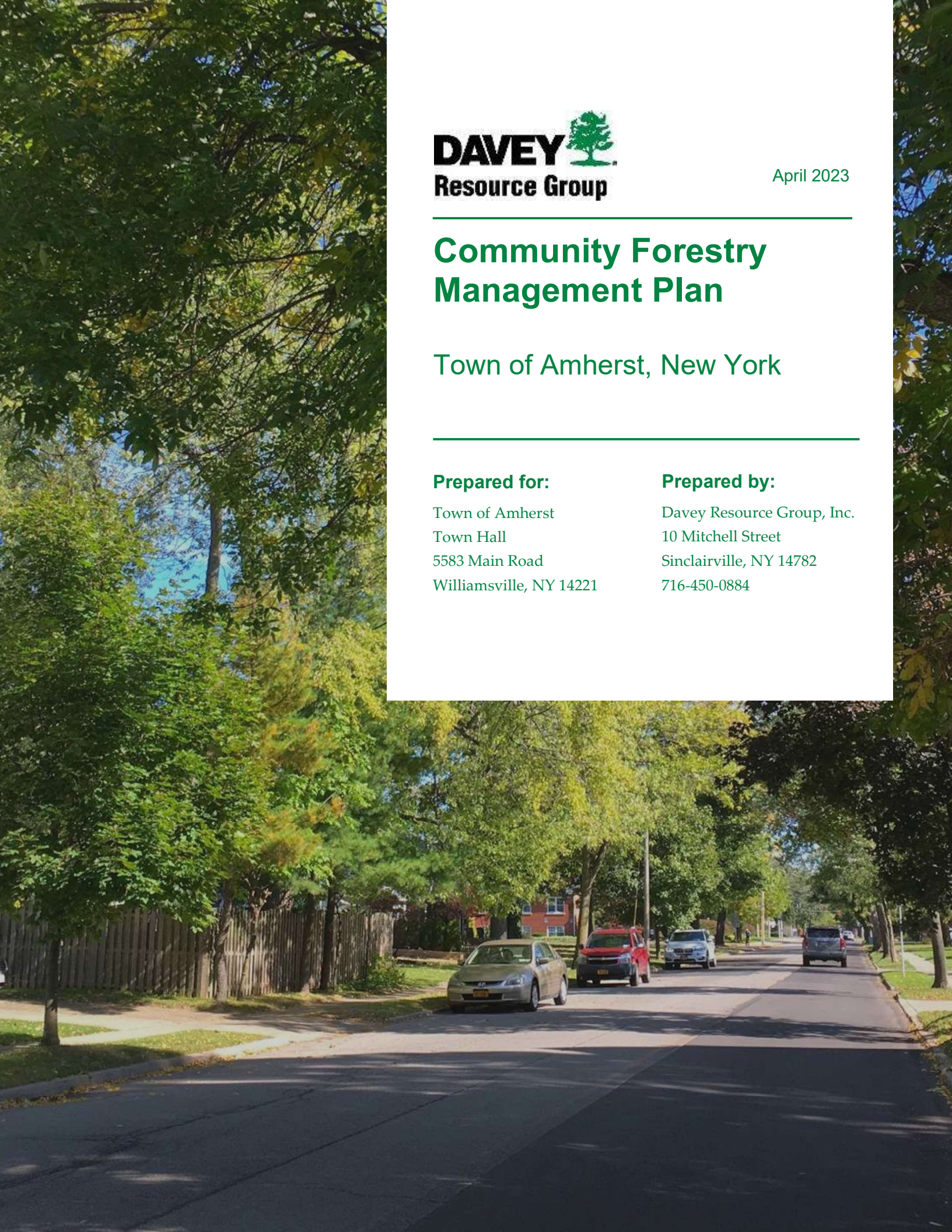

DAVEY Resource Group

April 2023

Community Forestry Management Plan

Town of Amherst, New York

Prepared for:

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ACKNOWLEDGMENTS

This project supports the Town of Amherst's vision to promote and enhance community well-being through public tree conservation and improved forestry management practices. This *Community Forestry Management Plan* offers expert recommendations for preserving and expanding urban canopy so the environmental, economic, and social benefits it provides continue for generations.

Amherst is thankful for the grant funding it received from the New York State Department of Environmental Conservation in cooperation with U.S. Forest Service through its Urban and Community Forestry (U&CF) Grant Program. The U&CF Grant Program is designed to encourage communities to create and support sustainable urban forestry programs throughout the United States. In addition, the Town would like to thank the following individuals:

Town Board:

Brian J. Kulpa, Town Supervisor
Debbie Bucki, Deputy Supervisor
Jacqualine Berger, Councilmember
Shawn Lavin, Councilmember
Michael Szukala, Councilmember

Tree Board:

Eric Borenstein, Chairperson
Ellen Banks, Tree Board Member
Dan Delano, Tree Board Member
Barbara Burke, Tree Board Member
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Jeffrey Szatkowski, Resource Person

Town Staff:
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Jeffrey Szatkowski, Planning Department

MISSION AND VISION FOR THE TOWN OF AMHERST

> "*Community Character, through the management of growth and change to preserve natural and cultural resources, maintain green space throughout Amherst, and revitalize older neighborhoods and commercial corridors while accommodating quality new development.*"
>
> *Town of Amherst Comprehensive Plan, Vision Statement*

Trees and wooded areas improve aesthetics and contribute to community character. These natural features provide numerous benefits including reducing flooding impacts and soil erosion, improving air quality, reducing water and noise pollution, providing economic and aesthetic value to property, and providing shade and habitat. The Town of Amherst hereby finds that there is a direct and important relationship between the existence of trees in the Town and the health, safety, and welfare of the community. The Town of Amherst Comprehensive Plan "Vision Statement" notes the importance of woodlands and tree canopy to the visual character of the Town. Consistent with this statement, tree canopy and woodlands should be preserved where possible and tree plantings encouraged on public and private lands. The Town has taken the necessary steps to follow this "vision" with local laws, zoning, establishment of a tree board, attaining Tree City USA status, and adhering to industry standards. The Town will continue to strive to implement policies set forth in the Comprehensive Plan and follow the goals and actions identified in this Community Tree Management Plan.

TREE CITY USA STATUS

The Town of Amherst has held The Arbor Day Foundation's Tree City USA status for over 23 years. The Town's core standards of urban forestry management include: maintaining a tree board or department, having a community tree ordinance, spending at least $2 per capita on urban forestry, and celebrating Arbor Day.

Community Tree Planting Event

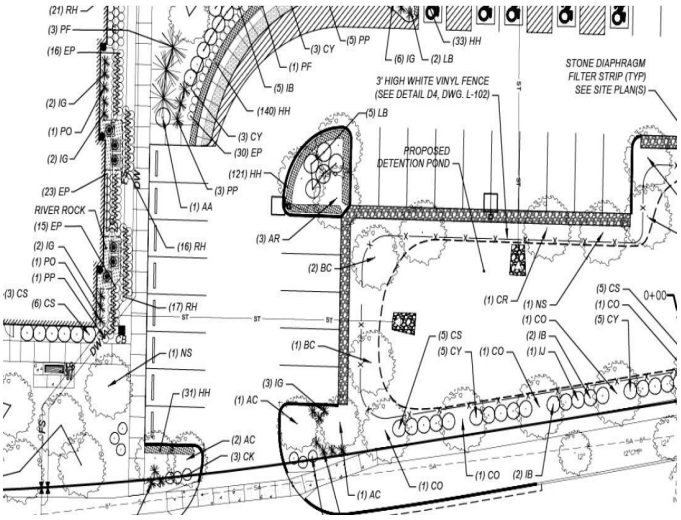
The Town meets the requirements for Tree City USA Status by upholding the following:

- Maintaining a Division of Forestry responsible for the care and maintenance of Town trees. The Division of Forestry includes a Town Forester (a representative from the Highway Department) and a Landscape Architect.

- There are Certified Arborists on staff and they, along with the members of the Division of Forestry, attend required training sessions sponsored by the New York State Department of Environmental Conservation (NYSDEC) and other forestry related organizations on an annual basis. The amendment to the Town tree law in March 2020 furthered this initiative with establishing a Tree Board.
- Maintaining tree care provisions in the Town Chapter 179 Trees and Chapter 203 Zoning administered by the Division of Forestry and enforced by the Commissioner of Building.
- Maintaining a Community Forestry Program with an annual budget of at least $2 per capita. The Town typically exceeds this requirement every year. Since 2016, the Town has planted on average 250–400 trees annually and spends well over the annual budget of $2 per capita (resident) requirement. Annually, the Town typically spends more than approximately $800,000 on tree planting and forestry related expenses.
- The Town Board provides an Arbor Day Proclamation and an Arbor Day celebration takes place in the Town annually. The Arbor Day celebration typically involves Town staff and volunteers planting a variety of tree species at various public or community spaces in the Town of Amherst. The planting sites are typically Town parks and the preferred planting type is small seedlings or container trees.

TOWN TREE LAW AND ZONING ORDINANCE

The Town adopted its own tree ordinance (Chapter 179 Trees) in 1992, with the most recent amendment occurring in March 2020. The law includes provisions for a local Tree Board, the Division of Forestry, tree care and preservation, tree removal, reforestation, diseases and pests, and enforcement with restrictions and penalties. This law states that "the Town of Amherst finds that there is an important relationship between the existence of trees in the Town and the health, safety, and welfare of the community", and that the Town should try to achieve this by "requiring the preservation and protection of trees on public and private property within the Town."



Typical Site Plan Application

The Town has specific tree and shrub requirements within Zoning Chapter 203 Sections 7-2-3, 7-2-4 and 7-2-7 for site plan applicants. A member of the Division of Forestry reviews all major and minor site plan submittals, re-zonings, subdivision plans/plats, and proposed solar and telecommunication infrastructure projects to ensure these requirements are met. The site plan vegetation requirements includes specific quantities and dimensions in parking lots, along property lines, and adjacent to the building. Trees are to be located in all landscape islands and at the end of all parking aisles which allows an increase in shade and reduction of the heat island effect. Vegetation buffers with large deciduous and coniferous plants are required between various land uses; the type and magnitude of these buffers depends on the type of land uses. During a final certificate of occupancy (issued by the Building Department), the Division of Forestry completes a final inspection to determine if the applicant/owner has met the approved site plan and necessary zoning requirements.

TREE BOARD

The amendment to the Town law in March 2020 established a Tree Board. This board would guide the annual implementation of tree planting and operations, while understanding the long-term planning effort. The Tree Board is separate from the Town staff, but the two members of the Division of Forestry are resource members on the board.

Town staff will provide technical information and guidance. The following are items the Town Tree Board would be responsible for/support under the Division of Forestry and the Highway Department:

- Review, develop, and administer a written Community Tree Management Plan and assist with the five-year updates.
- Create a work plan for the care, preservation, pruning, planting, replanting, removal, or disposition of trees in parks, along streets, and in other public areas. This plan will be presented annually to the Town Board at the second meeting of each year.
- Update and publish a schedule of cost for trees to be planted on an annual basis. When requested by the Town Board, consider, investigate, advise, report, and make recommendations on any special matter of question coming within the scope of its work.
- Prepare planting plans to address the unique characteristics of various locations through factors such as species diversity, understory plantings, erosion control, and brownfields that can be positively impacted with tree planting to address localized needs.
- Coordinate the Greening Amherst and the "Million Tree" campaign. Strive to raise consciousness of the importance of trees to the Town.

TREE INVENTORY

Typical Town Street Tree Planting

The Town of Amherst started a Town-wide tree inventory through a NYS DEC grant opportunity in 2020. The Urban Community Forestry Grant Program provides funding for municipalities to have trees on Town rights-of-way and property inventoried and assessed by a certified ISA Certified Arborist. The NYS DEC grant allowed the Town to inventory neighborhoods south of Sheridan Drive (NYS Route 324). Currently, the Town Highway Department staff are updating and adding tree locations based on work orders and daily operations. The Town's goal is to have all trees inventoried in Town road rights-of-way and at Town facilities. The intent of the inventory is to help the Town understand its urban forest composition and tree maintenance needs for both short- and long-term planning efforts. The database produced by the inventory will include pertinent tree characteristics. This information includes the minimum diameter breast height (DBH), street address, risk assessment, parking, utility lines, and growth space. The tree inventory on TreeKeeper® software can be found on the Town website.

TOWN APPROVED TREE LIST

The Town maintains an approved tree list. This list is updated when a new street tree planting contract is being prepared for bid. The Town removes species with potential problems or to add more variety to the tree canopy. The trees are broken down into different categories based on the type of planting. The large deciduous trees are used when there are limited constraints. The smaller trees are placed in areas near overhead utility lines and adjacent to buildings when there is a lack of space.

Each year a different species of tree could generate problems or difficulties due to unforeseen circumstances. Like many municipalities in the Midwest and Northeast, there have been a considerable amount of ash trees needed to be removed as a result of the emerald ash borer ("EAB"). In certain locations, these trees present an immediate threat to a residential area or road Right-of-Way. The cost to remove these trees is considerable and identifying the priority tree removal sites can be difficult. The dying trees not only present a safety issue, but these areas need an implementation plan to keep the invasive species from flourishing in the recently cleared sites. In 2020, the Town lost dozens of linden trees during wind storms. The shallow roots of the linden did not secure the trees within the planting space between the sidewalk and the curb.

WORK PLAN AND TREE PLANTINGS

The operation and maintenance activities are implemented by the Highway Department Parks Division. The Town forestry operations require various equipment and other resources. The Town employs the necessary tree trucks, small hand tools and other sharp tools for pruning, pesticides, injection equipment, and equipment to manage storm damage. In a typical year, the Highway Department replaces approximately plants 80–100 trees, prunes 3,500 trees, and removes dead trees as needed from the Town road Right-of-Way. The following operations take place on Town property and in the local road Right-of-Way:

Removal of Large Tracts of Dead Ash Trees **(Fraxinus pennsylvanica)**

- Tree Planting
- Tree Pruning and Trimming Tree Removal
- Stump and Root Grinding
- Tree Treatment and Spraying Tree Inspections
- Re-staking and Removing Stakes from Newly Planted Trees
- Wrapping Tree Trunks
- Landscape Restoration
- Maintaining the Tree Canopy from Storm Damage
- Office Administration and Updating the Tree Inventory Database with TreeKeeper® software

Street Trees

Amherst plants in two separate seasons; spring and fall. New street trees are planted to replace trees that were removed/considered to be a threat to public health and safety due to disease, insect damage, or storm damage/structural problems. A portion of the street streets are funded with escrow fees paid when building permits are issued for new developments. One tree is required for every 40 linear feet of a new development adjacent to the Right-of-Way. All trees are 1¾-inch to 2-inch caliper minimum (8-foot-high minimum) balled and burlapped. In the summer months, the Town waters the trees planted in the Right-of-Way once a week for two years. To date, this practice has saved 20% of newly planted trees from dying within the first two years.

Pruning

The Town uses ANSI A-300 Standards for pruning techniques. After trees are planted, they are inspected by the Highway Department. The trees are pruned to remove any damage done by contractor planting to prevent issues with the trees in the future. The trees are then put on a list for ten-year trimming maintenance. This practice trains the tree for its life in the urban landscape. Trees are evaluated after planting and in following years to determine the best age to prune until maturity. The trees are then put on the 20-year pruning list. When streets are paved, the Highway Department trims only necessary limbs and branches, making sure the trees are not stressed and to keep heavy equipment from hurting or killing the trees. These trees are trimmed 14' in vertical height above road and 8' above sidewalk. The Town offers tree trimming to residents with low or dead branches when they call and request trimming.

TREE MAINTENANCE GUIDELINES

The following tree maintenance activities are based on the guidelines for *ANSI A300 – Standard Practices for Tree, Shrub and other Woody Plant Maintenance*, or most current editions. The Town uses these practices for tree care and maintenance and encourages these practices for local property owners.

Pruning

- Do not shear shrubs with electric trimmers. Use hand tools only to prune dead or damaged plant material. Allow the shrubs to grow in their natural form for the first 3 years. This allows the shrub to be used as intended for screening purposes as per the Zoning Ordinance Chapter 203.
- Consult a certified arborist for any tree related problems, diseases, or damages/injuries.
- Use sharp hand handle tools or loppers to prune trees. Only prune dead or damaged plant material during the growing season. Only prune trees during the winter or dormant months.
- Prune the flowers of flowering trees and shrubs immediately after the bloom.
- Prune any low, hanging branches or vines from existing trees and shrubs that overhang walks, streets and drives, or parking areas as follows:

  <u>Limb-up Trees</u>

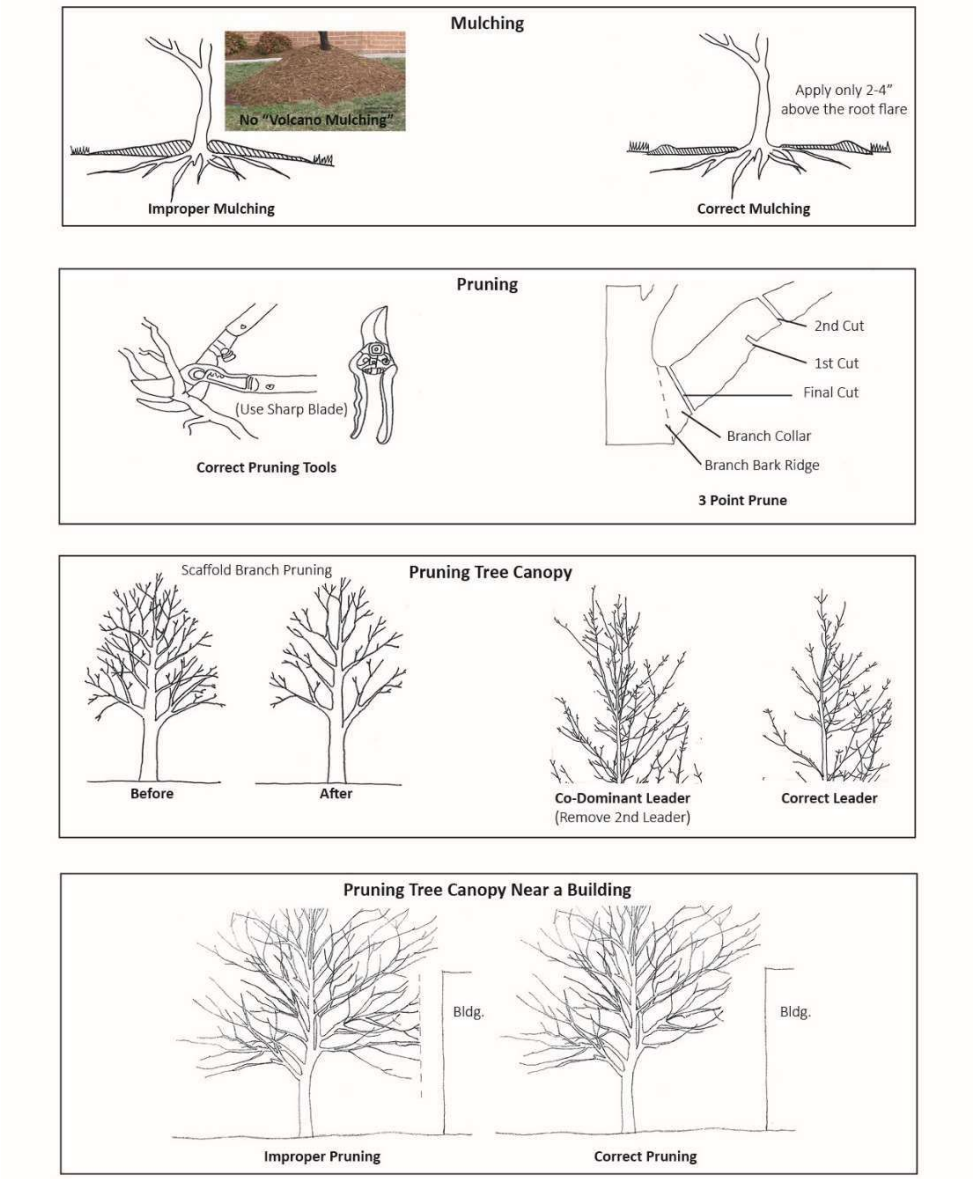
  - Walks - within 8' vertically of the proposed walk elevation.
  - Parking areas - within 12' vertically of the proposed parking surface elevation.
  - Streets and drives - within 14' vertically of the proposed driving surface elevation.

Watering

- Properly water the plants, especially for the first 3 years after planting. Water once a week (10 gallons per tree at 3" caliper or less) for the first 3 years after planting. Less water is needed for shrubs and more water is needed for any larger transplanted trees.
- If rainfall is inadequate, the soil around the tree roots must be deeply watered every 10 to 14 days.

Mulch/Lawn Mowing

- Apply only 2 to 4" of mulch above the root flare per tree. Do not mound or over mulch the tree pit "volcano mulching".
- Do not damage the stem of the tree with weed whackers or lawn mowers.
- Lawn height should be between 2" to 4" depending on the season and current conditions. Do not remove more than 1/3 of the grass blade during any one cutting.
- Do not mow when ground is oversaturated.
- Apply seed to bare spots or sparsely covered locations.
- Clean up all grass clippings, leaves, and other debris from sidewalks, walkways, and parking lots.



Plant Maintenance Guidelines

NATIONAL GRID GUIDELINES AND RECOMMENDATIONS

National Grid provides guidelines for proper tree planting for both municipalities and residents. The following graphic depicts the clearance needed for a standard distribution pole on a Town road Right-of-Way. In October 2006, the Town was surprised by the October Storm. Ice and snow load damaged large deciduous trees creating a local emergency. Power was down in certain neighborhoods and access to and from Town roads was challenging. The proper placement of trees and selecting the right type of tree species will help to minimize the extent of these events.

