</sup>
  - Sampled in October 2016 by Jerry Bond of Urban Forest Analytics LLC in order to estimate maintenance needs of a large number of trees left unrated by SWAT, and of the street tree resource more generally.<sup>4</sup>
- Park trees: Full Inventory by Bond in June 2016.<sup>5</sup>

The data from this work provides a solid understanding of what is out there, what kind of work it needs and where we want to take it. Here are important findings from those inventories.

- **Tree population**
  - Streets: 3,623.
  - Parks: 697.
  - Significance: provides an index of quantity of work, though absolute number are less significant than distribution and stocking rate.
- **Species distribution**
  - Streets: about  $\frac{1}{3}$  are Norway maples, and a full 60% are maples of some kind.
  - Parks: about  $\frac{1}{4}$  are silver maples, with a total 45% maples of some kind.
  - Significance: the reliance upon a single genus such as maple (*Acer*) leaves the City more vulnerable to catastrophic loss due to storms, pests and other disturbances. Most common species are shown in Figure 2.

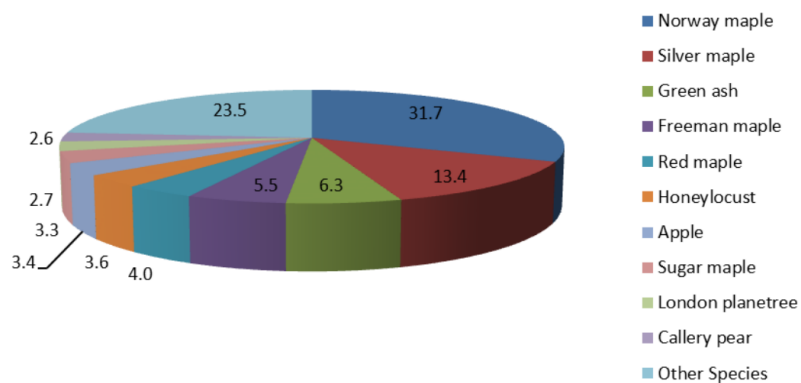
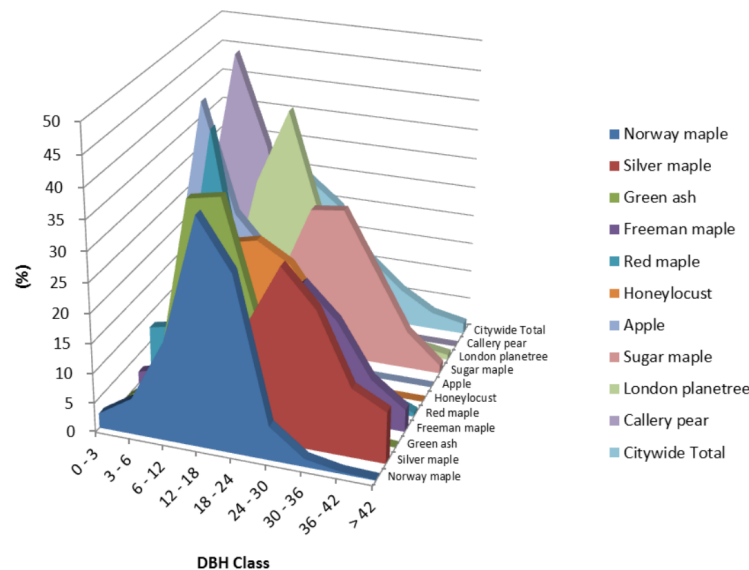