National Grid Brochure Excerpt

"GREENING AMHERST" AND "MILLION TREE" INITIATIVE

The "Greening Amherst" supports preserving and enhancing the environmental resources and community character. This idea would involve the entire community in a tree planting and re-vegetation program. The "Million Tree" initiative is part of this overall effort and will not be limited to Town owned properties and parks. The program transforms into a collaborative effort on behalf of residents, businesses, developers, volunteer groups, and other groups, to re-green and reforest the largest Town in the State of New York. This initiative provides ample opportunity for each resident, business owner, developer, or community member to participate in tree planting. Community groups and residents can register or log their tree on the Town website to participate in the effort. On commercial property, the Town will encourage tree plantings and community planting events. The Town will work with Village, State, and County partners to coordinate tree planting events and secure additional funding for plantings. The Town will seek grant funding to increase the municipality overall tree planting effort. Private partnerships may also help fund the overall scope of the program, in addition to helping to maintain the trees planted. A majority of the trees planted will be smaller nursery stock and/or sapling trees.

COMMUNITY CHARACTER AND TREES

The Town Comprehensive Plan, as well as the recent input gathered in ten 2018 Neighborhood Meetings, acknowledges the importance of retaining the existing neighborhood character. This community character varies throughout this 53.6-square-mile Town. There is a mix of urban, rural, suburban, civic, office, industrial, recreation, open space, and agricultural land uses. Each one of these places is different and has individual aesthetic qualities. Overall, the tree canopy is part of this community character and quality of life in each neighborhood. The following images represent the variety of trees used in the Town's environment.

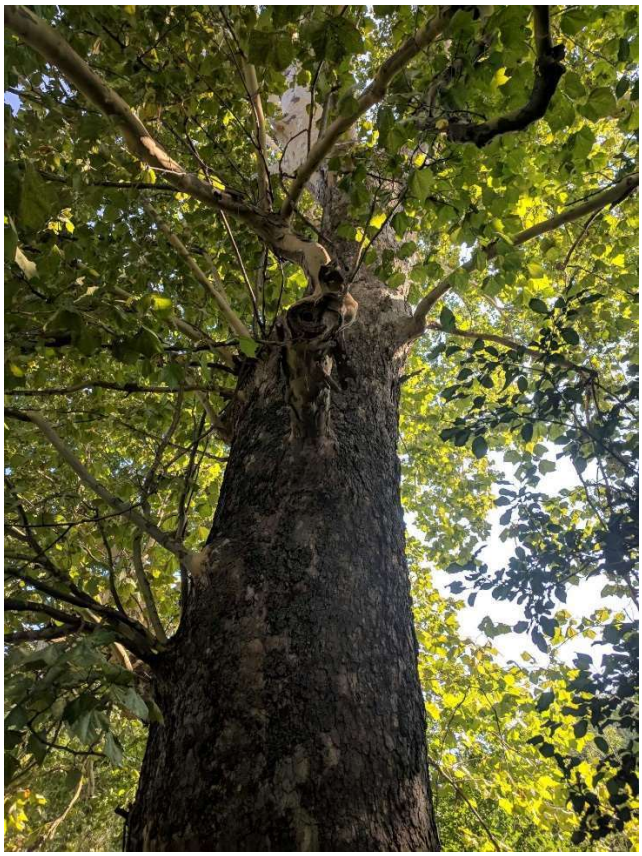
Typical Town Street Tree Planting

Town Street Tree Planting in the Winter Time

Town Park Planting

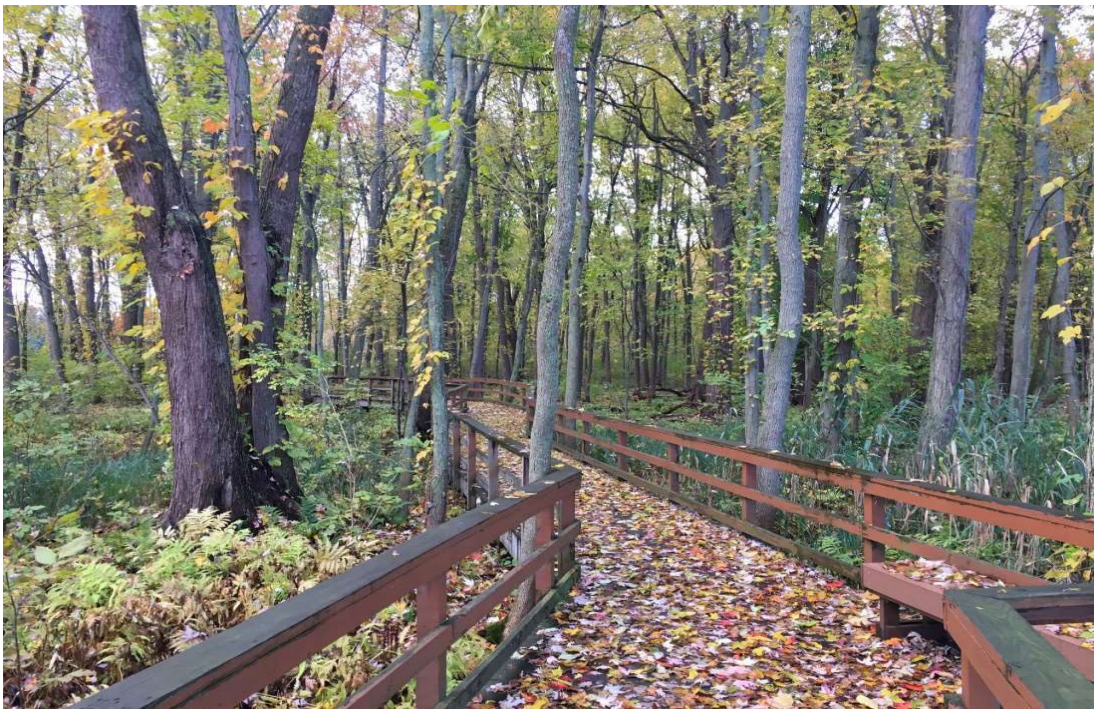
State Park Planting

Forested Area Within the Town



Large Mature Specimen Tree Near Ellicott Creek

Wetland Restoration Planting Along Town Road Right-of-Way



NYS DEC Conservation Land within the Town

Office/Business Park Planting

Residential Wooded Area near Ellicott Creek

Community Facility and Tree Planting

Typical Commercial Tree Plantings in Parking Lots

TOWN OF AMHERST COMMUNITY TREE MANAGEMENT PLAN GOALS

- **Goal 1:** Improve and enhance the Town of Amherst's existing tree canopy.
  - *Action:* The Town's local laws, zoning, and forestry plan should be reviewed every 5 years. The Tree Board will provide recommendations on a 5-year cycle to update the Community Forestry Management Plan.
  - *Action:* Increase species diversity by annually reviewing the tree bid list and revising the list as needed based on Tree Board recommendations.
- **Goal 2:** Implement the Town Comprehensive Plan's "Greening Amherst" initiative. "Greening Amherst" is designed to involve the entire community in a tree planting and re-vegetation program in support of the Aesthetic/Community Character Key Initiative.
  - *Action:* Implement and coordinate the Town's "Million Tree" effort with the Town departments and other involved groups and agencies. This initiative will encompass both public and private properties encouraging residents and business owners to plant trees.
- **Goal 3:** Map and inventory the Town's trees on a singular database that can be accessed by both the public and Town offices.
  - *Action:* Apply for NYS DEC funding to continue the tree inventory north of Sheridan Drive (Route 324) and complete the database for the entire Town.
  - *Action:* The Highway Department should continually update the database based on their weekly work orders in the local Town road Rights-of-Way.

- **Goal 4:** Prioritize the Town budget and operations, while preparing for the future/long range planning
    - *Action:* The Town should collect geo spatial data in areas of concern and map the most vulnerable locations.
    - *Action:* The Town should increase its annual tree budget to continue to remove dead ash trees in danger of falling on adjacent residences/buildings, roads, utility poles, trails, or other recreational areas.
    - *Action:* Identify and prioritize areas that need tree restoration plantings (areas with emerald ash borer and invasive species)
- **Goal 5:** Prepare a storm response plan/system for local needs.
    - *Action:* The Town will work with Emergency Management Services to prepare a storm response plan.
    - *Action:* Determine the best course of action based on the past experiences with the October 2006 surprise storm and the emerald ash borer infestation.
- **Goal 6:** Promote urban forestry awareness with media and other public outreach efforts.
    - *Action:* The Town should host annual tree planting events with community groups to advertise the awareness and value of trees in Amherst.
    - *Action:* The Town should have regular website updates on the community events related to forestry and Town's long-range tree canopy plans.
    - *Action:* Promote National Trends related to Urban Tree Matters – reduce pollution, improve the air quality, quality of life, reduce the urban heat island, educate the public on the social and environmental benefits of trees, proper tree industry standards.
- **Goal 7:** Follow the current industry standards for all Town tree operations and local agency review processes.
    - *Action:* The Division of Forestry and Certified Arborist should continue to participate in forestry training sessions and seminars on an annual basis.
    - *Action:* The Highway Department follows the tree maintenance guidelines in the Community Tree Management Plan.

CONCLUSION

Starting more than three decades ago, the Town established tree planting practices and standards. The current tree work and operations are consistent with Policies 4–10 and 4–11 of the Town's Comprehensive Plan. The Town has taken the necessary measures to continue these community forestry efforts with amendments to local laws and zoning, and creating a Tree Board injunction with a long-range forestry plan. The goals in this plan increase community and interagency involvement. As a result, the Town is poised to continue and enhance Amherst's vision for a healthy urban tree canopy for future years and generations. This effort adds to the Town's community character and quality of life.

REFERENCES

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PUBLIC TREE RESOURCE ANALYSIS AND MAINTENANCE SCHEDULE EXECUTIVE SUMMARY

The Town of Amherst's *Public Tree Resource Analysis and Maintenance Schedule*, written by Davey Resource Group, Inc. "DRG", focuses on analyzing the inventory data, quantifying the benefits provided by the inventoried tree resource, and addressing its maintenance needs.

KEY FINDINGS

- A total of 56,636 trees, 488 stumps, and 2,058 vacant planting sites were inventoried along streets and in public parks in the urban area of Amherst between 2020 and 2023.
- Norway maple are overrepresented in the species breakdown for Amherst. Norway maple make up 30% of the inventoried street trees but only 6% of the inventoried park trees. Maple, in general, are also overabundant, comprising 49% of the street tree population. Maple, particularly Norway maple, should be planted sparingly or not at all until the urban forest is more diverse.
- Amherst's urban forest is particularly susceptible to eastern tent caterpillar, Asian longhorned beetle, and spotted lanternfly. The Town should educate the public on these pests and monitor susceptible tree populations to identify infestations early when management is feasible.
- The overall condition of the inventoried tree resource is Fair to Good. Tree condition can be improved over time by implementing proactive maintenance practices, such as routine tree pruning cycles.
- Most street and park trees in Amherst are young or established. Both street and park trees will need greater investment in young tree training and establishment.
- The inventoried trees provide $322,483 annually in stormwater reduction, air pollutant removal, and carbon sequestration benefits. This is only a fraction of the benefits provided by a fraction of the total trees in the Town – the total benefits provided by all Town trees are much greater.
- Large-stature, broad-leaf trees provide the greatest benefits to Amherst. Honeylocust are particularly beneficial for Amherst. Planting programs should prioritize installation of large trees.
- To provide priority maintenance and begin routine, proactive maintenance cycles, Amherst should plan to spend $7,629,713 on its tree maintenance program between 2023 and 2028.

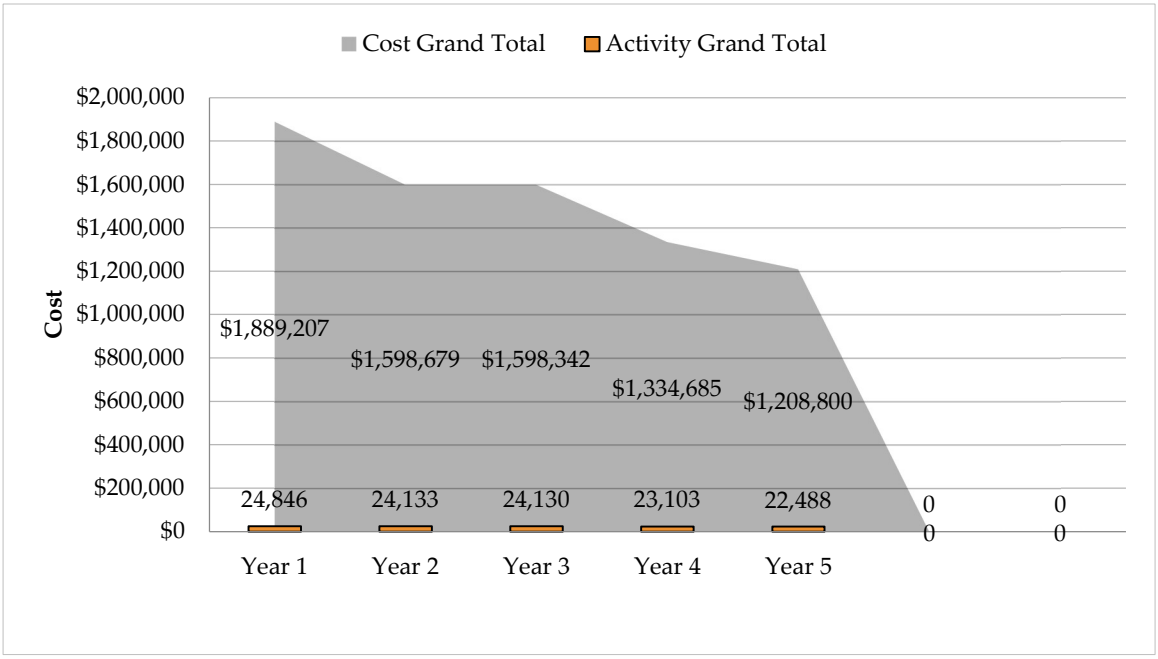


Figure 1. Town of Amherst five-year proposed budget.

Recommended Maintenance Types

Tree Removal

Trees designated for removal have defects that cannot be cost-effectively or practically corrected. Many of the trees in this category have a large percentage of dead crown.

Total = 3,731 trees
Extreme Risk = 0 trees
High Risk = 26 trees
Moderate Risk = 616 trees
Low Risk = 3,086 trees
Stumps = 489

Priority Pruning

Priority pruning removes defects such as dead and dying parts or broken and/or hanging branches. Pruning the defective part(s) can lower risk associated with the tree while promoting healthy growth.

Total = 1,960 trees
Extreme Risk = 0 trees
High Risk = 57 trees
Moderate Risk = 1,903 trees

Routine Pruning Cycle

Over time, routine pruning of Low Risk trees can minimize reactive maintenance, limit instances of elevated risk, and provide the basis for a robust risk management program.

Total = 26,884 trees

Number of trees in cycle each year = approximately 5,377 trees

New Tree Planting

Planting new trees in areas that have poor canopy continuity or sparse canopy is important to ensure that tree benefits are distributed evenly across the Town.

Planting goal: 637 per year plus additional donated trees

Young Tree Training Cycle

Younger trees may have branch structure that can lead to potential problems as the tree ages, requiring training to ensure healthy growth. Training is generally completed from the ground with a pole pruner or pruning shear.

Total = 13,864 trees

Number of trees in cycle each year = approximately 4,621

Routine Tree Inspection & Inventory Updates

Routine inspections and inventory updates are essential to uncovering potential problems with trees and should be performed by a qualified arborist who is trained in the art and science of planting, caring for, and maintaining individual trees.

Total = 52,905 trees not recommended for removal

Number of trees in cycle each year = approximately 10,581

INTRODUCTION

The Town of Amherst is home to around 130,000 residents[1] benefitting from public trees in their community. The Town's Highway Department manages all trees, stumps, and planting sites along the street rights-of-way (ROW) and throughout public parks.

Urban forestry program budgets are funded by the Town's General Fund. The Town of Amherst has a tree ordinance, an Urban Tree Committee, celebrates Arbor Day, and has been a Tree City USA community for 26 years. Past urban forestry projects include annual Arbor Day festivals with tree plantings.

This Community Forestry Management Plan is designed to help the Town achieve these goals, understand the current state of its public tree resource, set future goals and benchmarks, anticipate future program needs, and shift from reactive to proactive maintenance. The sections of this plan are as follows:

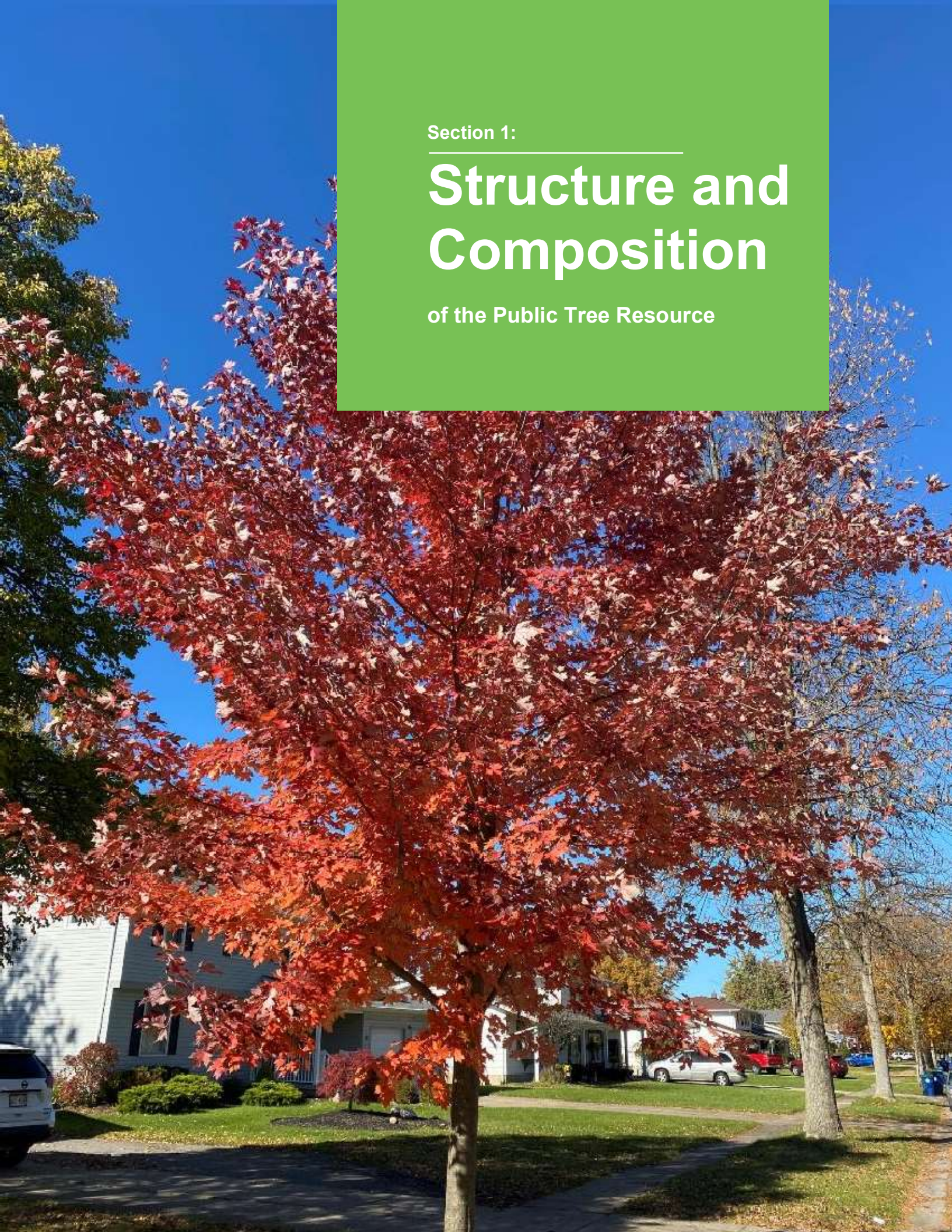
- *Section 1: Structure and Composition of the Public Tree Resource* summarizes the inventory data with trends representing the current state of the tree resource.
- *Section 2: Functions and Benefits of the Public Tree Resource* summarizes the estimated value of benefits provided to the community by public trees' various functions.
- *Section 3: Recommended Maintenance of the Public Tree Resource* details a prioritized maintenance schedule and provides an estimated budget for recommended maintenance activities over a five-year period.

[1] U.S. Census Bureau. 2020. Search: Amherst NY. Retrieved from https://www.census.gov/search-results.html?q=amherst+ny&page=1&stateGeo=none&searchtype=web&cssp=SERP&_charset_=UTF-8

Section 1:

Structure and Composition

of the Public Tree Resource



SECTION 1: STRUCTURE AND COMPOSITION OF THE PUBLIC TREE RESOURCE

Between August 2022 and February 2023, DRG arborists collected data on trees, stumps, and planting sites along the street ROW north of Sheridan Drive, and in parks throughout Amherst. This is in addition to sites that DRG collected during the summer of 2020. **59,655 overall sites were inventoried**, with 94.1% collected along the street ROW and 5.9% collected in public parks. Figure 2 breaks down the inventoried sites by type (tree, stump, planting site, or do not replace site) and locations (street ROW versus parks). See Appendix A for details about DRG's methodology for collecting inventory data.

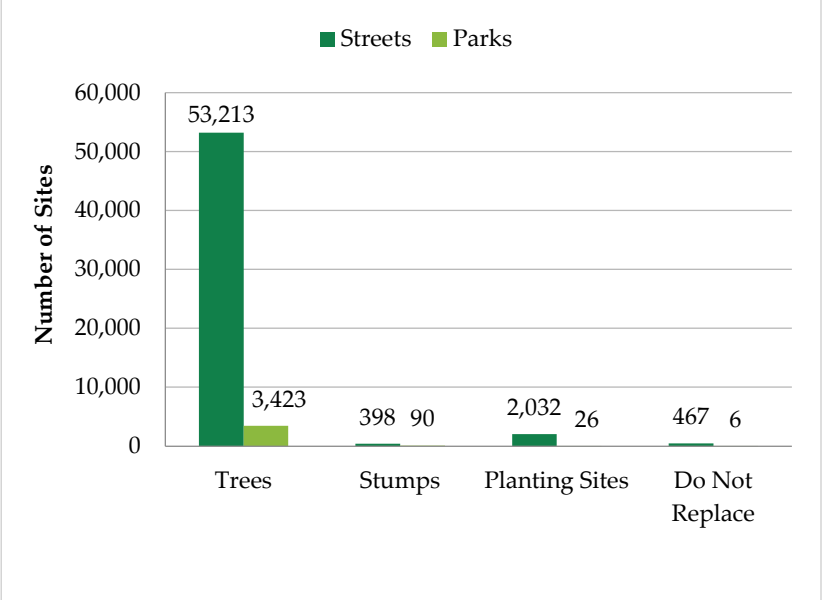


Figure 2. Number of inventoried sites by location and type.

INVENTORIED PARKS & CEMETERIES

Amherst Center for Seniors
Amherst Gateway Park
Amherst Veterans Canal Park
Amherst Veterans Memorial
Audubon Recreation Complex
Bassett Park
Billy Wilson Park
Briarhurst Park
Buffalo Niagara Heritage Village
Campus Drive Recreation Area
Central Amherst Little League Complex
Cindy Drive Play Area
Clearfield Community Center, Park, and Library
Creekwood Park
Dana Heights Play Area
Dellwood Park
ECO Park
Eggertsville Community Park
Ellicott Creek Trailway
Fetto Park
Garnet Park
Getzville Fire Department Baseball Diamond
Glen Park
Harlem Road Community Center
I-990 Trailway
John J Audubon Library
Jurek Post
Kingsgate Park
Lou Gehrig Baseball Complex
Mel Ott Little League
North Amherst Fire Company Baseball Diamond
North Amherst Recreation Center
North Forest Park
North French Soccer Complex
Northtown Center
Paradise Park
Saratoga Park
Sattler Field
Snyder Library
West Royal Parkway Recreation Area
Wehrle FAA Recreation Complex
Willow Ridge Park

HISTORIC EXAMPLES OF THE IMPORTANCE OF DIVERSITY

The Dutch elm disease epidemic of the 1930s provides a key historical lesson on the importance of diversity. The disease killed millions of American elm trees, leaving behind enormous gaps in the urban canopy of many communities. In the aftermath, ash trees became popular replacements and were heavily planted along Town streets. History repeated itself in 2002 with the introduction of the emerald ash borer into United States. This invasive beetle devastated ash tree populations across the country (Karnosky 1979). Other invasive pests and diseases, severe weather events, and climate change threaten our urban forests today, so it's vital that we learn from history and plant a wider variety of tree species and genera to develop a resistant and resilient public tree resource.

Emerald ash borer damage.

Photo courtesy of Eric R. Day, Virginia Polytechnic Institute and State University, Bugwood.org

SPECIES & GENERA DIVERSITY

Diversity within plant communities is important for increasing their resistance and resilience to disturbance. The 10-20-30 rule is a common industry metric for tree species diversity in which a single species should compose no more than 10% of the population, a single genus no more than 20%, and a single family no more than 30%[2].

Resistance: the ability of a plant community to remain essentially unchanged despite disturbance.

Resilience: the ability of a plant community to recover after disturbance.

Disturbance: an event or force that brings about mortality to plants and/or changes their spatial distribution.

Figure 3 shows the species diversity breakdown for Amherst's street trees and includes the six most common species. The 53,433 street trees recorded in this inventory belong to 190 different species. Of these species, **Norway maple are the most common street tree** (30%). The second most common street tree is green ash (12%), followed by silver maple (9%), littleleaf linden (8%), honey locust (7%), and Callery pear (5%).

Green ash are the most common park tree, making up 14% of the park tree population. Figure 4 shows the species diversity breakdown for park trees and includes the six most common species. Other common species found in Amherst's parks included red maple (7%), Austrian pine (6%), Norway maple (6%), red oak (5%), and Callery pear (5%). **There are 102 different species in Amherst's parks.**

Figure 5 shows the genera diversity breakdown for Amherst's street trees and includes the five most common genera. Following the distribution of species, **the maple genus makes up nearly half** (49%) of the street tree population, followed by ash (13%), linden (8%), locust (7%), and pear (5%). **The Town's street trees represent 60 distinct genera.**

[2] Santamour, F.S. 1990. Trees for Urban Planting: Diversity Uniformity, and Common Sense. U.S. National Arboretum: Agricultural Research Service. Retrieved from https://pdfs.semanticscholar.org/.

Maple is also the most common genus among park trees (22%). Figure 6 shows the genus diversity breakdown for park trees and includes the five most common genera. Ash (14%), pine (10%), oak (9%), and apple (6%) were other common park tree genera. **47 distinct genera** are represented by Amherst's park tree population.

Nearly half (49%) of street trees belong in the Sapindaceae, or soapberry, family. This family includes genera such as maple and horse chestnut. Figure 7 shows the family diversity breakdown of street trees and includes the five most common families. The Oleaceae, or olive, family is the second most common family (17%), followed by Malvaceae (8%), Fabaceae (8%), and Rosaceae (7) families. The street tree population represents 34 different families.

The Sapindaceae family also makes up the highest percent of park trees (22%). Figure 8 shows the family diversity breakdown of park trees and includes the five most common families. The next most common family for park trees is Pinaceae (17%), followed by Oleaceae (16%), Rosaceae (14%), and Fagaceae (9%). There are 26 distinct families represented by Amherst's park tree population.

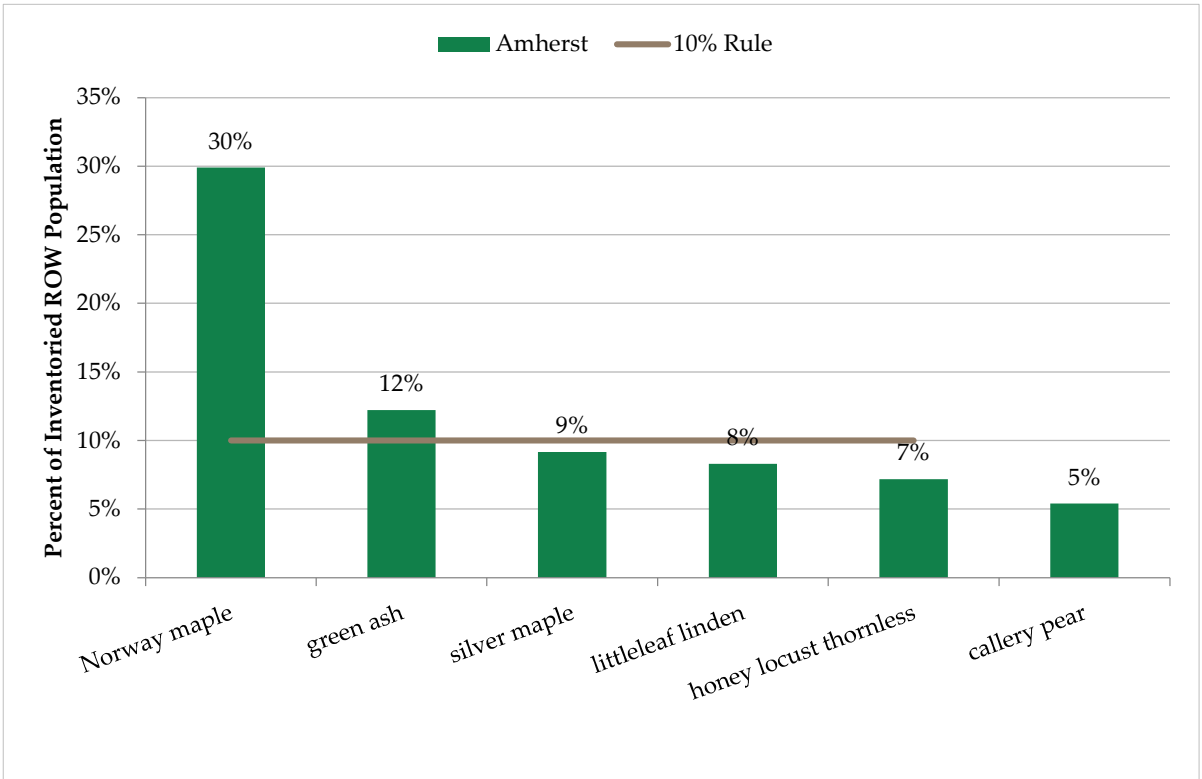


Figure 3. Species distribution of the inventoried Right-of-Way tree population.

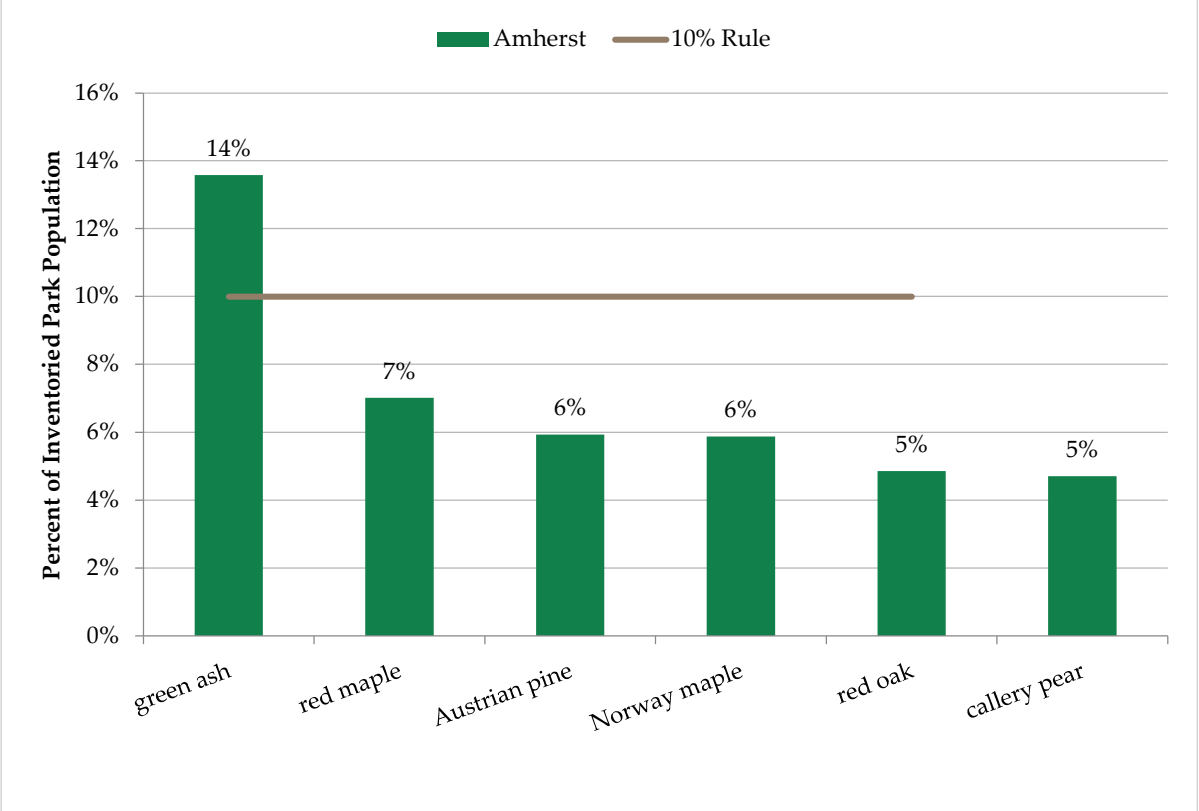


Figure 4. Species distribution of the inventoried park tree population.

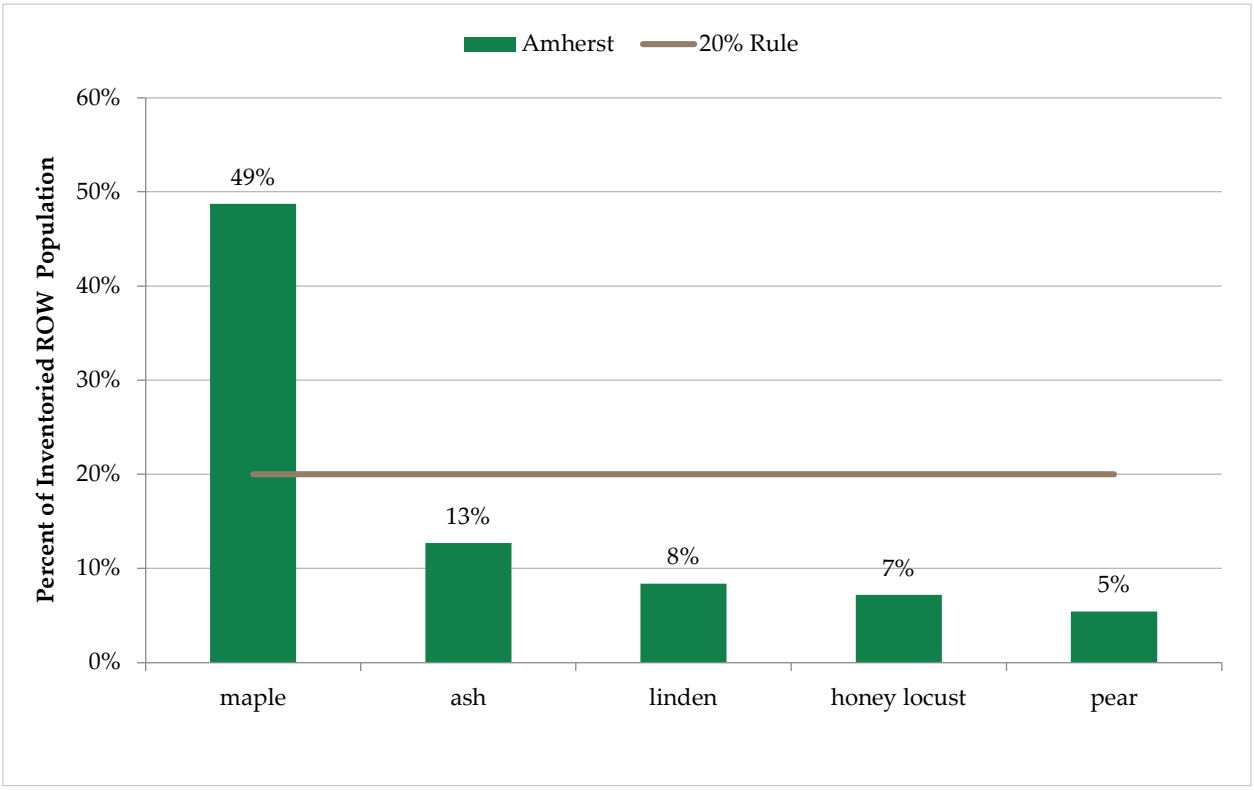


Figure 5. Genus distribution of the inventoried Right-of-Way tree population.

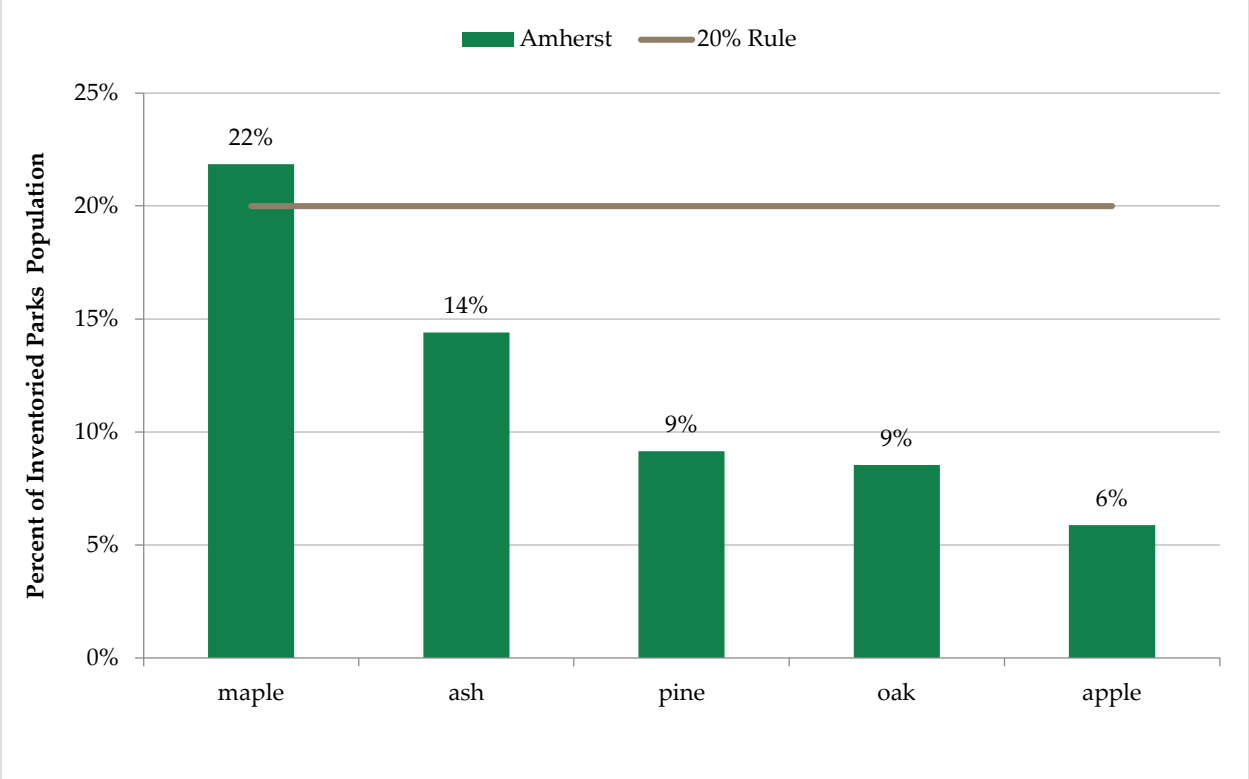


Figure 6. Genus distribution of the inventoried park tree population.

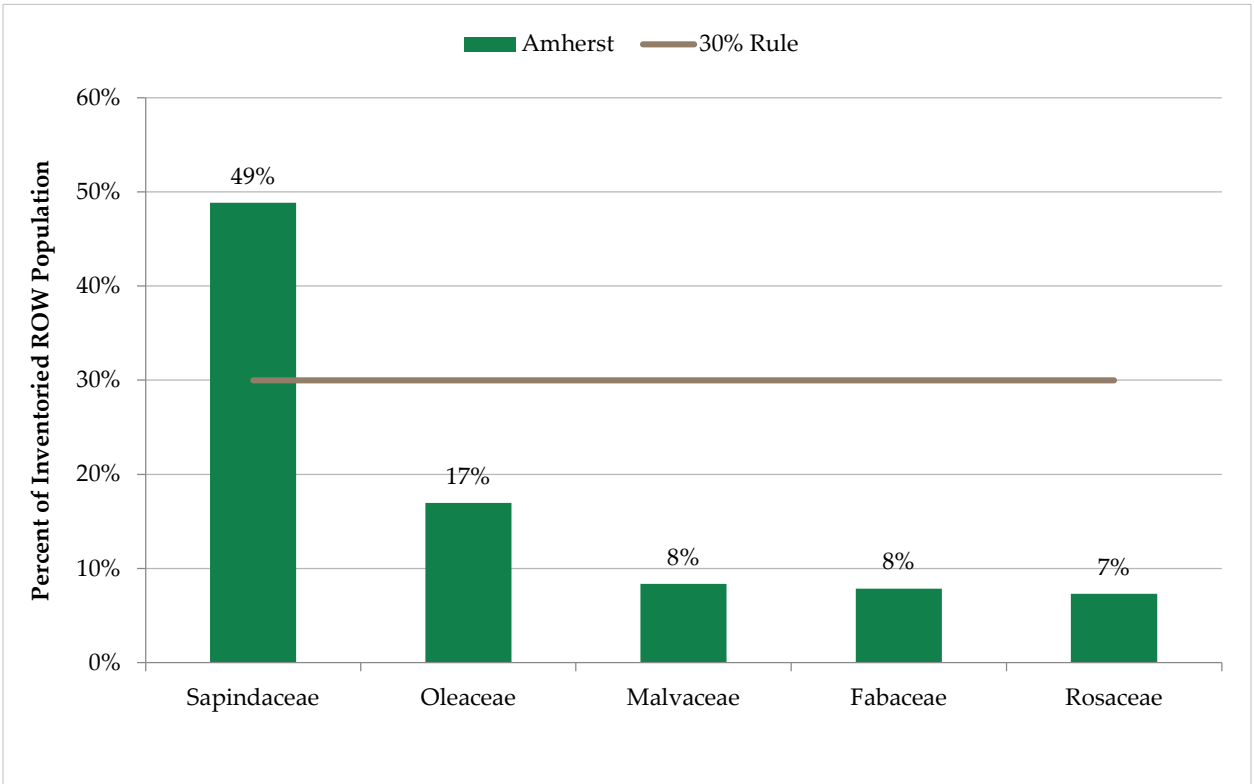


Figure 7. Family distribution of the inventoried Right-of-Way tree population.