Figure 2: Species distribution of public trees in Batavia

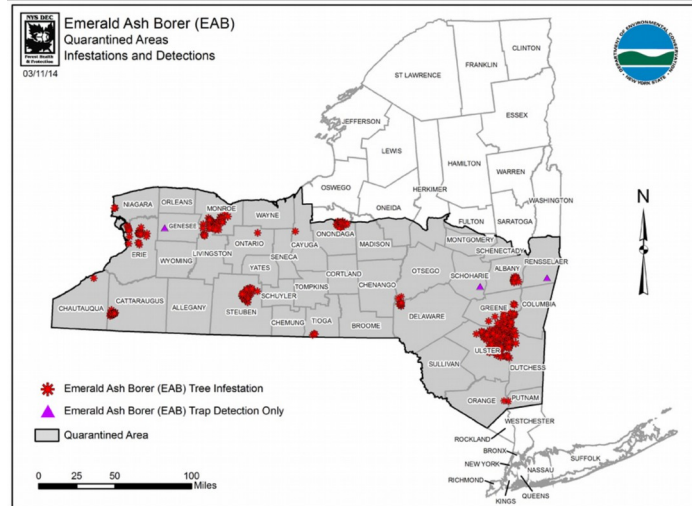
- **Size** (Diameter at Breast Height, a proxy for age)
  - Streets: about 70% lie between 6-30” in diameter, though Norway maples average about 16” while silver maples are twice that. Most common species shown in Figure 3.
  - Parks: about 75% of the trees lie between 6-30” in diameter.
  - Significance: DBH varies significantly among species, because of both different planting times and different genetic growth patterns. But the striking dominance of the failure-prone silver maples in the larger DBH classes (Figure 3) indicates a substantial maintenance load in the future.



**Figure 3: Diameter class of public trees in Batavia**

- **Stocking rate** (% of available planting sites occupied by a tree)
  - Streets: 67%.
  - Parks: N/A, since specific sites are lacking.
  - Significance: indicates that the number of street trees could potentially be increased by as much as 50%.
- **Condition**
  - Ability to live (judged from canopy traits)
    - Streets: over 90% of the trees were found to be in “Good” condition, with less than 1% determined to be “Poor” or “Dead/Dying.” This result of the SWAT inventory excluded over 500 large trees whose condition was deemed to need expert consultation. The short-term estimate (Ftn 4) indicated that many of those 500 are in “Poor” condition.
    - Parks: about 50% are in “Good” condition, about 15% “Poor” or “Dead/Dying.” These results imply substantial maintenance needs in the near future.
  - Ability to stand (judged from visible defects)
    - Streets: almost 95% of the trees were found to be in “Good” or “Fair” condition. SWAT results, with same exclusion as above. The short-term estimate indicated many of the excluded trees have “Poor” ability to stand.
    - Parks: about 75% are in “Good” or “Fair” condition, but about 20% were “Poor.”

- **Pests** (focus on the Emerald Ash Borer, with active core centers moving in from Erie and Monroe Counties<sup>6</sup>).
  - Streets: about 7% of the trees are ashes (250 trees).
  - Parks: close to 8% of the trees are ashes (54 trees).
  - Significance: the City will need to develop a response to this threat in the near future.



**Figure 4: Emerald ash borer: infestations and detections, showing its establishment E and W of Batavia. (Source: DEC)**

- **Pruning** (except young tree training)
  - Streets: best estimate is that 195 +/- 40 trees need priority pruning
  - Parks: 16 trees were designated for priority pruning.
  - Significance: provides good indication of required work and budget
- **Removals**
  - Streets: best current estimate is that something over 350 trees need priority removal.
  - Parks: about 100 trees, a bit less than half of which are tagged as priority.
  - Significance: provides good indication of required work and budget

### 1.3 Ecosystem Services

People have appreciated the aesthetic and social benefits of tree-covered public spaces for millennia, but the rapid development over the last century of large cities and populations has raised the stakes. Furthermore, it has only been within the last two decades that the monetary value of what are now called “ecosystem services” (the benefits people obtain from ecosystems of all kinds) has been calculated using the best available science. They are commonly divided into four broad categories:<sup>7</sup>

- Supporting—e.g., the products of photosynthesis that make life possible, starting with oxygen.
- Provisioning—e.g., minerals, food and raw materials.
- Regulating—e.g., water and air purification.
- Cultural—e.g., spiritual, emotional and recreational enrichment.

In urban environments these services depend primarily on tree canopy cover. The amount of canopy cover can be calculated for our purposes as the percentage of the ground surface covered directly overhead by foliage. This number can vary greatly within a city, where it is often low in the downtown business district and much higher in residential areas. Canopy cover also varies over time due to changing natural and human forces. National canopy cover percentages range widely: from 10 to 54% for large cities, with higher values often found for smaller communities, especially in the Northeast. Citywide, Batavia enjoys an average canopy cover of about 38%.<sup>8</sup> It may be helpful for planning purposes to recognize how commonly recommended canopy targets vary across an urban area:

- average for the entire city: 40%
- suburban residential zones: 50%
- urban residential zones: 25%
- central business districts: 15%

Also important is leaf condition, which can be estimated from observing crown parameters such as the density of the foliage, the greenness of the leaves, etc.--parameters significantly affected by urban forestry activities such as species selection, maintenance and protection.