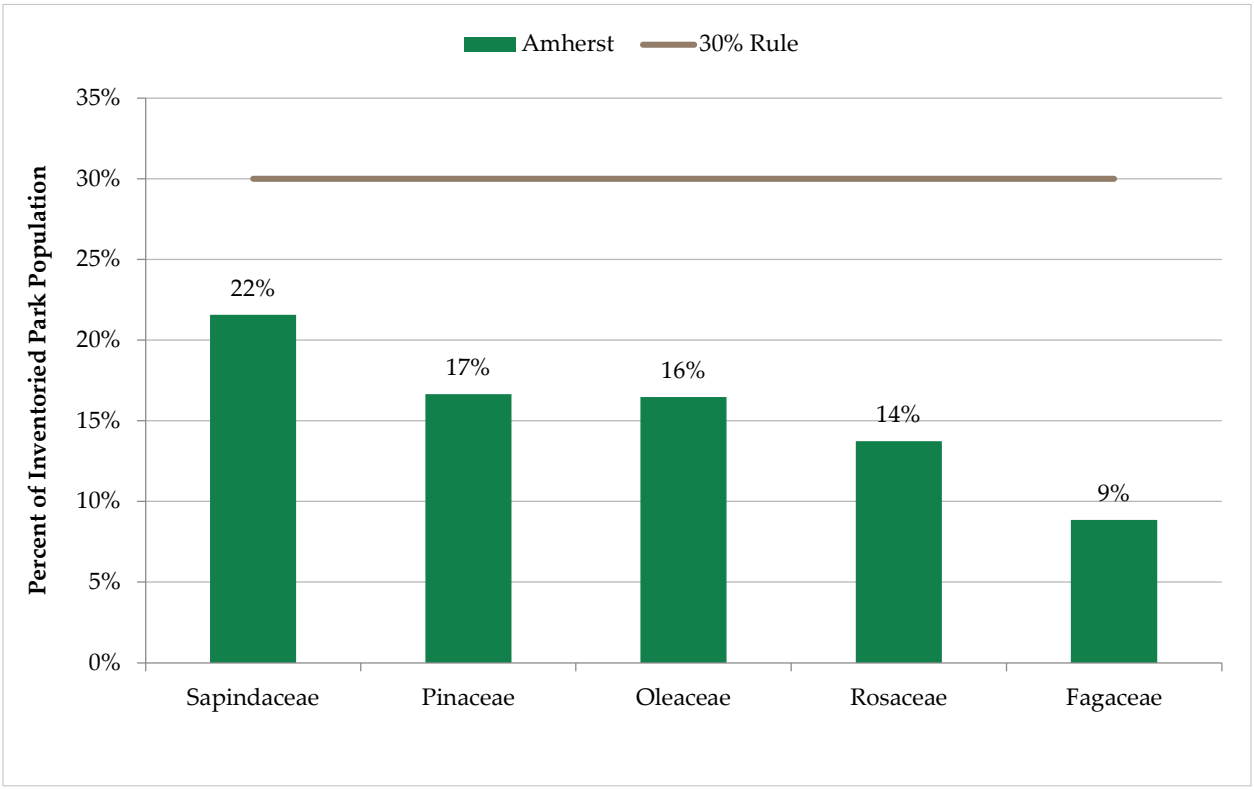


Figure 8. Family distribution of the inventoried park tree population.

Species & Genera Diversity Recommendations

- Avoid or limit planting of maple and increase planting of other genera until maple make up less than 20% of the public tree resource.
- Remove Norway maple volunteers from maintained public areas while small.
- Do not plant green ash due to the presence of emerald ash borer in the Town.
- Increase planting of uncommon species and genera which are well suited to urban environments.

PEST SUSCEPTIBLITY

Early identification of tree pests and diseases can reduce the impact of infestations on the urban forest. Infestations which are caught while still limited to a small number of trees can be more easily and cost-effectively managed and further spread of the pest or disease prevented. Since pests and diseases have preferred host tree species and genera, the susceptibility of an urban forest to a pest or disease can be predicted based on its species and genus diversity. Figure 9 presents the percent of inventoried trees which are susceptible to pests and diseases of concern in Massachusetts. See Appendix B for additional information about these pests and diseases.

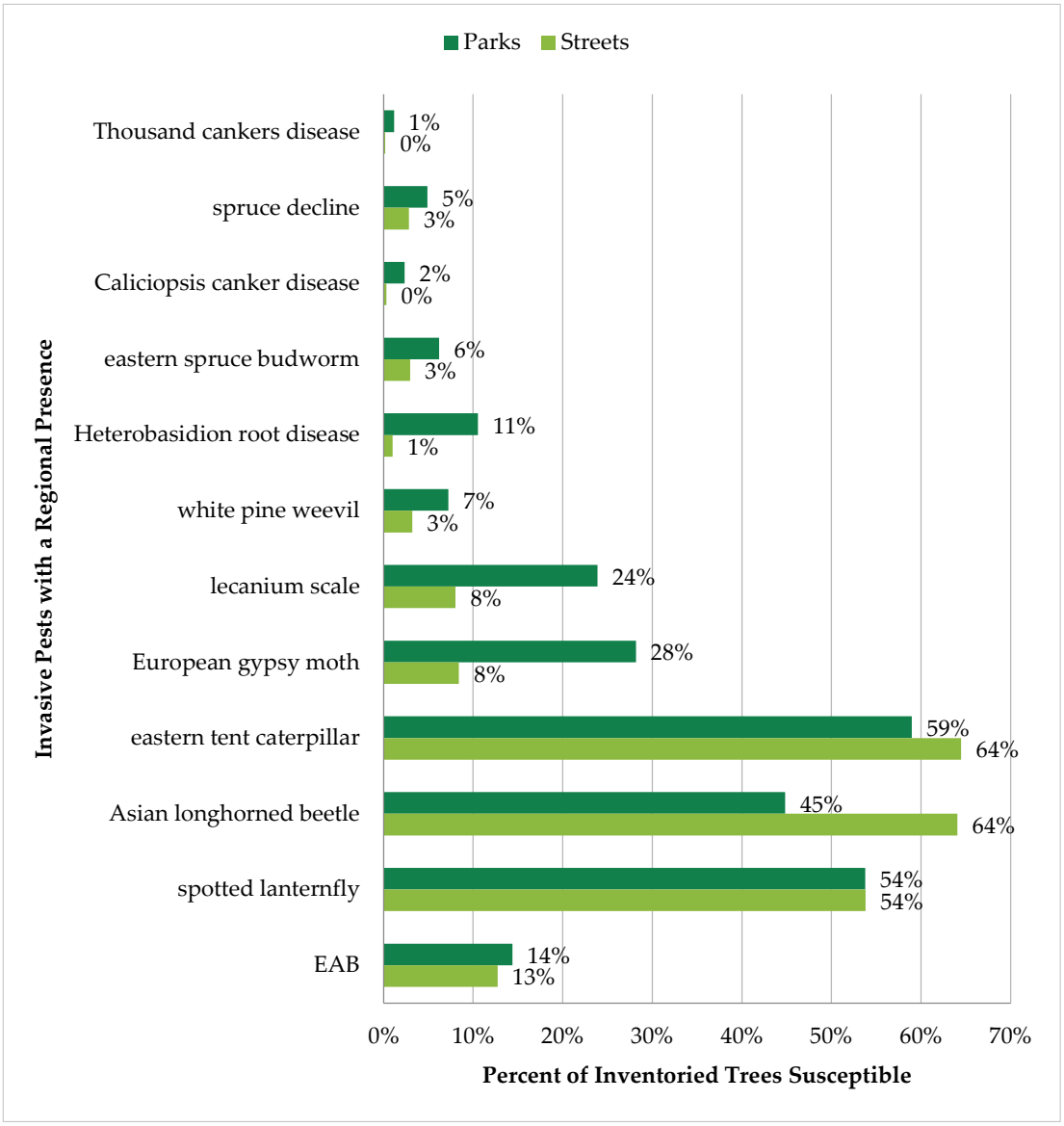


Figure 9. Susceptibility of the tree resource to pests and diseases of concern in Massachusetts.

A majority of Amherst's street trees and park trees are susceptible to eastern tent caterpillar (64% and 59%), Asian longhorned beetle (64%, 45%), and spotted lanternfly (54% for both). Emerald ash borer imposes a significant threat to a majority of the overall tree population (13% of street trees and 14% of park trees). The Town has been proactive in treating the current population to prevent the loss of their population. Treatments need to continue or the trees will become susceptible to the insects in the future. If funding becomes a concern, gradually stopping treating some and replacing them is a viable option.

Pest Susceptibility Recommendations

- Monitor trees for signs and symptoms of pests and diseases on a regular basis. This can be done as part of other routine maintenance activities such as routine pruning.
- When a pest or disease is suspected, act quickly to confirm the identification and begin management.
- Prepare an invasive species management plan to guide the response to future pest or disease infestations.
- Spotted lanternfly can host on many tree genera but prefer tree-of-heaven. Consider removing or otherwise managing tree-of-heaven populations to reduce the suitability of Amherst's urban forest to host spotted lanternfly.
- When planting trees, select pest- or disease-resistant species or cultivars whenever possible.
- Use preventative pesticide treatments on high-value or historic trees to protect individual trees from common pests and diseases.

CONDITION

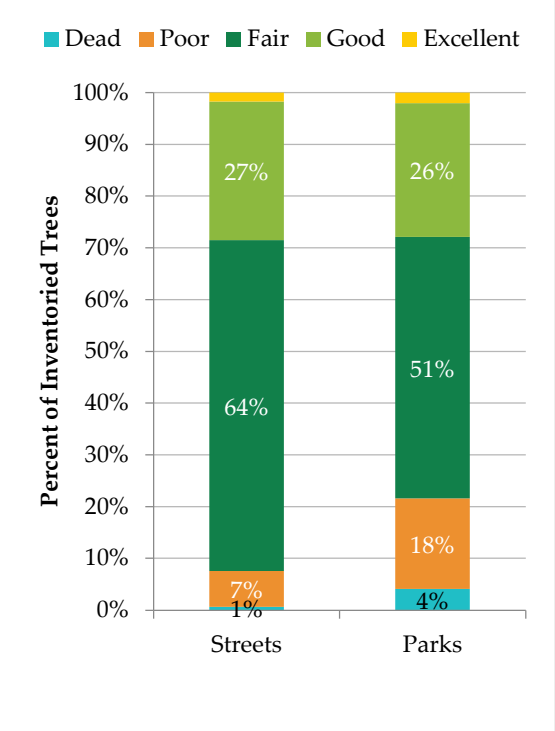


Figure 10. Inventoried tree susceptibility to invasive pests with a regional presence.

During the inventory, each tree was assigned a condition rating based on multiple factors, including root characteristics; branch structure; trunk, canopy, and foliage condition; and the presence of pests or disease. Condition ratings included Excellent, Good, Fair, Poor, and Dead.

Condition Ratings

Excellent: A good tree that shows no problems.

Good: trees in Good condition have no significant issues.

Fair: trees in Fair condition may have some issues which are likely to improve with time or maintenance (e.g., dead branches that can be removed during pruning, minor trunk wounds that the tree can heal over time).

Poor: these trees have more significant issues which are not likely to improve with time or maintenance (e.g., large sections of dead canopy, decay cavities in the stem or roots).

Dead: dead trees show no signs of life.

Figure 10 provides the condition rating breakdown for park and street trees in Amherst. A majority of Amherst's street trees (91%) and park trees (77%) were recorded in Fair or Good condition, and 2% of each population was considered to be in Excellent condition. A small portion (8%) of street trees were recorded as either Dead or in Poor condition, while 22% of park trees were recorded under the same conditions.

Condition Recommendations

- Dead trees should be removed as soon as possible in priority order from higher risk to lower risk to reduce public hazards, free space for new planting, and improve the appearance of Amherst's streets and parks.
- Trees in Poor condition not recommended for removal should be maintained to reduce risk associated with defects and may need continued monitoring for further decline that would necessitate removal.
- Condition ratings can be improved over time by instituting proactive maintenance cycles such as a routine pruning cycle and young tree training cycle. Pruning should follow ANSI A300 (Part 1) guidelines[3].

[3] American National Standards Institute. 2017. ANSI A300 (Part 1): Tree, Shrub, and Other Woody Plant Management—Standard Practices (Pruning). Tree Care Industry Association, Inc.

RELATIVE AGE DISTRIBUTION

Analysis of a tree population's relative age distribution can be performed by assigning age classes to the diameter of inventoried trees. Although actual tree age cannot be determined by diameter alone, this method of approximation is an industry standard technique that can help identify potential challenges and maintenances needs of an urban tree population.

Age/Size Classes

Young: 0–8 inches diameter at breast height (DBH).

Established: 9–17 inches DBH.

Maturing: 18–24 inches DBH.

Mature: 25+ inches DBH.

The size classes (left) were chosen so that the inventoried trees could be compared to the ideal relative age distribution proposed by Richards, which holds that the largest proportion of the inventoried tree population (40%) should be young trees, smaller portions should be established and maturing trees (30% and 20%, respectively), and the smallest proportion (10%) should be mature trees[4].

Figure 11 compares the age distribution of the park and street tree populations to Richards' industry recommendation. **Street trees are mostly trending toward the industry recommended age distribution**, with a surplus of established trees (39%), moderate numbers of young (35%), maturing trees (17%), and mature trees (9%). Parks trees, however, have a surplus of young trees (42% versus the industry standard of 40%) and of established trees (38% versus the industry standard of 30%). There are fewer maturing trees (12%) and mature trees (8%) than what the industry recommends (20% and 10%, respectively) in parks as well.

Figures 12 and 13 compare tree condition ratings across the relative age classes for street and park trees. **Both park and street trees across all age classes are generally in Fair condition**, except for the young age class in parks. Nearly half of these young trees (44%) are in Good condition.

[4] Richards, N.A. 1983. "Diversity and Stability in a Street Tree Population." Urban Ecology 7(2):159–171.

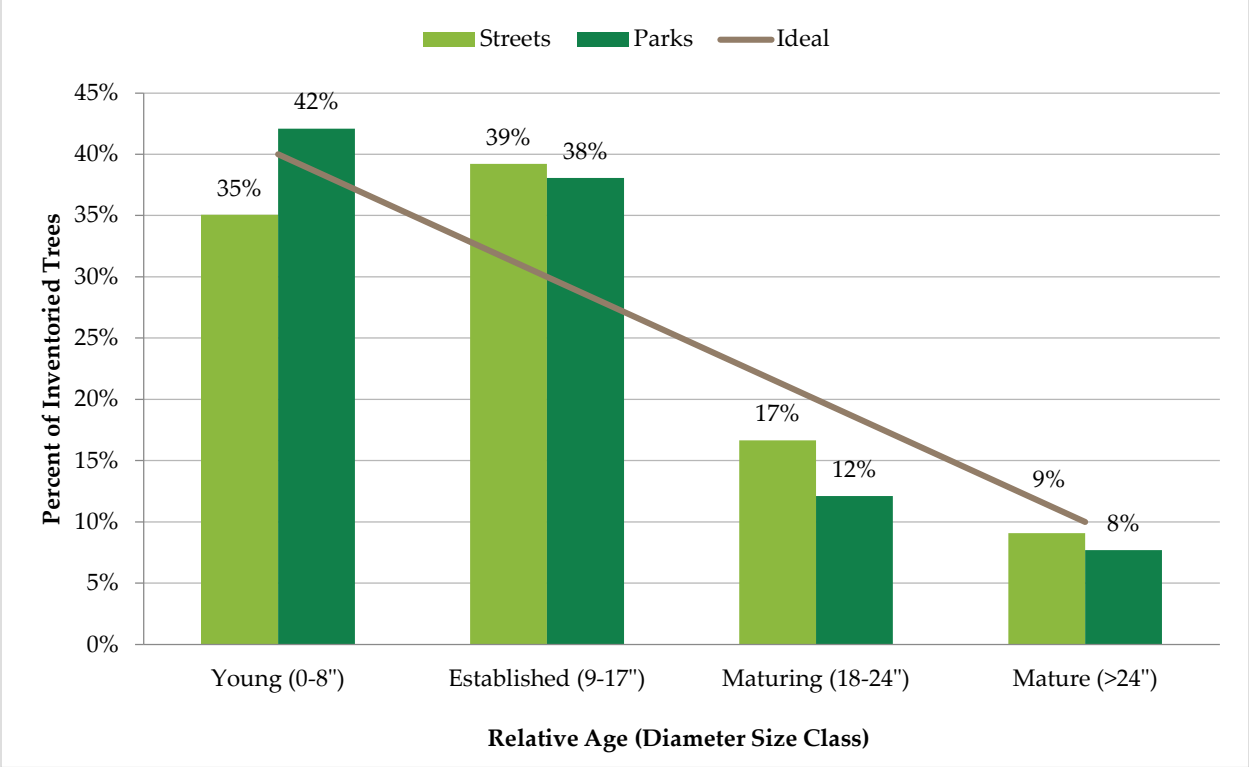


Figure 11. Relative age distribution inventoried street and park tree population compared to the ideal.

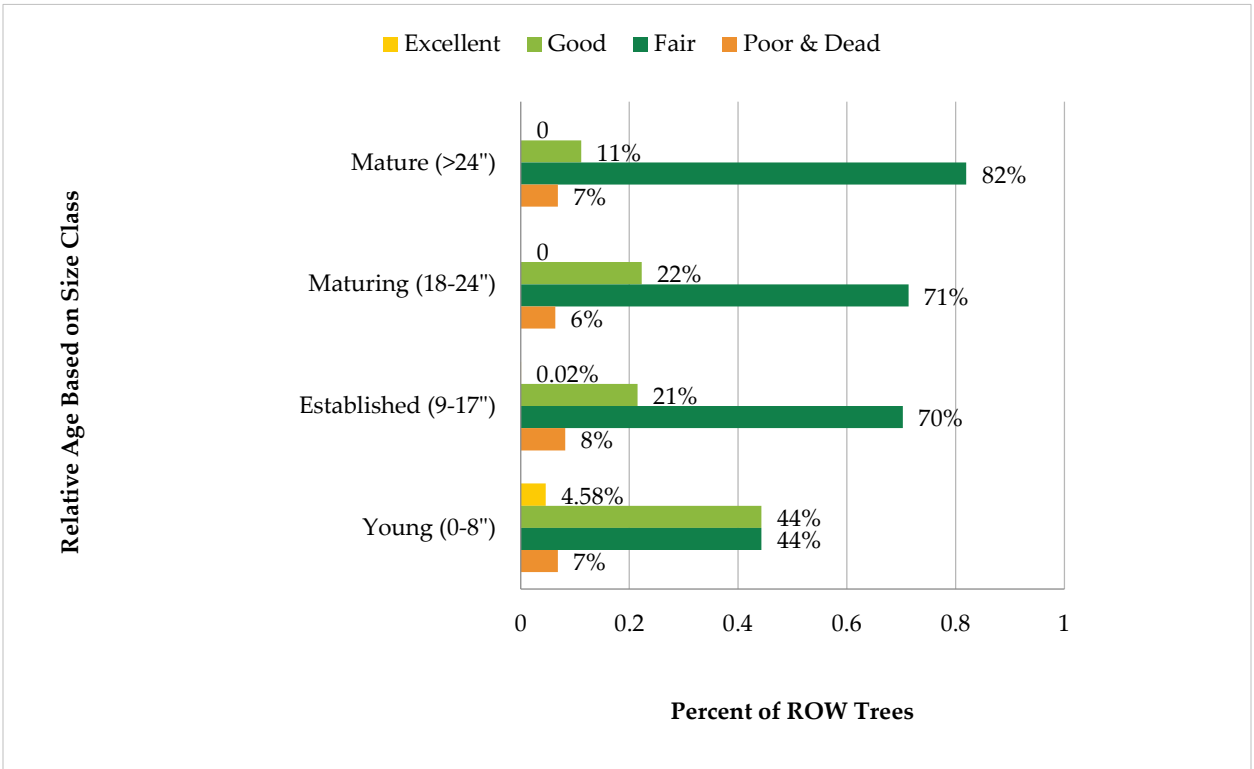


Figure 12. Condition of inventoried Right-of-Way trees by relative age (size class).

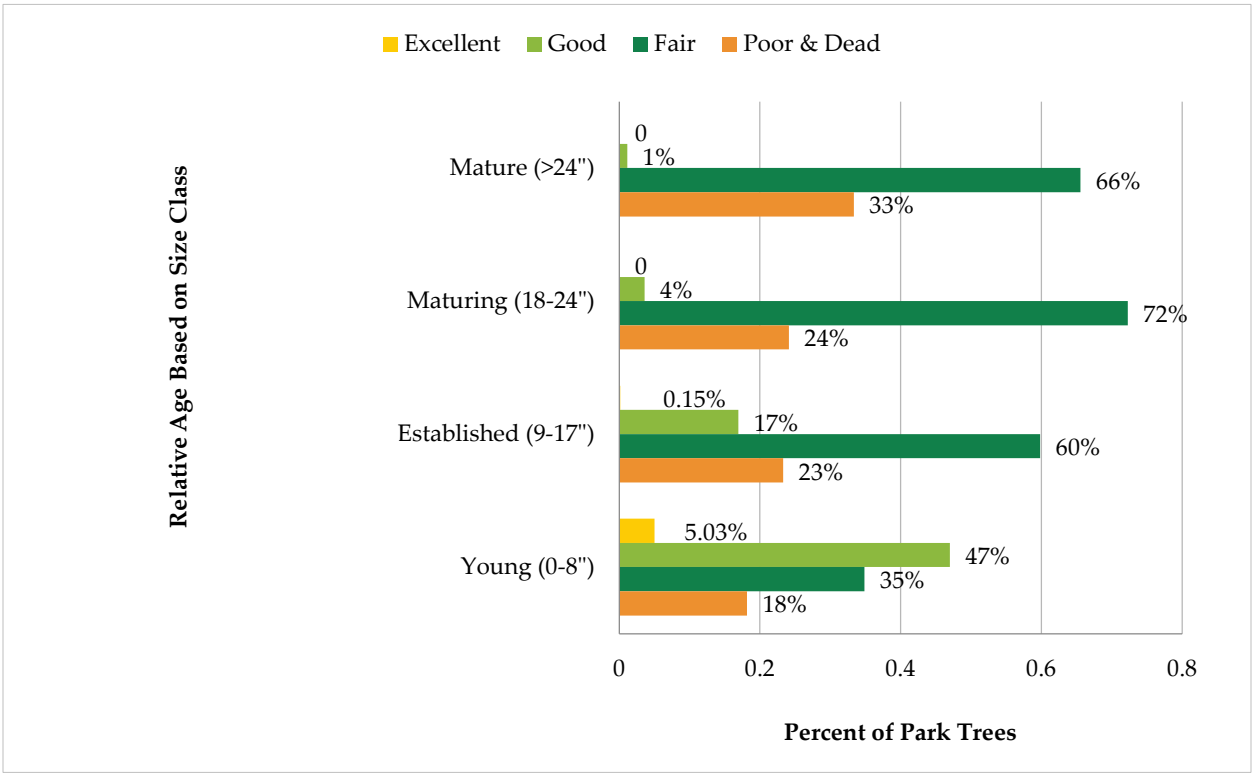


Figure 13. Condition of inventoried park trees by relative age (size class).

Relative Age Recommendations

- Maturing and mature trees are somewhat rare in Amherst's parks (20% of the total park tree population). The Town should focus on tree preservation and proactive care for these large-stature trees, as they provide the greatest benefits to the residents of Amherst.
- 74% of the population of street trees are young or established. A young tree training cycle should be implemented to structurally prune these trees to ensure good form and health as they mature.
- Street tree planting is not yet sufficient to maintain the recommended age distribution. Increased planting of young trees, or trees that mature at smaller DBH size classes, will increase the population of young trees to reach the industry recommendation.
- Routine, proactive maintenance, such as young tree training and routine pruning, may help improve tree condition, particularly among maturing and mature trees, in the future.

DEFECT OBSERVATIONS

During the inventory, DRG arborists took note of any damage, decay, structural flaws, pests/diseases, or dead portions of inventoried trees and recorded these defect observations for each tree. Where a tree had more than one defect, only the most significant defect, i.e., the defect causing the greatest detriment to the tree and/or most likely to cause whole or partial tree failure within a year, was recorded.

Deadwood was the most commonly recorded defect for both street trees (32%) and park trees (44%) (Table 1). Only 5% of street trees and only 6% of park trees had no significant defect at the time of the inventory.

Defect Examples

Deadwood: dead branches above 2 inches DBH or crown.

Cavity or Decay: cavities, decay columns, fungal fruiting bodies, trunk wounds.

None: no significant defect present.

Other: pest or disease problems, foliar disorders, stem girdling, defects not covered by other categories.

Root Problems: dead roots, cut roots, root plate lifting, soil cracking, root damage/decay, girdling roots.

Mechanical Damage: trunk damage from lawnmowers or car accidents.

Codominant Leader: acute branch angles, codominant stems or limbs, multiple branch attachments at same point on stem.

Defect Observation Recommendations

Table 1. Defect observations for street and park trees.

Defect	Street Trees	Percent of Street Trees	Park Trees	Percent of Park Trees
Cavity/Decay	11,906	22%	557	16%
Codominant Leader	8,738	16%	654	19%
Deadwood	16,779	32%	1,509	44%
Fire Hydrant	60	0%	0	0%
Grate/Guard	3	0%	0	0%
Included Bark	6,516	12%	299	9%
Mechanical Damage	2,558	5%	54	2%
Mulched Improperly	131	0%	2	0%
None	2,759	5%	193	6%
Other	2,198	4%	73	2%
Pest Problem	149	0%	44	1%
Planted Improperly	68	0%	0	0%
Poor Location	290	1%	20	1%
Pruned Improperly	315	1%	10	0%
Reinspect	43	0%	0	0%
Root Problem	533	1%	8	0%
Underground Utilities	167	0%	0	0%
Total	53,213	100%	3,423	100%

- Deadwood was the most common defect observation for trees in Amherst. Regular pruning, as done in a routine pruning cycle, could likely improve the health of these trees and reduce risk associated with dying tree parts. Removal of dead limbs also improves the visual impact of trees and may help improve public perceptions of the level of tree care in the Town.
- Cavities and decay were the second most recorded defect for street trees (22%). The severity and location of the cavity and/or decay determines the condition, level of maintenance, and maintenance type. Trees with cavities and/or decay in limbs should be pruned during a routine pruning cycle. Trees that have severe cavities or decay at the base of the tree, or throughout the trunk, should be removed.
- Codominant leaders were the second most common defect within park trees (19%). These types of defects can often be resolved by structural pruning within the first 10 to 20 years of the tree's life. Instituting a young tree training program could reduce instances of these defects over time.

INFRASTRUCTURE CONFLICTS

In an urban setting, growing space for trees is limited both above and below ground, and conflicts between infrastructure, such as buildings, sidewalks, utility wires, and pipes, are common. Trees which cause damage to infrastructure are often considered a nuisance and may even threaten public safety. At the same time, trees which conflict with infrastructure are often damaged or removed during infrastructure repair or upgrades. Reducing conflicts between Town infrastructure and trees benefits the Town, Town residents, public and private utility companies, and trees. During the Amherst inventory, tree conflicts with overhead utilities and hardscape were observed and recorded.

Overhead Utilities

Overhead Utilities: any overhead 3 phase or single phase power lines were recorded if they were conflicting with space a tree crown would potentially occupy.

Not Present: no overhead utilities were present in the space a tree crown would potentially occupy.

Present: overhead utilities were present and were in contact with the tree or were likely to be in contact with the tree within a year.

Hardscape Damage

Hardscape Damage: if a sidewalk is lifted or cracked, and the curb cracked or damaged by a previous or current tree, it was noted.

Yes Crack in Sidewalk: a crack was present in the sidewalk from a previous or current tree.

Yes Sidewalk Lift: if a sidewalk was lifted by a previous or current tree.

Yes Both for Sidewalk: the sidewalk was both lifted and had cracks.

Yes Curb Damage: the curb was damaged due to the presence of a previous or current tree.

No: hardscape damage was not present.

Table 2 shows the number and percentage of street and park trees observed to conflict with overhead utilities or surrounding hardscape; **8% of street trees and 12% of park trees had overhead utilities present**.

42% of street trees were recorded to have caused some form of hardscape damage. The majority of the damage observed by street trees was sidewalk lifting. Only 1% of park trees had caused hardscape damage, which was lifting the sidewalk.

Table 2. Infrastructure conflicts recorded during the inventory.

Conflict	Street Trees	Percent of Street Trees	Park Trees	Percent of Park Trees
Overhead Utilities				
Present	4,259	8%	423	12%
Not Present	48,954	92%	3,000	88%
Total	**53,213**	**100%**	**3,423**	**100%**
Hardscape Damage				
Yes Crack Sidewalk	2,002	4%	14	0%
Yes Sidewalk Lift	12,039	23%	25	1%
Yes Both for Sidewalk	6,157	12%	5	0%
Yes Curb Damage	2,238	4%	1	0%
No	30,777	58%	3,378	99%
Total	53,213	100%	3,423	100%

Infrastructure Recommendations

- Strategic pruning of trees near electric distribution lines, often called utility pruning, may unbalance tree crowns, reduce benefits provided by street trees, cause or worsen tree defects, and impact the aesthetic value of trees. However, tree conflicts with electric distribution lines can cause fires, power outages, and significant expenses and conflicts between tree managers and utility owners. Amherst should:
    - Reduce tree conflicts with electric distribution lines by planting only small stature trees beneath or near overhead electric utilities (see Eversource's recommended "30 Trees Under 30 Feet Tall" list for some approved trees for this purpose). Consider looking for dwarf or small cultivars of typically large-stature trees, such as Town Sprite or Wireless zelkovas or Summer Sprite linden, to diversify small-stature planting lists.

DRG Recommended Overhead Utility Clearances

Small Trees up to 30 feet tall can be planted under and within 20 feet of overhead utilities.

Medium Trees 30 to 45 feet tall should be planted 20 feet or further from overhead utilities.

Large Trees over 45 feet tall should be planted 40 feet or further from overhead utilities.

- Develop and maintain good working relationships with electritown providers for the Town. Open lines of communication and strategic contacts can simplify emergency response efforts, ease tensions between competing interests, and potentially limit excessive utility pruning of Town trees.
- Consider developing or reviewing and revising permitting processes for utility pruning work. This can allow Amherst greater oversight on utility pruning operations and ensure that the work is done in a way that meets the needs of the utility company without doing undue damage to Town trees.

- Limited soil volume and root space available for trees, compounded by planting large trees in very constrained spaces, is a common cause of hardscape damage. Hardscape damage can reduce the walkability of a Town, cause Americans with Disabilities Act (ADA) compliance issues, lead to injuries and public complaints, impact tree health and vigor, and require expensive repairs which may damage street trees or even require their removal. Amherst should:
  - Develop and document standards for tree planting which require specific growing space dimensions and/or soil volumes for various sizes of tree. Planting only small trees where the growing space and soil volume is restricted will help reduce hardscape damage issues due to tree root growth.
  - Encourage collaboration between Town planning, engineering, and tree management departments and staff. Considering trees early in the planning process when repairing or redesigning streets and sidewalks allows greater flexibility in the strategies used to ensure trees can be a productive part of the new streetscape.
  - Consider a variety of strategies for incorporating sufficient growing space into street and sidewalk designs, including enlarging planting wells or siting them on the back edge of the sidewalk adjacent to lawns, installing new tree wells or lawns, creating traffic bumps outs, and incorporating Silva Cell or structural soil technology into designs.
  - Implement a variety of techniques for retaining mature street trees despite conflicts with hardscape. If possible, reroute sidewalks or build temporary ramps of pavement or wood over tree roots rather than remove healthy, mature trees in favor of sidewalk repairs.

DRG Recommended Minimum Growing Space Dimensions

Small Trees: 4 feet x 4 feet.

Medium Trees: 6 feet x 6 feet.

Large Trees: 8 feet x 8 feet.

- 181 tree conflicts with underground utilities were recorded during this inventory. Tree roots can damage water and sewer piping, gas lines, and electric conduits. Maintenance of these utilities often results in cut tree roots, which may destabilize trees and cause tree failure, or may simply reduce tree vigor or kill the tree.
    - Plant trees at least 5 feet from any underground utility to allow room for large, structural roots to develop without impacting the utility.
- Conflicts with other infrastructure, such as buildings, road signage, streetlights, and driveways should also be considered. Amherst should:
    - Develop and document planting guidelines which dictate required clearances for different types of infrastructure. See the sidebar (page 17) for a list of clearances recommended by DRG.
- Recognize that many competing needs intersect when trying to site street trees. Town streetscapes must balance needs for driving, parking, pedestrian access, overhead and underground utilities, street furniture, signage, lighting, winter snow removal, and many other considerations. Some areas will not be suitable for trees, and alternatives to street planting should be used in these areas instead of planting street trees.

DRG RECOMMENDED CLEARANCES FOR TREE PLANTING

40 feet between: large trees

30 feet from: intersections (approaching traffic)

30 feet between: medium trees

20 feet from: fire hydrants

20 feet between: small trees

15 feet from: utility poles, streetlights, buildings

10 feet from: driveways, intersections (retreating traffic), crosswalks, important street signage

5 feet from: underground utilities

Example tree planting specifications

Courtesy of the Town of Ithaca, NY

Potential Alternatives to Street Trees

Setback planting program.

Planting behind sidewalk when ROW is sufficiently wide.

Encouraging private tree planting and tree preservation.

Creation of pocket parks.

Maintenance and improvement of nearby parks and public grounds.

Section 2:

Functions and Benefits

of the Public Tree Resource

SECTION 2: FUNCTIONS AND BENEFITS OF THE PUBLIC TREE RESOURCE

Trees play a vital role in the urban environment by providing a wide array of economic, environmental, and social benefits which can far exceed the investments in planting, maintaining, and removing them. Trees reduce air pollution, improve public health outcomes, reduce stormwater runoff, sequester and store carbon, reduce energy use, and increase property value, among other benefits.

ENVIRONMENTAL BENEFITS

- Trees decrease energy consumption and moderate local climates by providing shade and acting as windbreaks.
- Trees act as mini reservoirs, helping to slow and reduce the amount of stormwater runoff that reaches storm drains, rivers, and lakes. One hundred mature tree crowns intercept roughly 100,000 gallons of rainfall per year (U.S. Forest Service 2003a).
- Trees help reduce noise levels, cleanse atmospheric pollutants, produce oxygen, and absorb carbon dioxide.
- Trees can reduce street-level air pollution by up to 60% (Coder 1996). Lovasi (2008) suggested that children who live on tree-lined streets have lower rates of asthma.
- Trees stabilize soil and provide a habitat for wildlife.

ECONOMIC BENEFITS

- Trees in a yard or neighborhood increase residential property values by an average of 7%.
- Commercial property rental rates are 7% higher when trees are on the property (Wolf 2007).
- Trees moderate temperatures in the summer and winter, saving on heating and cooling expenses (Evans 2012, Heisler 1986).
- On average, consumers will pay about 11% more for goods in landscaped areas, with this figure being as high as 50% for convenience goods (Wolf 1998b, Wolf 1999, and Wolf 2003).
- Consumers also feel that the quality of products is better in business districts surrounded by trees than those considered barren (Wolf 1998b).
- The quality of landscaping along the routes leading to business districts had a positive influence on consumers' perceptions of the area (Wolf 2000).

SOCIAL BENEFITS

- Tree-lined streets are safer; traffic speeds and the amount of stress drivers feel are reduced, which likely reduces road rage/aggressive driving (Wolf 1998a, Kuo and Sullivan 2001a).
- Chicago apartment buildings with medium amounts of greenery had 42% fewer crimes than those without any trees (Kuo and Sullivan 2001b).
- Chicago apartment buildings with high levels of greenery had 52% fewer crimes than those without any trees (Kuo and Sullivan 2001a).
- Employees who see trees from their desks experience 23% less sick time and report greater job satisfaction than those who do not (Wolf 1998a).
- Hospital patients recovering from surgery who had a view of a grove of trees through their windows required fewer pain relievers, experienced fewer complications, and left the hospital sooner than similar patients who had a view of a brick wall (Ulrich 1984, 1986).
- When surrounded by trees, physical signs of personal stress, such as muscle tension and pulse rate, were measurably reduced within three to four minutes (Ulrich 1991).

i-TREE ANALYSES

DRG used i-Tree Eco, a tool within the i-Tree suite, to model benefits provided by Amherst's inventoried public trees. i-Tree Eco combines tree inventory data with local air pollution and meteorological records to quantify the functional benefits of a community's tree resource. DRG also used i-Tree Canopy to estimate the benefits provided by the entire urban canopy, both public and private. By framing trees and their benefits in a way that everyone can understand, as dollars saved per year, i-Tree models can help communities to understand trees as both a natural resource and an economic investment. Knowledge of the composition, functions, and monetary value of trees helps to inform planning and management decisions, assists in understanding the impact of those decisions on human health and environmental quality, and aids communities in advocating for the necessary funding to manage their vested interest in the public tree resource.

ANNUAL BENEFITS

The i-Tree Eco model estimates the annual value of three major tree benefits: carbon sequestration, airborne pollutant removal, and stormwater runoff reduction. The model also calculates the amount and value of carbon storage done by the inventoried trees and the replacement value of the tree resource. **The inventoried trees in Amherst provide approximately $322,483 of air quality, stormwater management, and carbon sequestration benefits each year** (Figure 14).

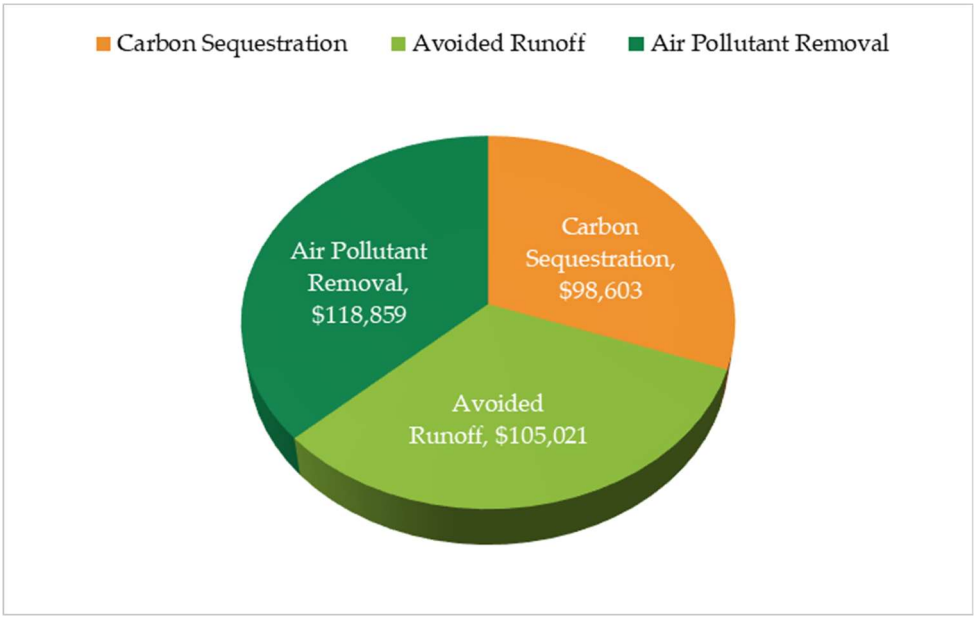


Figure 14. Breakdown of annual benefits provided by the inventoried tree resource.

Compared to rural landscapes, urban landscapes are characterized by high pollutant emissions in a relatively small area. **Air pollutant removal was the most valuable benefit estimated by i-Tree Eco for Amherst**, with an annual value of $118,859. Avoiding stormwater runoff reduces the risk of flooding and combined sewer overflow, both of which impact people, property, and the environment. i-Tree Eco estimated the value of this benefit at $105,021 annually. Carbon dioxide (CO_2) also impacts people, property, and the environment as the primary greenhouse gas driving climate change. Amherst receives an estimated $98,603 of carbon sequestration benefits each year.

SEQUESTERING AND STORING CARBON

Trees are carbon sinks – the opposite of carbon sources. While carbon is released from cars and smokestacks as fossil fuels are consumed, it is absorbed into trees during photosynthesis and stored in their tissue as they grow. The i-Tree Eco model estimates the amount and value of carbon sequestered each year and the total carbon stored by the inventoried trees over their lifetimes. **Amherst's public trees sequester 578 tons of carbon per year** (Table 3), **valued at $98,603**. Additionally, the urban forest of Amherst stores approximately 31,515 tons of carbon per year, which is i-Tree Eco values at $5,374,977.

Using the i-Tree Eco results, tree species which are contributing significantly to the benefits experienced by Amherst can be identified. Table 3 provides a summary of the top species contributing to carbon sequestration and storage benefits among the inventoried public trees. Norway maple and silver maple contribute the most to CO_2 stored, storing about 5,632 tons and 8,822 tons of carbon, respectively. Despite having a lower population size than other tree species, thornless honeylocust stores the third most amount of carbon, about 6,123 tons. Norway maple and silver maple both sequester the most tons of carbon per year: about 161 and 102 tons per year, respectively.

Table 3. Summary of benefits provided by the most common inventoried street trees.

Most Common Trees Inventoried		Count	Percent of Total	Benefits Provided by Street Trees				
				CO_2 Stored	CO_2 Sequestered	Avoided Runoff	Air Pollution Removed	Replacement Value
Common Name	Botanical Name		%	tons	tons/year	gal/year	lbs/year	Dollars
Norway Maple	*Acer platanoides*	16,128	28.4%	5,631.7	160.8	2,023,844	4,200	$20,534,171
Green Ash	*Fraxinus pennslyvanica*	6,974	12.3%	2,743.4	52.4	2,224,430	4,620	$15,462,786
Silver Maple	*Acer saccharinum*	4,993	8.8%	8,822.1	101.6	2,894,828	6,000	$16,536,894
Littleleaf Linden	*Tilia cordata*	4,527	8.0%	1,361.9	30.3	879,781	1,820	$8,562,961
Thornless Honeylocust	*Gleditsia triacanthos v. inermis*	3,813	6.7%	6,123.4	99.4	1,170,758	2,420	$13,416,005
Callery Pear	*Pyrus calleryana*	3,070	5.4%	309.2	12.9	176,686	360	$1,926,858
Red Maple	*Acer rubrum*	2,958	5.2%	1,006.8	25.7	392,638	820	$3,759,791
Japanese Tree Lilac	*Syngria reticulata*	2,337	4.1%	105.2	6.9	41,627	80	$737,092
Freeman Maple	*Acer × freemanii*	1,492	2.6%	1,409.4	25.7	352,736	740	$2,019,401
Blue Spruce	*Picea pungens*	1,127	2.0%	221.4	3.6	136,507	280	$1,294,917
Apple spp	*Malus* spp.	744	1.3%	167.8	3.5	37,953	80	$644,638
Hedge Maple	*Acer campestre*	676	1.2%	52.0	1.6	59,660	120	$346,640
Austrian Pine	*Pinus nigra*	588	1.0%	132.0	2.7	79,855	160	$729,172
Japanese Zelkova	*Zelkova serrata*	552	1.0%	19.5	0.9	38,190	80	$295,891
Norway Spruce	*Picea abies*	401	0.7%	148.9	2.0	105,223	220	$829,583
All Other Trees Inventoried		6,331	11.2%	3,261	48.2	1,137,855	2,140	$9,749,148
Total		56,711	100%	31,515	578.2	87,915,329	24,380	$96,845,949

CONTROLLING STORMWATER

Trees play a significant role in local hydrology and water cycling (see side panel, "Hydrological Functions of Trees"), helping to reduce the amount of stormwater runoff generated during rain events. Since stormwater runoff can cause infrastructure damage and flooding, reducing the amount of precipitation that becomes surface runoff can save a Town costs of infrastructure repair and flooding mitigation**. The inventoried trees in Amherst divert about 11,752,569 gals. of stormwater each year valued at $105,021** (Table 3).