**Quantitative ecosystem benefits.** Based on the monetary value of the services provided by urban trees, the i-Tree software suite developed by the USDA Forest Service can calculate such benefits. The results being reported here were obtained using an application in that suite called i-Tree Streets, into which Batavia street and park tree inventory data were imported.<sup>9</sup>

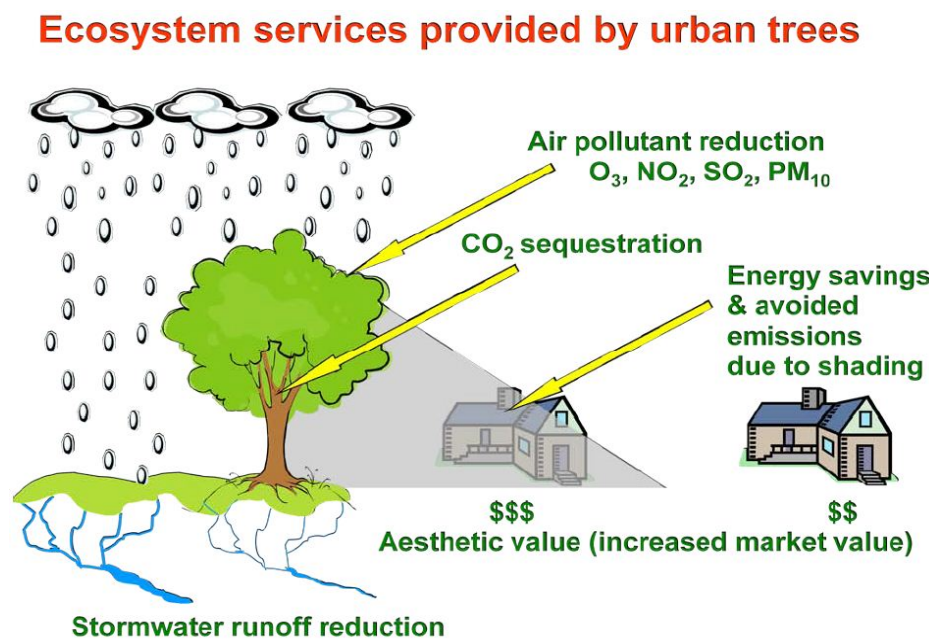


Figure 5: Representation of ecosystem services (Source: [urbantreealliance.org](http://urbantreealliance.org))

- Benefit types<sup>2</sup>
  - Energy: modify climate and conserve building heating/cooling
  - CO2: remove and store the greenhouse gas carbon dioxide
  - Air Quality: filter particle pollution and reduce ozone formation<sup>10</sup>
  - Stormwater: reduce the amount of runoff and the pollutant loading it brings
  - Aesthetic/Other: provide a host of esthetic, social, economic, and health benefits
- Summary of quantifiable benefits from Batavia public trees.<sup>11</sup>

**Table 1: Annual public tree benefits**

Location	Energy	CO2	Air Quality	Stormwater	Aesthetic/Other	Totals
<b>Streets</b>	\$161,935	\$5,601	\$41,262	\$1,381	\$44,266	\$254,444
<b>Parks</b>	\$36,223	\$1,169	\$9,588	\$349	\$0	\$47,329
<b>Citywide</b>	\$198,157	\$6,770	\$50,850	\$1,729	\$44,266	\$301,772

- When costs are removed, **net benefits are about \$78,800, a benefit-cost ratio of 1.34 for public trees** (calculations by i-Tree Streets).

**Qualitative ecosystem benefits.** Benefits such as social effects or the aesthetic value of Parks resist a scientific assignment of dollar value, but are equally important. In Table 1 there is no calculable Aesthetic/Other benefit for Park trees since i-Tree Streets restricts those benefits to the effect on property value. As a result, it is necessary to explore other avenues to appreciate qualitative benefits.

Because they are centered on daily experience, these benefits should form an integral component of the promotion of urban forestry and the tree management plan behind it. In the example above, for example, it is unquestionable that Parks have a significant if incalculable impact on community members. Some of the most significant benefits supported by research include the following:<sup>12</sup>

- Reduce road rage
- Improve worker productivity
- Attract business investment and shoppers
- Increase social ties & neighboring
- Increase perceptions of safety
- Reduce domestic violence
- Enhance children's play
- Improve physical and mental health
- Create wildlife habitat
- Increase community pride
- Improve consumer behavior
- Increase recreational opportunities

With strong research now supporting the economic and social value of this wide range of ecosystem services, communities have a renewed sense of the importance of tree canopy cover.