Based on the i-Tree Eco results, the species of trees which contribute the greatest benefits to stormwater control include silver maple, green ash, Norway maple, thornless honeylocust, and littleleaf linden (Table 3). In general, large-stature, broadleaf trees are providing the greatest stormwater control benefits in Amherst.

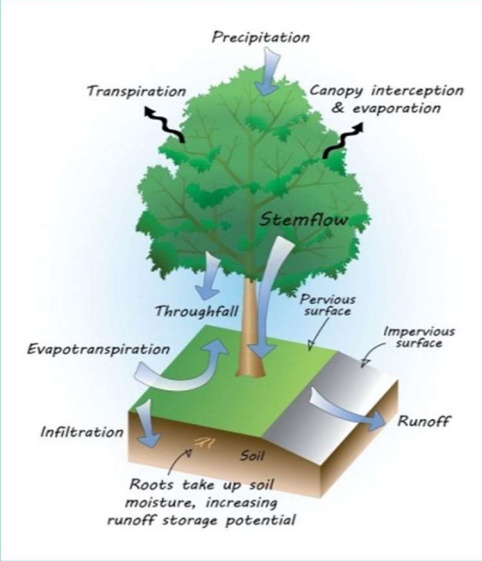
IMPROVING AIR QUALITY

Trees and other vegetation help to improve urban air quality in several ways. They absorb some gaseous pollutants through leaf stomata, while other solid particulate pollutants accumulate on leaf surfaces and are washed away during rain events. Trees also help to decrease air pollutant levels by providing shade or windbreaks and thus reduce the need for energy consumption to cool or heat buildings. Since airborne pollutants can have serious effects on human health, this function of the urban canopy can be very valuable in heavily developed areas[5]. **37% of the annual value of Amherst's urban tree benefits estimated by i-Tree Eco are derived from the air pollutant removal functions of public trees** (Figure 15)**.**

HYDROLOGICAL FUNCTIONS OF TREES

Trees play a significant role in local hydrology and water cycling by:

- Catching rainfall in their crowns, reducing the impact with the ground, and mitigating erosion and compaction of soils.
- Slowing runoff, allowing time for water to be absorbed into the soil and reducing erosion.
- Increasing pore space in the soil with their roots and aiding in permeation of water into the ground.
- Cooling the surrounding landscape by casting shade with their canopies and releasing water from their leaves (evaporative cooling).
- Diverting stormwater runoff, thereby mitigating flooding, combined sewer overflow, and other infrastructure damage.



Hydrological functions of trees

Diagram from Stormwater to Street Trees: Engineering Urban Forests for Stormwater Management, EPA publication 841 B 13 001

[5] National Park Service. 2022. "Air Pollution Removal by Urban Forests." nps.gov/articles/000/uerla-trees-air-pollution.htm.

The **inventoried street trees in Amherst remove 24,380 lbs. of airborne pollutants each year; a service valued at $118,859**. Silver maple, green ash, and Norway maple also remove the most amount of pollutants per year, 3 tons, 2.31 tons, and 2.10 tons per year, respectively.

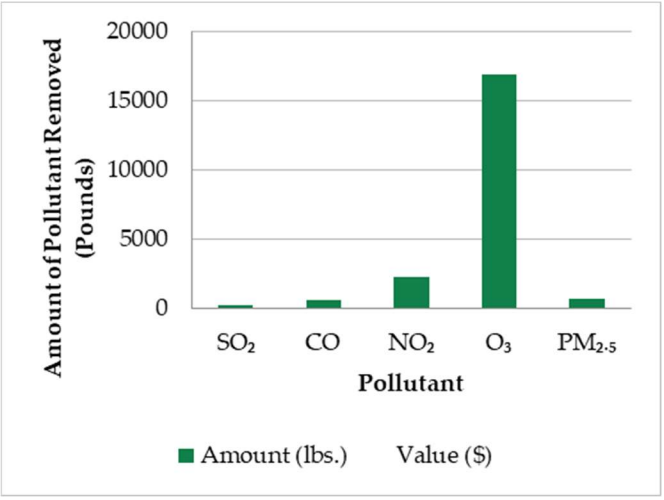


Figure 15. Amount and value of air pollutant removal conducted by the inventoried trees annually.

i-Tree Eco estimates the quantity and value of the removal of five different airborne pollutants, including sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), ozone (O_3), and particulate matter smaller than 2.5 microns ($PM_{2.5}$). The inventoried street and park trees together remove 184 lbs. of SO_2, 591 lbs. of CO, 2,225 lbs. of NO_2, 16,842 lbs. of O_3, and 649 lbs. of $PM_{2.5}$ each year. The reduction in $PM_{2.5}$ is the most valuable pollutant removal service, resulting in $78,164 worth of benefits annually (Figure 15).

REPLACEMENT VALUE

Replacement value is the approximate cost that would be required to replace an existing tree with a tree of similar size and species. While doing this is not usually possible – for example, it is impossible to replace a 20-inch diameter tree with another tree of similar size instantly – replacement value can provide an idea of the overall value of the inventoried trees in Amherst's public tree resource.

In total, Amherst's inventoried trees have a replacement value of about $96,845,948. Table 10 compares the per-tree replacement value of the park and street trees with the overall highest replacement values. **Norway maple is the most valuable tree in Amherst's tree population, with a replacement value of $20,534,171**, followed by silver maple ($16,536,894), green ash ($15,462,786), thornless honeylocust ($13,416,005), and littleleaf linden ($8,562,961).

Tree Benefit Recommendations

- **The highest contributing tree species for eco-benefits within Amherst tend to be the trees that are of overabundance along the ROW.** To avoid increasing tree species and genus populations to above industry standards, Amherst should consider planting other species of trees that may contribute less to eco-benefits. These species would include thornless honeylocust and littleleaf linden for street trees.
- **Amherst should also consider protecting and maintaining existing Norway maple, silver maple, and green ash populations.** Preserving these trees will enable them to continue their contributions towards eco-benefits for Amherst.

- The benefits provided by street trees could be increased by planting large-stature, broad-leaf street trees wherever possible, enlarging existing tree planting spaces or creating new large tree planting spaces to accommodate large street trees, preserving existing large-stature trees along streets, and providing proactive care to young street trees to ensure they achieve mature status in the future.
- Large-stature, broad-leaf trees tend to provide the greatest benefits. Amherst should plan to plant these types of trees whenever and wherever possible to increase the benefits provided by the public tree resource.
- **The highest contributing species to eco-benefits were some of the most abundant species and genus within Amherst parks as well.** It is recommended that Amherst plant other species, such as thornless honeylocust and littleleaf linden, to prevent species from reaching an overabundance in the park tree population.

Section 3:

Recommended Maintenance

of the Public Tree Resource

SECTION 3: RECOMMENDED MAINTENANCE OF THE PUBLIC TREE RESOURCE

During the inventory, both a risk rating and a maintenance activity were assigned to each tree. DRG recommends prioritizing and completing each tree's recommended maintenance activity based on the assigned risk rating. This five-year tree maintenance schedule takes a multi-faceted and proactive approach to tree resource management.

Extreme & High Risk

- All Extreme and High Risk tree maintenance should be completed as soon as possible because these trees have serious defects that cause potential risk to public safety and increase liability for the town.

Further Inspection

- Trees with a requirement in the Further Inspection data field have defects that could become worse and increase their risk and which should be assessed by an arborist as soon as possible.

Moderate Risk

- All Moderate Risk tree maintenance should be performed after all Extreme and High Risk tree maintenance has been completed.

Routine Inspection

- Routine Inspections help detect significant defects before their risk level increases. Inventoried trees should be routinely inspected and attended to as needed.

Routine Pruning

- Routine Pruning cycles correct defects before their risk level increases and should begin after all Extreme and High Risk tree maintenance has been completed.

Young Tree Training

- Young Tree Training cycles improve tree structure so they do not develop defects that become hazards in the future and should begin when Routine Pruning cycles begin.

Low Risk

- All Low Risk tree maintenance should be performed when convenient, after all Extreme, High, and Moderate Risk tree maintenance has been completed.

Stump Removal

- Stump removals should be performed when convenient, ideally before a planting season begins, so additional planting sites become available.

Tree Planting

- Tree planting is important for replacing removed trees, reaching ideal stocking level, and meeting canopy goals, but existing tree maintenance is often a greater priority.

RISK MANAGEMENT AND RECOMMENDED MAINTENANCE

Every tree, regardless of condition, has an inherent risk of whole or partial tree failure. During the inventory, DRG performed a modified Level 2 rapid risk assessment for each tree and assigned a risk rating based on ANSI A300 (*Part 9*)[6] and the companion publication *Best Management Practices: Tree Risk Assessment*[7]. Trees can have multiple potential modes of failure, each with its own risk rating. The potential mode of failure with the highest risk rating was recorded for each tree during the tree inventory. The specified time period for the risk assessment was one year. Appendix C provides additional details on the International Society of Arboriculture's (ISA) risk rating system.

DRG recommends that tree maintenance activities are prioritized and completed based on the risk rating that was assigned to each tree during the inventory. Trees with Extreme or High Risk ratings should be attended to first, followed by trees with a Moderate Risk rating, and trees with a Low Risk rating should be maintained once higher-risk trees have been pruned or removed. This inventory was unique in that each tree was assigned a level of priority following guidelines from Amherst. Trees with critical priority should be attended to first, followed by immediate and routine pruning. Young trees with a DBH of 7 inches or below were assigned a designed priority ("young"), unless those trees needed to be removed. The following sections describe the recommended maintenance activities for each risk rating and priority rating category.

HIGH PRIORITY RECOMMENDED MAINTENANCE

Pruning or removing Extreme and High Risk trees is strongly recommended to be prioritized and completed as soon as possible. In general, maintenance activities should be completed first for larger diameter trees that pose the greatest risk. Once these trees are addressed, recommended tree maintenance activities should be completed for smaller diameter trees that pose the greatest risk. Addressing Extreme and High Risk trees in a timely and proactive manner often requires significant resources to be secured and allocated. However, performing this work expediently will mitigate risk, improve public safety, and reduce long-term costs.

The inventory identified 54 High Risk street trees (Figure 16) and 3 High Risk park trees recommended for pruning (Figure 17). These High Risk park trees were all larger than 31 inches DBH, while the High risk street trees recommended for pruning ranged in size from 10 to 30 inches DBH**. DRG also identified 21 High risk street trees (Figure 18) and 5 High Risk park trees recommended for removal (Figure 19)**. These High risk park trees ranged in size from 16 to >31 inches DBH, while the street trees ranged from 10 to >31 inches DBH. **No Extreme risk trees were identified during the inventory.** Using the prioirity rating system from Amherst, **243 street trees and 12 parks trees were recommended for critical priority pruning** (Figures 16 and 17)**.** The trees identified as needing critical priority pruning were mostly 13 inches DBH to 42 inches DBH, with a few trees over 43" DBH. **Another 102 street trees and 27 park trees were identified for critical removal** (Figures 18 and 19, respectively)**.** These trees ranged from 4 inches DBH to over 43 inches DBH.

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[6] American National Standards Institute. 2017. ANSI A300 (Part 9): Tree, Shrub, and Other Woody Plant Management Standard Practices (Tree Risk Assessment a. Tree Failure). Tree Care Industry Association, Inc.

[7] Smiley, T.E., Matheny, N., and Lilly, S. 2017. *International Society of Arboriculture Best Management Practices: Tree Risk Assessment*.

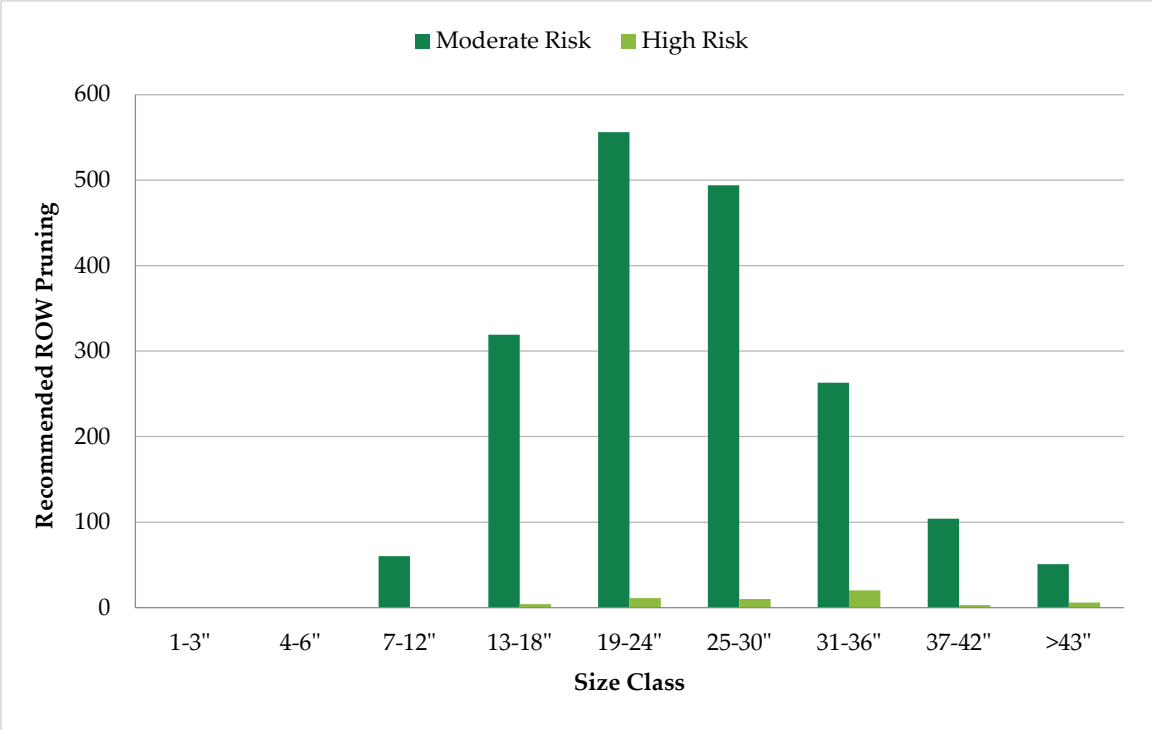


Figure 16. Right-a-way risk pruning.

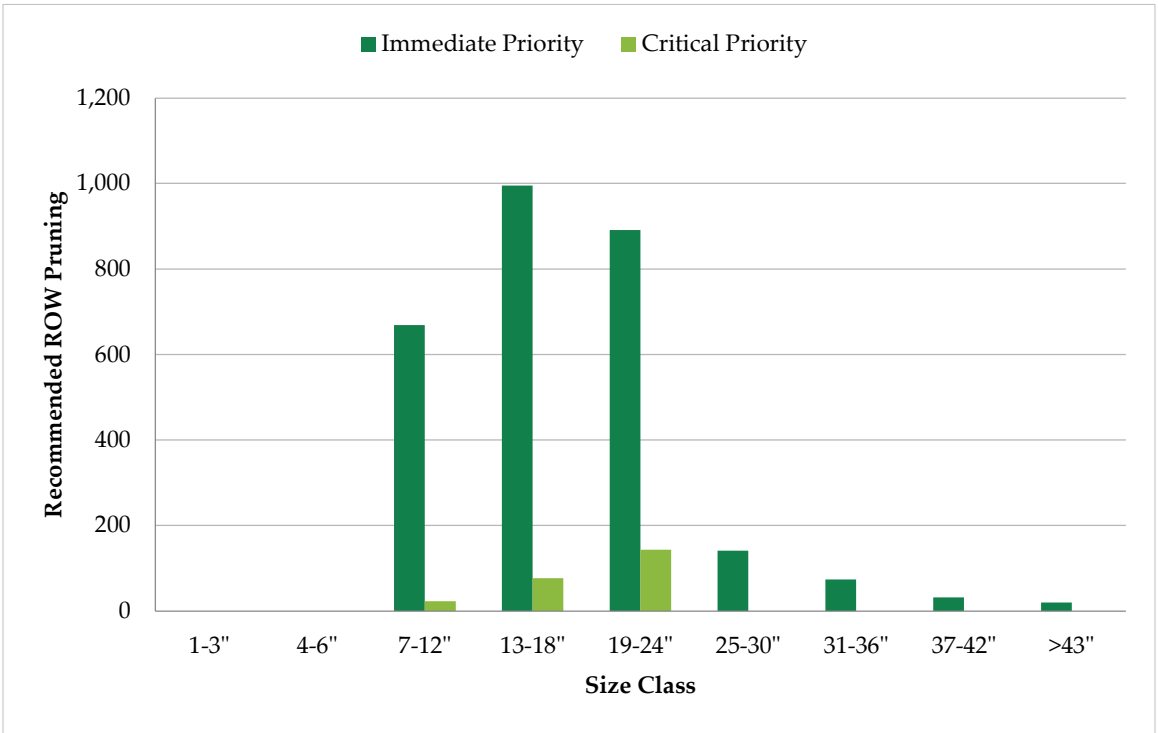


Figure 17. Right-a-way priority prune.

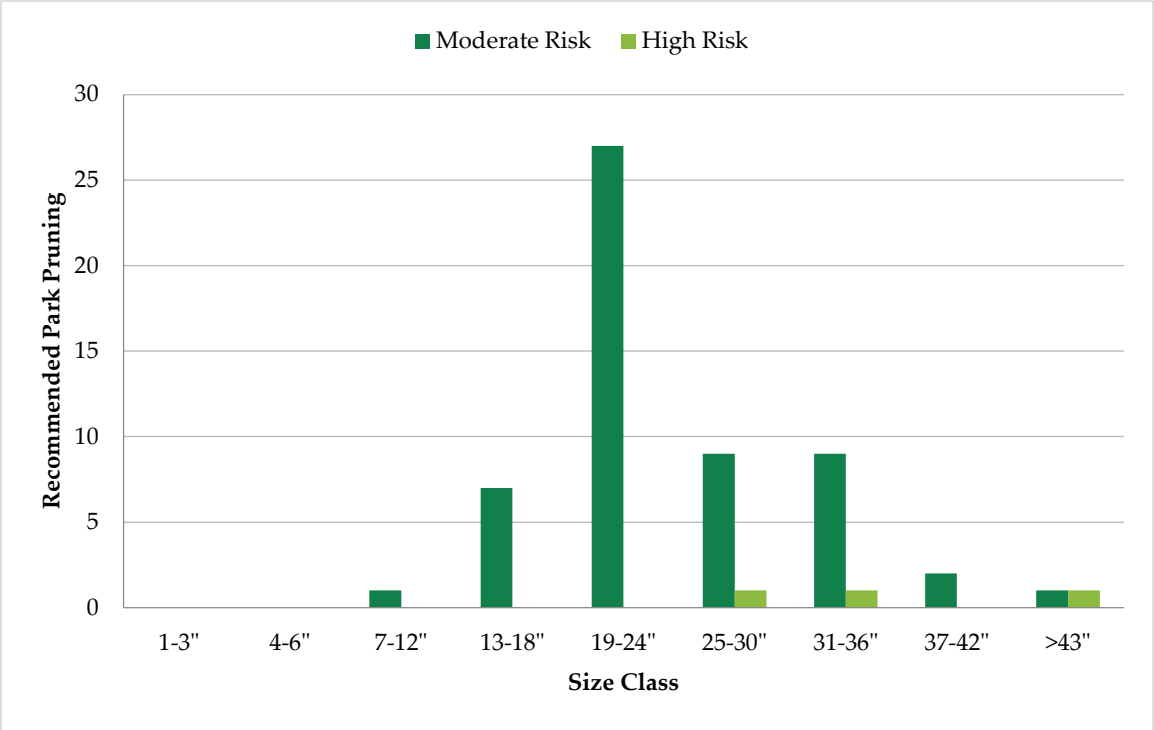


Figure 18. Park risk prune.

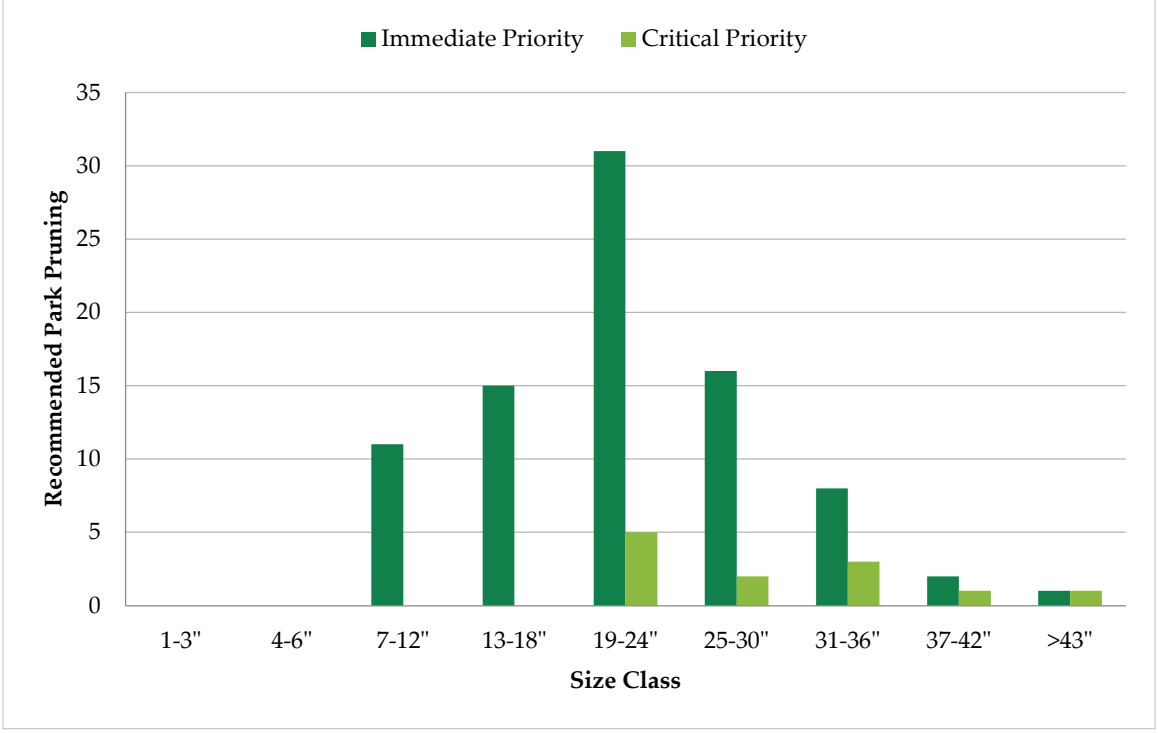


Figure 19. Park AmPriority prune.

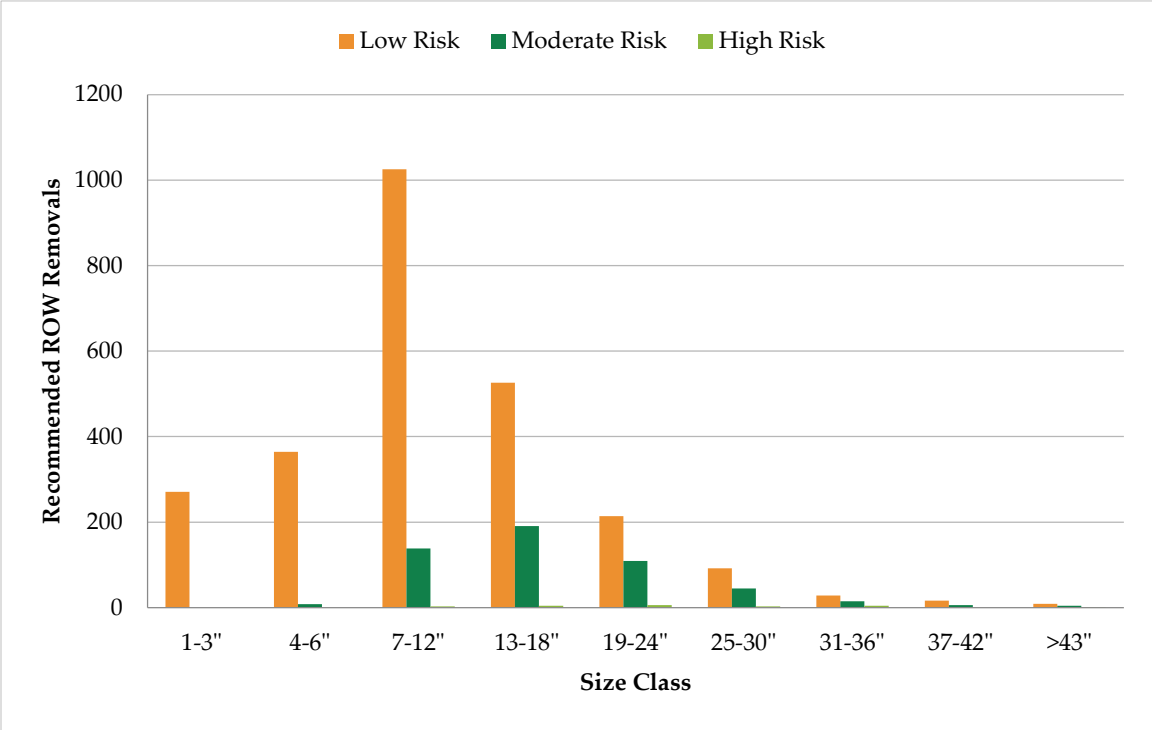


Figure 20. Right-of-Way risk removal.

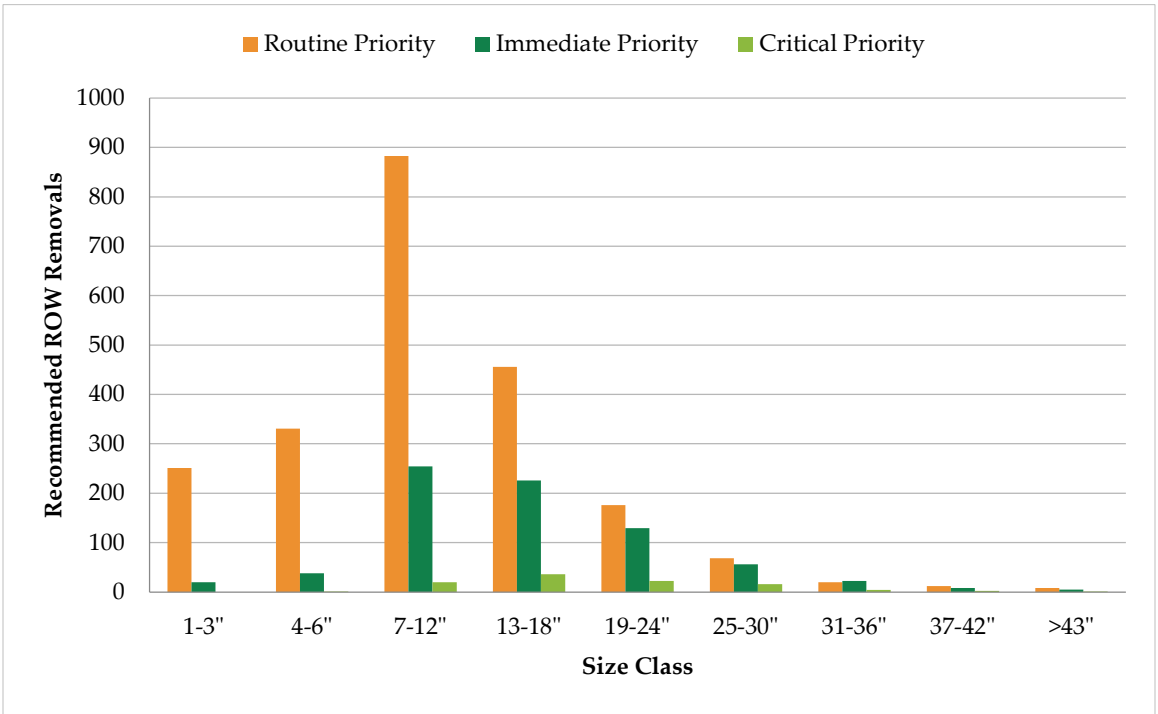


Figure 21. Right-of-Way AmPrior removal.

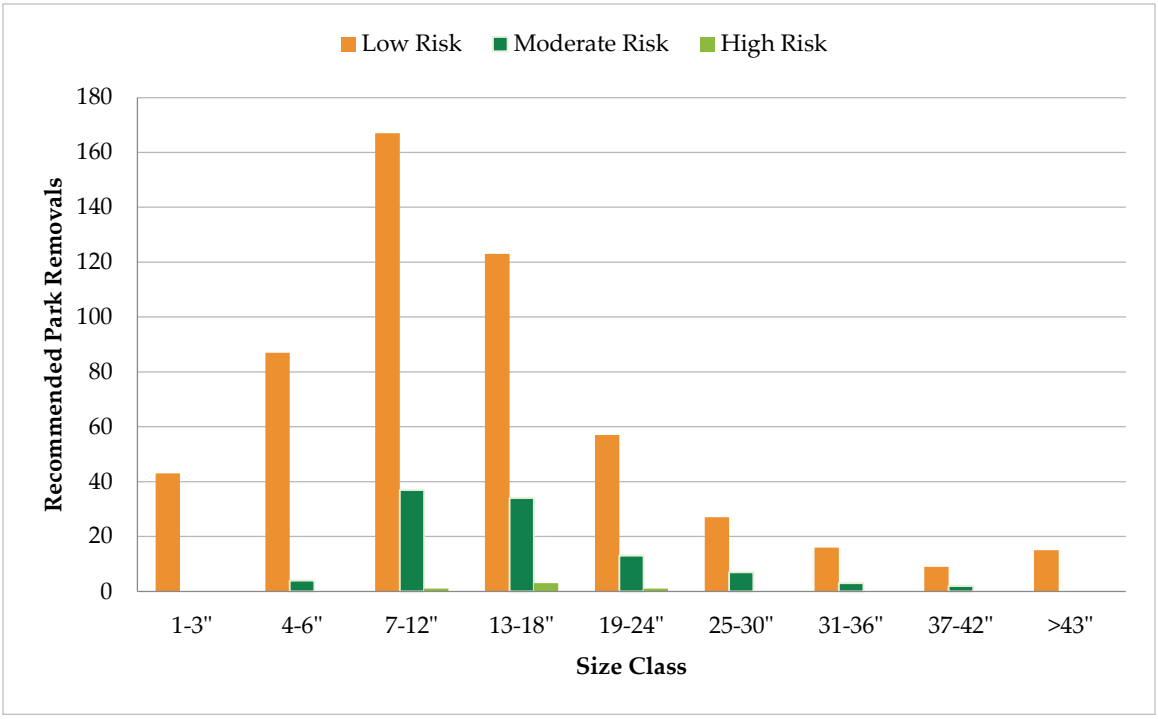


Figure 22. Park risk removal.

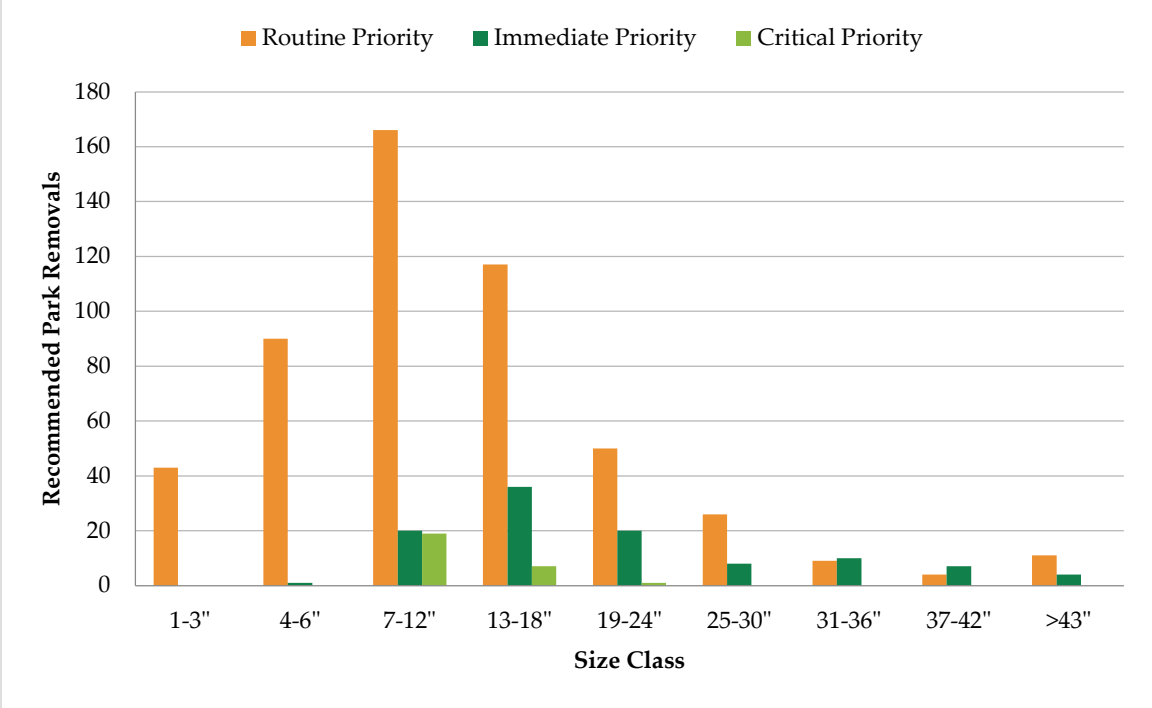


Figure 23. Park priority removal.

High Priority Pruning & Removal Recommendations

Trees with Extreme or High risk ratings recommended for pruning should be pruned immediately. This generally requires removing defective parts such as dead and dying limbs, broken and/or hanging branches, and limbs with missing or decayed wood that may be present in tree crowns even when most of the tree is sound. In these cases, when pruning the defective parts can correct the problem, risk associated with the tree is reduced while promoting healthy growth.

Trees with Extreme or High Risk ratings recommended for removal should be removed immediately and prioritized based on their risk rating and size class. DRG recommends that trees be removed when pruning will not correct their defects, eliminate the risks that their defects cause, or when corrective pruning would be cost-prohibitive.

High priority pruning and removals can be performed at the same time to increase efficiency of maintenance crews.

FURTHER INSPECTION

The Further Inspection data field indicates whether a tree requires additional and/or future inspections to assess and/or monitor conditions that may cause it to become a risk to people, property, or other trees. Further inspections are beyond the scope of a standard tree inventory.

This inventory identified 479 trees for reinspection.

Further Inspection Recommendations

- The trees recommended for advanced risk assessment should be assessed by a Tree Risk Assessment Qualified (TRAQ) arborist as soon as possible to determine whether these trees require removal, pruning, or other corrective action to reduce the risk associated with their observed defects. Advanced risk assessments may require specialized or additional equipment, such as bucket trucks or resistance drills, to access and assess tree defects.

Further Inspection

Level 3 Assessment: The tree has a defect requiring additional or specialized equipment or expertise for investigation.

Insect/Disease Monitoring: The tree appears to have an emerging insect or disease problem.

Recent Damage Inspection: A tree has recently sustained damage and should be monitoring for declining condition due to this damage.

No: No additional inspection required.

- All trees recommended for insect/disease monitoring should be inspected to confirm the presence of damaging insects or diseases and should either be removed or treated, if necessary, to reduce the pest species load and improve the health of the public tree resource.
- Trees recommended for recent damage inspection should be assessed annually to monitor their condition and look for signs of worsening defects that may merit intervention. Some of these trees will likely recover given time and will no longer need additional monitoring, while others may require removal if their defects worsen.

MODERATE AND LOW PRIORITY RECOMMENDED MAINTENANCE

Pruning or removing Moderate and Low Risk trees are generally the next priorities for maintenance activities. For efficiency, Moderate and Low Risk removals may also be addressed when removing adjacent higher risk trees. Most trees recommended for pruning with a Low Risk rating can be maintained during proactive, routine pruning cycles. DRG recommends implementing proactive maintenance programs incrementally over time as the backlog of elevated risk trees is reduced.

DRG identified 56 Moderate Risk park trees and 1,847 Moderate Risk street trees recommended for priority pruning (Figure 15). A further 100 Moderate Risk park trees and 516 Moderate Risk street trees were recommended for removal (Figure 16).

25,813 street trees and 1,067 park trees were rated Low Risk and recommended for pruning during the inventory (Figure 20). **These trees can be maintained as part of a routine pruning cycle**, discussed later in this report**.** Four additional trees were identified as having no risk but required pruning: these trees are included within the routine pruning cycle. 21,340 street trees and 1,028 park trees were recommended for routine priority pruning (Figure 20). An additional 16 trees were not assigned a priority; these trees were included in the routine pruning cycle. **DRG identified 544 Low Risk park trees and 2,542 Low Risk street trees recommended for removal during the inventory** (Figures 18 and 19). 2,201 street trees and 516 park trees were identified within the routine removal priority during this inventory (Figures 18 and 19). Low Risk removals pose little threat; these trees are generally small, dead, invasive, or poorly formed trees that need to be removed. Healthy trees growing in poor locations or undesirable species are also included in this category. Eliminating these trees will reduce breeding site locations for insects and diseases and will increase the aesthetic value of the area.

Figure 24. RP cycle by size class.

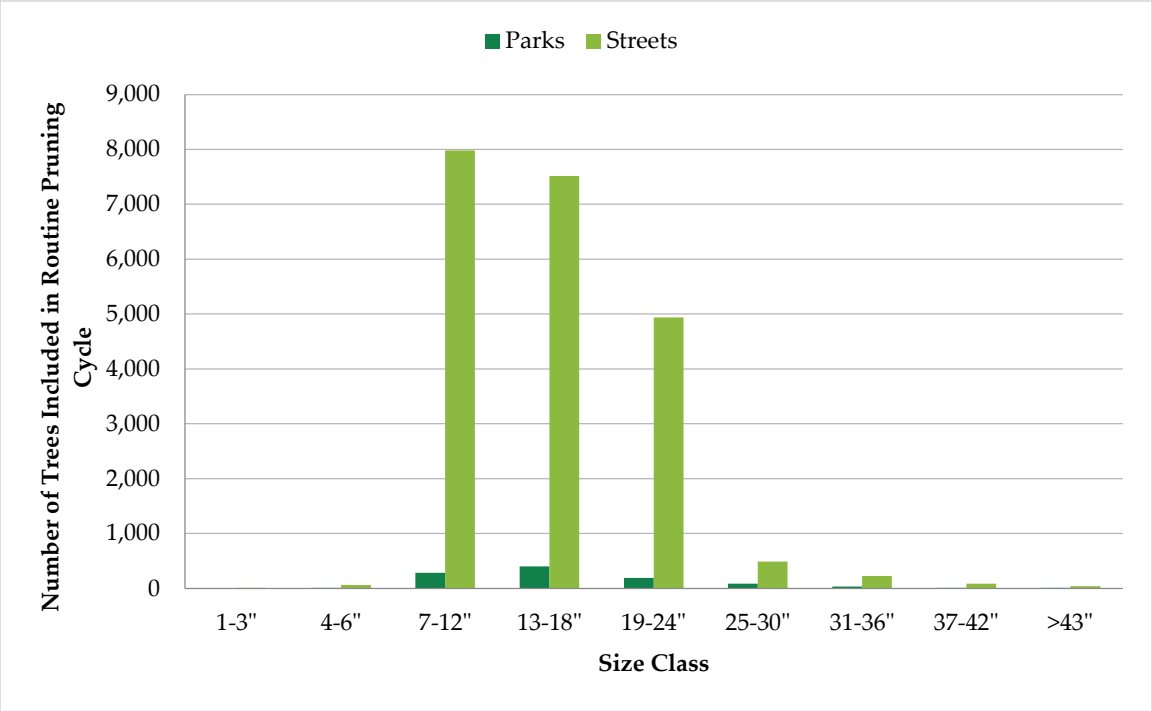


Figure 25. RP cycle by Apriority.

Moderate Risk Pruning & Removal Recommendations

- Moderate Risk pruning and removals should be performed after all Extreme and High Risk recommended maintenance is complete.
- Moderate Risk tree pruning and removals can take place at the same time, and can also be combined with higher risk removals and pruning when located near these trees to increase maintenance crew efficiency.

Low Priority Removal Recommendations

- Low risk trees should be removed when convenient after all higher risk pruning and removals have been completed and may be performed concurrently with routine pruning.
- Low risk tree removal can be done at the same time as higher risk tree removal or pruning when doing so increases the efficiency of the work due to proximity of these Low risk trees to other, higher risk trees which are being pruned or removed.

ROUTINE INSPECTIONS & INVENTORY UPDATES

Inspections are essential to uncovering potential problems with trees. They should be performed by a qualified arborist who is trained in the art and science of planting, caring for, and maintaining individual trees. Ideally, the arborist will be ISA Certified and hold the ISA Tree Risk Assessment Qualification credential. Level 1 and 2 assessments (see side panel, "Levels of Risk Assessment") can be completed during regular tree maintenance activities, such as routine pruning, to streamline the process and reduce workloads and cost. When trees need additional maintenance, they should be added to the work schedule immediately. Use asset management software such as TreeKeeper® to update inventory data and schedule work records.

LEVELS OF RISK ASSESSMENT

Arborists assess tree risk using different tools and at different levels of detail. ISA best management practices suggest three levels of risk assessment, from least to most intensive:

Level 1: Limited Visual Assessment

A walk-by or drive-by assessment designed to quickly and efficiently scan a large population of trees and identify those which need a more advanced assessment due to defects with an imminent or probable likelihood of failure.

Level 2: Basic Assessment

A detailed, 360-degree visual inspection of individual trees assessing the site, roots, trunk, and branches, resulting in a risk rating that can be used to prioritize tree work within a large population of trees.

Level 3: Advanced Assessment

Additional inspection following a Basic Assessment that uses specialized equipment to provide more detailed information about an individual tree, typically to help make management decisions about that specific tree.

DRG conducted a slightly modified "rapid" assessments protocol similar to the Level 2 Basic Assessment during Amherst's inventory.