**Figure 6. Trees in the median near City Hall add significant social benefits**

## 1.4 Principles and Goals

The following principles and goals for Batavia's Tree Management Plan are founded on the data and research that have been reviewed, and have been adopted for this Tree Management Plan.

### Principles

1. Trees should be treated by all City departments and citizens as a standard municipal service that is shared and valued.
2. Tree benefits are to be spread as equitably as possible across the population.
3. Tree diversity is critical to a healthy and sustainable urban forest.
4. A program of tree protection or replacement for healthy and stable public trees should be integrated into the evaluation of construction and development plans, both private and public.

### Goals

1. Establish a substantially enlarged and more robust tree population within 20 years whose larger canopy cover at maturity will supply a significant increase in benefits.
2. Increase awareness about the benefits and services provided by the urban forest among municipal and private stakeholders.
3. Create a web-based resource archive of urban tree management documents easily accessible for any user, from municipal employee to private citizen.
4. Put in place a more efficient tree management system that responds to present needs and anticipates future ones.



**Figure 7. An important option is to consider “setback planting” of public trees on private property where ROW planting is not possible or favorable.**



## 2. Short-term Phase 1 management

### 2.1 Scope of work

A good over-arching term for the proposals in this Plan is **Rejuvenation**, i.e., the creation of a younger urban forest. In the short term Phase 1 (years 1-7), Batavia’s public tree management should concentrate on stabilization. The current situation, as described in the Introduction, is unstable because

of a high number of large older trees in poor condition and a tree-management system that needs upgrading.

The following overview is intended to serve as an introduction and rationalization of the detailed recommendations for short-term action at the end of this section.



Figure 8. The Two Tasks. In the foreground is a new planting that will require maintenance during establishment; in the background an old and declining tree will need to be removed soon.

### 2.2 Personnel

Over the next 5 years the primary need in terms of tree management personnel is to provide training to the field crew in order to give them a review of basic procedures and to brief them on current industry standards.

Important topics include planting, post-planting care, small tree pruning, and “Level 1” risk assessment.<sup>13</sup>

Initial steps in raising the efficiency of office procedures should be taken as well.

### 2.3 Field work

Field work will be the big area for the short-term Phase 1. It possesses two aspects that are tightly linked:

- The removal of large defective trees, which will require significant resources in terms of budget, scheduling and public relations.
- The planting of replacement trees, which should begin at the same time and be highlighted in announcements, publications and meetings.

Citizens often don’t like to see many removals in a short period of time, so the emphasis throughout should be on the concept of **rejuvenation** and the need for replanting a future forest.

## 2.4 Administration

Policies and procedures are critical to efficient urban forestry management. Policies are clear, simple statements of how the City intends to conduct its services and actions. Procedures are the specific methods employed to express those policies.

Batavia currently has only a small number of standard policies regarding management of the public urban forest, and its foundation document in City Code is out of date. Procedures for office and field staff are similarly minimal, and need to be standardized during this stabilization period.

Tree Service Call Topics  
May 2015 to September 2016

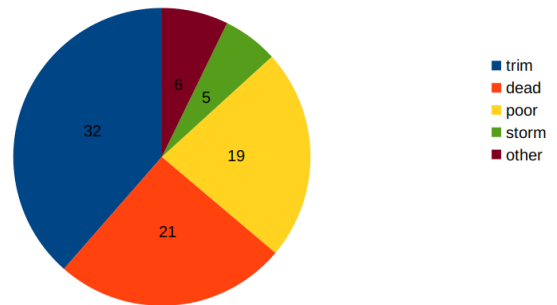


Figure 9: Almost half of the (mostly accurate) service calls report the need to trim, and another quarter a dead tree.

## 2.5 Canopy

It is important not to lose sight of the long-term goal during this first period: the expansion of tree cover. With a significant loss of large trees and their canopy, there will be a net drop until new plantings begin to have a measurable effect.

## 2.6 Evaluation

At the completion of Phase 1, an evaluation can be conducted through the use of a small random sample of the population of large trees (> 24”), using the original 2016 Working Database. The goal would be to estimate the residual priority pruning and removal needs and compare them against the results from seven years earlier.

## 2.7 Cost projections

Projected costs over the short-term Phase 1 (years 1-7).

**Table 2: Short-term Phase 1 cost projections (costs provided by City of Batavia).** Quantities: Pruning (priority): 200 from sampling + 30/yr; Removals: 50/yr; Planting: 75/yr.

	Unit cost	Quantity	Estimated Cost
<i>Pruning</i>	310	410	\$127,100
<i>Removal</i>	1,022	350	\$357,700
<i>Planting</i>	287	525	\$150,675
<b>TOTAL</b>			<b>\$635,475</b>

## 2.8 Recommendations and priorities – Phase 1

**Table 3: Short-term Phase 1 recommendations and priorities**

Area	Recommendation	Priority
<i>Personnel</i>		
	Provide in-house training on industry-standard tree care techniques.	1
	Consider using an electronic Tree Complaint form that would reduce time and paper, and increase accuracy and facilitate review. Associate TreeID from Working Database.	2
	Review and summarize service requests and their resolution on an annual basis.	3
<i>Field Work</i>		
	Set up a windshield survey for 1 ward per year for pruning and risk assessment.	1
	Assemble a <i>Specifications for Public Tree Care</i>	1
	Begin program of routine structural pruning (“training”) for newly planted trees approximately 3 years after planting.	3
	Consider implementing systematic management that cycles through the City in a standard fashion.	2
	Carry out aggressive removal of large, old and defective silver maples identified in the SWAT inventory and by DPW personnel.	1
	Monitor ash trees for signs of EAB presence on annual basis	1
<i>Administration</i>		
	Improve and standardize QAQC procedures.	2
	Collect 3-yr survival data when training is done on new plantings	1
	Learn to work with and maintain the Working Database	1
	Review the tree management section of the Batavia City Code for restructuring, changes and additions.	2
	Develop a policy for dealing with the imminent arrival of Emerald Ash Borer, especially for street trees. <sup>14</sup>	1
	Become a Tree City USA <sup>15</sup> to promote interest in public trees.	3
<i>Canopy</i>		
	Maintain stocking level by continuing planting	1
	Strive for a 2:1 replacement ratio for removals to account for 30-year mortality rate of 50% for new trees.	2
	Explore the possibility of using setback planting where sufficient room above or below ground is unavailable. <sup>16</sup>	2



## 3. Long-term Phase 2 management

### 3.1 Scope of work

At the end of the short term (years 1-7), Batavia's public tree management should have been stabilized with the successful conclusion of a recommended set of actions and procedures. That achievement will enable long-term Phase 2 (years 8-20) planners to concentrate on **sustainability**: the conditions under which the City of Batavia and its public forest can exist in productive harmony to support present and future generations.

**Table 4. Urban tree canopy long-term threats and strategies**

Threat	Strategies
Root damage	Improved standard of care
Development	Agreements and regulations
Ignorance and Apathy	Education, promotion
Weather	Selection, preparedness
Old age	Appropriate replanting
Insects and Diseases	Species diversity

### 3.2 Personnel

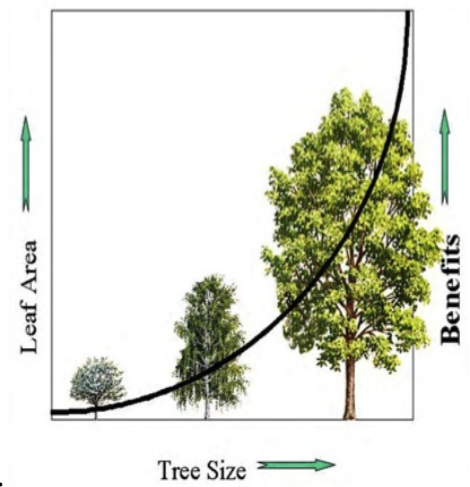
In terms of personnel, the pursuit of sustainability means to train and hire people who will become self-motivated and self-sufficient in urban forestry. The all-important first step will be to get an International Society of Arboriculture Certified Arborist associated with the program, through training of existing individuals, hiring to the job from the outside or engaging a contract forester. Though only about one-third of American cities in the same population group have a Certified Arborist associated with their urban forestry program,<sup>17</sup> it would be highly desirable for Batavia given the scope of its canopy project to bring professionalism, knowledge and skills in key areas:

- Ability to advocate for urban forestry in front of any audience
- Experience in creating and applying QAQC methods
- Understanding of principles and goals of the urban forest program
- Background in species and stock selection, tree risk assessment, interaction with citizens, etc.
- Availability for field inspection and oversight based on Best Management Practices

### 3.3 Field work

This long-term drive for sustainability should witness fundamental changes in the type and quality of urban forestry field work. Some important examples:

- Training. This form of pruning is carried out on young trees to improve structure, reduce future problems from storms, pests, etc. , and to create longer-lived and lower-maintenance trees.
- Best Management Practices. The long-term goal is to bring industry best management practices into everyday tree care in Batavia that will raise professionalism and promote tree longevity.
- Pest management. A decision needs to be developed and executed for the impending arrival of Emerald Ash Borer. A few larger street-trees in good condition might be treated and retained, but the majority will likely be removed.



**Figure 10: Benefits increase with size, as do maintenance costs. (Source: [urbantreealliance.org](http://urbantreealliance.org))**

### 3.4 Administration

Administrative procedures should be reviewed, and improvements introduced. Examples include:

- Ward-based management. A shift from a work plan based primarily on “putting out fires” to one that proceeds in a systematic and predictable manner will bring many advantages.
- Effective communication and cooperation among departments. Actions that affect city trees should be collectively planned out with Maintenance, Streets and Building Inspection.
- Efficient information flow. Internally, moving to electronic tools will make sharing information faster, cleaner and more secure. Externally, increased and improved public relations will be important.
- Routine use of the Working Database. All existing street and park trees have a unique ID, and new ones should receive one. Those numbers should be referenced in all communications.

### 3.5 Canopy

The most important activity for canopy development during the long-term planning period lies in the area of replacement planting. Great care should be taken with its components:

- species and stock selection; planting and post-planting techniques
- community and business support; protection during development

All hopes of improved and enlarged canopy cover and of the increase in its benefits will rest on the survival and condition of the newly planted trees.



**Figure 11: Protect and promote.** An important aspect of the drive for canopy will be the protection during construction of existing trees in good condition. Note how the all-important root zone of the tree on the right lacks adequate protection.

### 3.6 Evaluation

At the end of Phase 2, an evaluation can be conducted by using a random sample of small trees (< 6”) that will provide the future urban canopy and provide its benefits to the City. Trees planted during Phases 1-2 can be measured for annual diameter increase and condition.

### 3.7 Cost projections

Projected costs over the long-term (Phase 2) period (8-20 years) along with the grand totals for the 20-yr planning period (CPI adjustments included).

**Table 5: Phase 2 and Total cost projections for recommended actions (costs provided by City of Batavia).**

Quantities: Pruning (priority): 30/yr; Removals: 20/yr; Planting: 75/yr

	Unit cost	Quantity	Estimated Phase 2 Costs	Estimated Phase 1 Costs (Table 2)	20-yr costs
<i>Pruning</i>	\$365	390	\$142,350	\$127,100	\$269,450
<i>Removal</i>	\$1,191	260	\$309,660	\$357,700	\$667,360
<i>Planting</i>	\$334	975	\$325,650	\$150,675	\$476,325
<b>TOTAL</b>					<b>\$1,413,135</b>

## 3.8 Recommendations and priorities – Phase 2

**Table 6: Long-term Phase 2 recommendations and priorities**

Area	Recommendation	Priority
<i>Personnel</i>		
	Identify a Field Crew member for Certified Arborist training, <sup>18</sup> and provide release time and funding.	1
	Find areas where the Supervisor's load can be reduced with volunteers or technology.	1
	Recruit volunteer groups to get involved in their local park planning and maintenance.	2
<i>Field Work</i>		
	Create a multi-year equipment replacement and update schedule and budget costs.	2
	Adopt the suitable tree care standards from ANSI and other organizations (Appendix B), and use them to produce work and bid specifications.	1
	Develop a recommended species planting list by tree size at maturity (Appendix D)	1
	Add tree emergency response procedures to municipal emergency protocol.	3
<i>Administration</i>		
	Invite volunteer groups to form an advisory Tree Board with responsibility for specific areas such as tree selection or Arbor Day.	3
	Create a <i>Public Tree Administration and Policy Manual</i>	2
	Set minimal training needed for anyone doing risk assessment.	2
	Greatly reduce planting of maple ( <i>Acer</i> ) species in public areas.	1
	Develop a proactive public relations program (Appendix C)	2
	Explore funding possibilities for activities such as a spike in removals, total street renovation or park management.	3
<i>Canopy</i>		
	Increase stocking rate in the downtown business district by 10%, using medium-large trees wherever possible. Plan for higher mortality rate.	1
	Identify low-canopy-cover areas in the urban residential zone for improving stocking rate by 20%.	1
	Monitor every 10 years or so the status of the urban forest using a random sample.	1

## 4. Conclusion

This Tree Management Plan poses some imperatives important to its success:

- Think in terms of decades and generations
- Seek a common vision for the forest
- Create a core group of advocates
- Establish a public education program
- Assert best management practices

The job before us now is to respond to these imperatives for the sake of the City of Batavia and its citizens.



**Figure 11. The promise of parks: trees and space. Early Spring in Farrell Park**



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# Appendices

## Appendix A: Electronic resources

Resource	Description
Full Public Tree Inventory	Static: some of the data are now 6 years old.
Working database	Dynamic, kept current by the Department of Maintenance.
i-Tree project file	A planning tool to be opened with i-Tree Streets. Not for day-to-maintenance.
Google Earth files	Localization and visualization tools.

## Appendix B: Standards, specifications and BMPs

### Official standards

**ANSI A300.** Mission: to develop consensus performance standards based on current research and sound practice for writing specifications to manage trees, shrubs, and other woody plants. Contractors should receive task-appropriate specifications that are based on this standard. Topics especially relevant to municipal tree care include:

- ANSI A300 (Part1) - 2008: Pruning (R2014)
- ANSI A300 (Part 2) - 2011: Soil Management (Fertilization)
- ANSI A300 (Part 6) - 2012: Planting and Transplanting
- ANSI A300 (Part 8) - 2013: Root Management
- ANSI A300 (Part 9) - 2011: Tree Risk Assessment
- ANSI Standard Z133.1 2012 - Safety Requirements

**ANSI Z133.** Safety standards. The 2012 revision of the ANSI Z133 Safety Standard provides the most current criteria in the United States for arborists and other workers engaged in arboricultural operations. Topics include;

- General safety
- Electrical hazard
- Use of vehicles and mobile equipment
- Portable power hand tools
- Hand tools and ladders
- Work procedures

**ANSI Z60.1.** American Standard for Nursery Stock. Important that buyers provide growers or distributors with specifications that conform to the terms of the Standard. Topics include:

- Specifications
- Minimum requirements
- Root ball requirements

### Other standards

**Tree City USA.** A nationwide movement that provides the framework necessary for communities to manage and expand their public trees. It requires four core standards of sound urban forestry management: maintaining a tree board or department, having a community tree ordinance, spending at least \$2 per capita on urban forestry and celebrating Arbor Day.

**ISA, Best Management Practices.** A series of Best Management Practices (BMPs) for the purpose of interpreting tree care standards and providing guidelines of practice for arborists, tree workers, and the people who employ their services. Among the many topics covered are these:

- Best Management Practices - Tree Inventories
- Best Management Practices - Tree Planting
- Best Management Practices - Tree Pruning – English
- Best Management Practices - Tree Risk Assessment
- Best Management Practices Managing Trees During Construction

## Specifications

Recommended specs for inclusion in a new Manual for use by Bureau of Maintenance personnel.

- Site selection
- Stock
- Planting, including Root and Structural Pruning
- Post-planting Care
- Trimming
- Removal
- Preservation
- Pests

Useful regional resources

- Rochester NY, Master Plan
  - <<http://nysufc.org/wp-content/uploads/2015/09/Rochester-Master-Plan.pdf> >
- Syracuse NY, Master Plan:
  - <<http://www.syracuse.ny.us/parks/forestry.html>>
- Buffalo, NY, Forestry page  
<[https://www.ci.buffalo.ny.us/Home/City\\_Departments/Public\\_Works\\_Parks\\_Streets/ParksDepartment/Forestry](https://www.ci.buffalo.ny.us/Home/City_Departments/Public_Works_Parks_Streets/ParksDepartment/Forestry)>

## Appendix C: Outreach methods and materials

### Door hangers

Effective with a ward-based management system to announce plantings, pruning, removals and public meetings. Provides quick description of what is happening and why, and supplies contact information.

### Posters

Good graphics make for a persuasive poster for all ages, and many are available on the web (search “urban forestry posters”) for free download and use. Examples:

- Trees need People series <<http://bit.ly/2krqeNg>>
- We all need Trees <<http://bit.ly/2k2ROSk>>

### Fliers and brochures

Good response when image-driven (i.e., minimal text) and interesting. Most easily distributed by bulk to relevant locations such as libraries, tourist centers, government buildings, etc. Possibilities:

- Volunteer projects: “Big trees in Batavia” or “Unusual trees in Batavia”
- Trees Pay us Back <<http://bit.ly/2lnWwGR>>

### Videos

Can be used effectively on the website, especially with an embedded viewer, and in public meetings. More: web search on “urban forestry videos,” but be careful to use only recent and qualified sources.

#### Examples

- Benefits of Urban Forests <<http://bit.ly/1A23gLt>>
- Instructional videos <<http://bit.ly/2kSA4bO>>
- i-Tree Streets videos <<http://www.itreetools.org/resources/videos.php>>

### Presentations, webinars, webcasts

Many good slide sets on urban forestry topics of all kinds are available for free download and use, with and without voice-over. Examples:

- Urban Forestry South presentations <<http://bit.ly/2krD9yP>>
- Collaboration & Consensus: Managing Volunteers & the Urban Forest <<http://bit.ly/2k31egK>>

## Appendix D: Species diversity

### Background

The history of urban forest catastrophes in America has demonstrated unequivocally the advantages of maintaining a high level of species diversity. Recent examples in the Northeast include:

- Elm species by Dutch Elm Disease in 1950s onward
- Maple (and other) species by Asian Longhorn Beetle in 1990s onward
- Ash species by Emerald Ash Borer 2000s onward

A general guideline proposed in 1979 by a Forest Service researcher (Santamour) is often suggested: the 10-20-30 rule. That means:

- no more than 10% of the species in a single species (e.g., silver maple)
- no more than 20% in a single genus (e.g., maples)
- no more than 30% in a single family (e.g., *Aceraceae*, the maple family)

Though not really a hard and fast RULE, it is a good place to start. In practical terms, such diversity should be the overall result of new planting, but need not govern a given annual stock order. Ordering something like 2 small, 2 medium and 2 large species for a year's planting reduces the workload and will result in a well diversified forest over time.

### Regional resources

- Syracuse planting list
  - <<http://www.syracuse.ny.us/parks/treeSpeciesPlanted.html>>
- Rochester Master Plan, including a planting list
  - <<http://nysufc.org/wp-content/uploads/2015/09/Rochester-Master-Plan.pdf>>
- Buffalo planting lists
  - <[https://www.ci.buffalo.ny.us/files/1\\_2\\_1/city\\_departments/public\\_works\\_and\\_streets/parks/pdfs/SpeciesList.pdf](https://www.ci.buffalo.ny.us/files/1_2_1/city_departments/public_works_and_streets/parks/pdfs/SpeciesList.pdf)>
  - <<http://www.buffalogreenfund.org/wp-content/uploads/2014/09/Updated-Species-List.pdf>>
- Cornell University, Urban Horticulture Institute
  - <<http://www.hort.cornell.edu/uhi/outreach/recurbtree/>>

## Appendix E: Benefits of all Batavia trees

These estimates were produced by i-Tree Canopy based on the interpretation of 500 random points dropped within Batavia's city limits (see Footnote 8).

### Tree Benefit Estimates

Abbr.	Benefit Description	Value	Amount
CO	Carbon Monoxide removed annually	\$49.11	1,158.58 lb
NO2	Nitrogen Dioxide removed annually	\$84.55	3.16 T
O3	Ozone removed annually	\$4,403.39	31.46 T
PM2.5	Particulate Matter less than 2.5 microns removed annually	\$9,102.61	1.53 T
SO2	Sulfur Dioxide removed annually	\$14.78	1.99 T
PM10*	Particulate Matter 2.5-10 microns removed annually	\$3,196.75	10.54 T
CO2seq	Carbon Dioxide sequestered annually in trees	\$231,626.30	6,405.71 T
CO2stor	Carbon Dioxide stored in trees	\$5,840,020.58	161,507.85 T
<b>TOTAL</b>		<b>\$6,088,498.07</b>	