An arborist conducting a risk assessment.
Photo courtesy of DRG, 2021

Routine Inspection and Inventory Update Recommendations

- All public trees should be regularly inspected and attended to as needed. Inspections can be particularly effective and necessary after major storms which may cause damage to trees or increase the risk posed by trees.
    - Level 1 walk-by or drive-by assessments can be a cost-effective method of inspection for the public tree resource after storm events and can help identify trees which need further, detailed inspection.
- When trees require additional or new work, they should be added to the maintenance schedule. The budget should also be updated to reflect the additional work. Utilize asset management software such as TreeKeeper® to make updates, edits, and keep a log of work records.
- Level 2 risk assessments and inventory updates should also be completed on a routine basis, ideally every 5 to 10 years, to identify defects that are not easily observed during Level 1 assessments and to update tree inventory information.
    - **To keep costs regular, 1/5 of the public tree resource should be re-inventoried each year**. With a total of around 52,905 public trees in the current inventory not recommended for removal, approximately 10,581 would need to be updated each year during a five-year inventory update cycle.

ROUTINE PRUNING CYCLE

The routine pruning cycle includes all Low Risk trees with a primary maintenance need of 'prune'. These trees pose some risk but have a smaller defect size and/or a lower probability of impacting a target and thus do not require priority maintenance. Over time, routine pruning can minimize reactive maintenance, limit instances of elevated risk, and provide the basis for a robust risk management program.

Based on Miller and Sylvester's research (see side panel, "Proactive Pruning", page 40), DRG recommends a five-year routine pruning cycle to maintain the condition of the inventoried tree resource. However, it is not always possible to remain proactive with a five-year cycle based on budgetary constraints, the size of the inventoried tree resource, or both. In these cases, extending the length of the routine pruning cycle is an option; however, the best practice is to not exceed a 10-year pruning cycle. Tree condition has been shown to deteriorate significantly after 10 years without regular pruning as once-minor defects worsen, reducing tree health and potentially increasing risk[8].

A total of 26,884 trees (25,817 street trees and 1,067 park trees) were rated Low Risk or No Risk with a maintenance recommendation of "prune" and should be included in a routine pruning cycle (Figure 17). If using Amherst's priority system, then 22,384 total trees (21,356 street trees and 1,028 park trees) were recorded with routine or no priority ratings and should be included in a routine pruning cycle. The routine pruning cycle will be based off of risk rating, as opposed to priority rating.

[8] Miller, R. W., & Sylvester, W.A. 1981. An Economic Evaluation of the Pruning cycle. Journal of Arboriculture 7(4): 109–112.

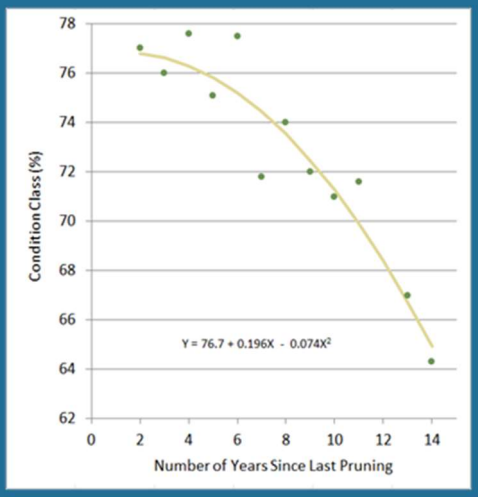
Routine Pruning Cycle Recommendations

- **Amherst should aim to prune 1/5 of its public trees each year during a five-year routine pruning cycle**. A five-year cycle would see around 5,154 street trees and around 213 park trees assessed and pruned, if needed, each year.
- Trees which are currently recommended for priority pruning (High and Moderate Risk trees with a maintenance recommendation of "prune") should be added to the routine pruning cycle once their immediate defects and elevated risk are mitigated.
- Young trees which grow out of the young tree training cycle (see next section) should also be included in the routine pruning cycle.
- Trees which die and are removed should be removed from the routine pruning cycle.
- The number of trees to be assessed and routinely pruned each year will vary depending on the number of trees which are planted and the number of trees which are removed in future years.
- Not every tree in the routine pruning cycle will need to be pruned each cycle – thus, the actual cost to maintain a routine pruning cycle will likely be lower than projected in Table 4.

YOUNG TREE TRAINING CYCLE

Trees included in the young tree training cycle are generally less than 6 inches DBH. These younger trees may have branch structures that can lead to potential problems as the tree ages. Potential structural problems include codominant leaders, multiple limbs attaching at the same point on the trunk, and crossing or interfering limbs. If these problems are not corrected, they are likely to worsen as the tree grows, increasing the risk associated with the tree and creating potential liability for the Town. The recommended length of a young tree training cycle is three years because young trees tend to grow

PROACTIVE PRUNING



Relationship between tree condition and years since previous pruning.

Adapted from Miller and Sylvester 1981

Miller and Sylvester studied the pruning frequency of 40,000 street trees in Milwaukee, Wisconsin. Trees that had not been pruned for more than 10 years had an average condition rating 10% lower than trees that had been pruned in the previous several years. Their research suggests that a five-year pruning cycle is optimal for urban trees.

Routine pruning cycles help detect and correct most defects before they reach higher risk levels. DRG recommends that pruning cycles begin after all Extreme and High risk tree maintenance has been completed.

DRG recommends two pruning cycles: a young tree training cycle and a routine pruning cycle. Newly planted trees will enter the young tree training cycle once they become established and will move into the routine pruning cycle when they reach maturity. A tree should be removed and eliminated from the routine pruning cycle when it outlives its usefulness.

at faster rates than mature trees. The young tree training cycle also differs from the routine pruning cycle in that the young tree training cycle generally only includes trees that can be pruned from the ground with a pole pruner or pruning shear.

The inventory identified 13,777 small, young trees which should be included in a young tree training cycle. These **young trees make up around 26% of the total inventoried public tree resource** not recommended for removal.

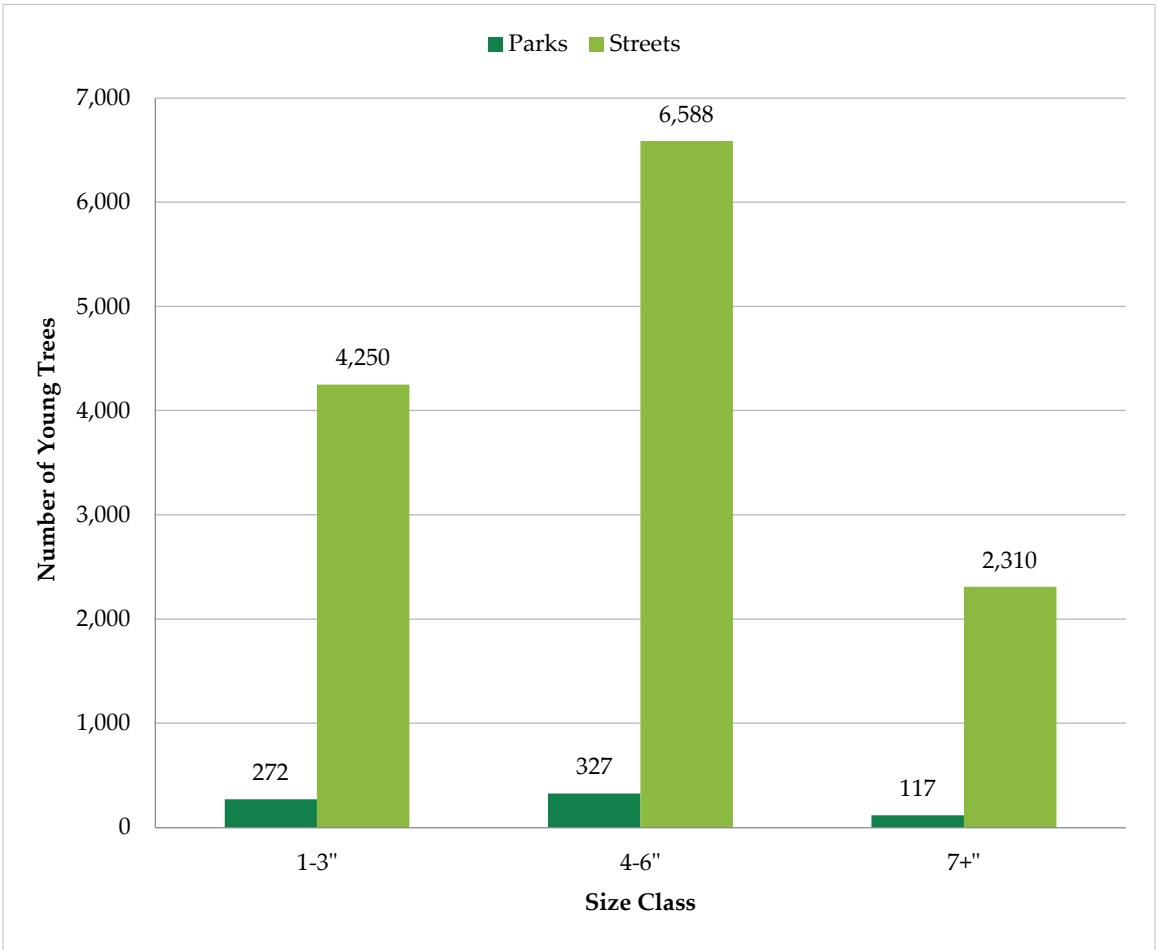


Figure 26. Young tree training cycle by size class.

Young Tree Training Cycle Recommendations

- Amherst should institute a three-year young tree training cycle beginning after the completion of all recommended higher priority work. Since Amherst has so many young trees, maintaining this cycle will be vital for the future condition of the public tree resource. With 1,888 young trees recommended for training at the time of the inventory, approximately 630 need to be assessed and pruned each year during the three-year cycle.
- When new trees are planted, they should ideally be pruned to correct major structural defects at the time of planting. After two to three years of establishment, the trees should be included in the young tree training cycle.

- Trees which have reached maturity should be removed from the young tree training cycle and moved into the routine pruning cycle.
- In future years, the number of trees in the young tree training cycle will depend on the growth rates of young trees in the Town and the number of new plantings.
- Not every tree in the young tree training cycle will need to be pruned each cycle – thus, the actual cost to maintain a routine pruning cycle will likely be lower than projected in the budget table provided (Table 4).

TREE PLANTING AND STUMP REMOVAL

The "right tree in the right place" mantra for tree planting is used by the Arbor Day Foundation and many utility companies nationwide. Trees come in many different shapes and sizes, and often change dramatically over their lifetimes. Before selecting a tree for planting, make sure it is the right tree—know how tall, wide, and deep it will be at maturity. Equally important to selecting the right tree is choosing the right spot to plant it. Blocking an unsightly view or creating shade may be a priority, but it is important to consider how a tree may impact existing overhead and underground utilities and hardscape as it grows taller, wider, and deeper. If the tree at maturity will reach overhead lines, or conflict with sidewalks, curbs, nearby buildings, or buried utilities, it is best to choose another tree or a different location. A list of suggested tree species for planting in Amherst is provided in Appendix D. This list is not exhaustive but can be used as a guideline for species that meet community objectives and to enhance any existing list of approved species.

During the inventory, **2,058 potential planting sites and 488 stumps were identified throughout Amherst**. An additional 473 sites were identified and recorded as "vacant- do not replace". Typically, these sites were either closer to a street intersection than recommended and would potentially block a street sign or were requested to remain vacant by the homeowner. Most of these sites were located along streets. Park planting sites were not fully inventoried as part of this inventory project, and there are likely more than the inventoried 26 vacant planting sites in Amherst's parks. Along the streets, 18% of the vacant sites were suitable for a small tree, 59% were suitable for a medium tree, and 23% were suitable for a large tree. Within the parks, 38% of vacant sites were suitable for a medium tree, and 62% were suitable for a large tree.

Tree Planting and Stump Removal Recommendations

- Stump removal should ideally be included in any tree removal contracts made by the Town. The Town should conduct quality assurance and control checks of contractor work to ensure that stumps are being removed fully and efficiently as part of the tree removal work.
- Stump removal should be done prior to targeted planting of any area to open up locations for new tree planting.

- Amherst should strive to plant the largest possible tree in each vacant planting site. Large-stature, broad-leaf trees provide the greatest benefits to the community.
    - Only small-stature trees (up to 25 feet at maturity) should be planted underneath and within 20 feet of overhead utility lines to minimize conflicts with the lines. Any small vacant site identified in the inventory can potentially support a small stature tree.
    - Medium-stature trees (between 25 and 40 feet tall at maturity) may be planted in medium vacant sites.
    - Large-stature trees (greater than 40 feet tall at maturity) may be planted in large vacant sites.
- To avoid loss of public tree canopy, Amherst should aim for, at minimum, a 1-for-1 replacement rate of planted trees to removed trees. Ideally, the Town will surpass this and hit a 2-for-1 or even a 3-for-1 replacement rate, which will ultimately help to increase the public canopy of the Town. The budget table (Table 3) assumes a 2-for-1 replacement strategy to show the costs of maintaining such a planting program.
- Trees selections for planting should be assessed for their tolerance to heat, drought, salt, and climate change, among other factors, and appropriate trees should be selected for each individual planting location. Planting the "right tree in the right place" will minimize conflicts with other infrastructure, improve tree survival rates and tree condition, and reduce maintenance costs.
- Where planting space along streets is limited and traditional street tree planting is not possible, the Town should consider alternate options for installing and increasing public tree canopy, including:
    - Creation of pocket parks.
    - Improvement and maintenance of existing nearby parks and public grounds.
    - Setback planting programs designed to install Town trees behind the ROW but within 20 feet of the public.
    - Encouraging planting of trees on private property via education, tree giveaways, tax breaks, and other methods.
- Where possible, Amherst should enlarge and improve tree planting areas along streets by:
    - Enlarging the dimensions and soil volume of planting strips and planting wells.
    - Considering use of structural soils or Silva Cells to improve root movement through soils and reduce infrastructure conflicts.
    - Working with other Town departments, such as engineering, to ensure that plans for new development or street improvement explicitly consider trees during the design process. This can help ensure that provisions made for trees are realistic and adequate to support healthy urban canopy.
- Continue to seek out and apply for grant funding to support tree planting projects. Significant funding is available at the state and federal level, particularly for planting projects within Environmental Justice areas.

MAINTENANCE SCHEDULE AND BUDGET

Using the Amherst tree inventory data, an annual maintenance schedule and budget were developed detailing the recommended tasks to complete each year over the next five years (Table 4). DRG made budget projections using Amherst's current tree care contract rates, industry knowledge, and public bid tabulations. Following this schedule can help shift the Town's tree care program from reactive toward a more proactive model.

To implement the maintenance schedule, Amherst's tree maintenance budget should be:

- No less than $1,889,207 for the first year of implementation.
- No less than $1,598,679 for the second year.
- No less than $1,598,342 for the third year.
- No less than $1,334,685 for the fourth year.
- No less than $1,208,800 for the fifth year.

These annual budget funds are needed to ensure that elevated risk trees are managed efficiently and that the vital young tree training and routine pruning cycles can begin as soon as possible. If routing efficiencies and/or contract specifications allow more tree work to be completed each year, or if this maintenance schedule requires adjustment to meet budgetary or other needs, then it should be modified accordingly. Unforeseen situations such as severe weather events may arise and change the maintenance needs of trees. If maintenance needs change, then budgets, staffing, and equipment should be adjusted to meet the new demand.

Table 4. Maintenance schedule and budget for a five-year tree management program

Activity Cost			Year 1		Year 2		Year 3		Year 4		Year 5		Five-Year Cost
Activity	Diameter	Cost/Tree	Count	Cost	Count	Cost	Count	Cost	Count	Cost	Count	Cost	
High Priority Removals	1-3"	$28		$0		$0		$0		$0		$0	$0
	4-6"	$58		$0		$0		$0		$0		$0	$0
	7-12"	$138	4	$552		$0		$0		$0		$0	$552
	13-18"	$314	7	$2,198		$0		$0		$0		$0	$2,198
	19-24"	$605	7	$4,235		$0		$0		$0		$0	$4,235
	25-30"	$825	3	$2,475		$0		$0		$0		$0	$2,475
	31-36"	$1,045	4	$4,180		$0		$0		$0		$0	$4,180
	37-42"	$1,485		$0		$0		$0		$0		$0	$0
	>43"	$2,035	1	$2,035		$0		$0		$0		$0	$2,035
Activity Total(s)			**26**	**$15,675**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$15,675**
Moderate Priority Removals	1-3"	$28		$0		$0		$0		$0		$0	$0
	4-6"	$58	12	$696		$0		$0		$0		$0	$696
	7-12"	$138	175	$24,150		$0		$0		$0		$0	$24,150
	13-18"	$314	225	$70,650		$0		$0		$0		$0	$70,650
	19-24"	$605	122	$73,810		$0		$0		$0		$0	$73,810
	25-30"	$825	52	$42,900		$0		$0		$0		$0	$42,900
	31-36"	$1,045	18	$18,810		$0		$0		$0		$0	$18,810
	37-42"	$1,485	8	$11,880		$0		$0		$0		$0	$11,880
	>43"	$2,035	4	$8,140		$0		$0		$0		$0	$8,140
Activity Total(s)			**616**	**$251,036**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$251,036**
Low Priority Removals	1-3"	$28	104	$2,912	106	$2,968	104	$2,912		$0		$0	$8,792
	4-6"	$58	150	$8,700	151	$8,758	150	$8,700		$0		$0	$26,158
	7-12"	$138	397	$54,786	398	$54,924	397	$54,786		$0		$0	$164,496
	13-18"	$314	217	$68,138	216	$67,824	216	$67,824		$0		$0	$203,786
	19-24"	$605	91	$55,055	90	$54,450	90	$54,450		$0		$0	$163,955
	25-30"	$825	41	$33,825	39	$32,175	39	$32,175		$0		$0	$98,175
	31-36"	$1,045	16	$16,720	14	$14,630	14	$14,630		$0		$0	$45,980
	37-42"	$1,485	9	$13,365	8	$11,880	8	$11,880		$0		$0	$37,125
	>43"	$2,035	8	$16,280	8	$16,280	8	$16,280		$0		$0	$48,840
Activity Total(s)			**1,033**	**$269,781**	**1,030**	**$263,889**	**1,026**	**$263,637**	**0**	**$0**	**0**	**$0**	**$797,307**
Stump Removals	1-3"	$18		$0		$0		$0		$0		$0	$0
	4-6"	$28		$0		$0		$0		$0		$0	$0
	7-12"	$44		$0		$0		$0		$0		$0	$0
	13-18"	$72		$0		$0		$0		$0		$0	$0
	19-24"	$94		$0		$0		$0		$0		$0	$0
	25-30"	$110		$0		$0		$0		$0		$0	$0
	31-36"	$138		$0		$0		$0		$0		$0	$0
	37-42"	$160		$0		$0		$0		$0		$0	$0
	>43"	$182		$0		$0		$0		$0		$0	$0
Activity Total(s)			**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$0**
High Priority Pruning	1-3"	$20		$0		$0		$0		$0		$0	$0
	4-6"	$30		$0		$0		$0		$0		$0	$0
	7-12"	$75		$0		$0		$0		$0		$0	$0
	13-18"	$120	4	$480		$0		$0		$0		$0	$480
	19-24"	$170	11	$1,870		$0		$0		$0		$0	$1,870
	25-30"	$225	11	$2,475		$0		$0		$0		$0	$2,475
	31-36"	$305	21	$6,405		$0		$0		$0		$0	$6,405
	37-42"	$380	3	$1,140		$0		$0		$0		$0	$1,140
	>43"	$590		$0		$0		$0		$0		$0	$0
Activity Total(s)			**50**	**$12,370**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$12,370**

Activity Cost			Year 1		Year 2		Year 3		Year 4		Year 5		Five-Year Cost
Activity	Diameter	Cost/Tree	Count	Cost	Count	Cost	Count	Cost	Count	Cost	Count	Cost	
Moderate Priority Pruning	1-3"	$20		$0		$0		$0		$0		$0	$0
	4-6"	$30		$0		$0		$0		$0		$0	$0
	7-12"	$75	21	$1,575	20	$1,500	20	$1,500	20	$1,500		$0	$6,075
	13-18"	$120	109	$13,080	108	$12,960	109	$13,080	109	$13,080		$0	$52,200
	19-24"	$170	195	$33,150	194	$32,980	194	$32,980	194	$32,980		$0	$132,090
	25-30"	$225	168	$37,800	168	$37,800	167	$37,575	167	$37,575		$0	$150,750
	31-36"	$305	92	$28,060	90	$27,450	90	$27,450	90	$27,450		$0	$110,410
	37-42"	$380	36	$13,680	35	$13,300	35	$13,300	35	$13,300		$0	$53,580
	>43"	$590		$0		$0		$0		$0		$0	$0
Activity Total(s)			**621**	**$127,345**	**615**	**$125,990**	**615**	**$125,885**	**615**	**$125,885**	**0**	**$0**	**$505,105**
Routine Inspection	Drive-by Assessment	$1	10,581	$10,581	10,581	$10,581	10,581	$10,581	10,581	$10,581	10,581	$10,581	$52,905
	Walk-by Assessment	$5	10,581	$52,905	10,581	$52,905	10,581	$52,905	10,581	$52,905	10,581	$52,905	$264,525
Activity Total(s)			**10,581**	**$52,905**	**10,581**	**$52,905**	**10,581**	**$52,905**	**10,581**	**$52,905**	**10,581**	**$52,905**	**$264,525**
Young Tree Training (3-year Cycle)	1-3"	$20	1,507	$30,140	1,507	$30,140	1,508	$30,160	1,507	$30,140	1,507	$30,140	$150,720
	4-6"	$30	2,305	$69,150	2,305	$69,150	2,305	$69,150	2,305	$69,150	2,305	$69,150	$345,750
	6"<	$40	809	$32,360	809	$32,360	809	$32,360	809	$32,360	809	$32,360	$161,800
Activity Total(s)			**4,621**	**$131,650**	**4,621**	**$131,650**	**4,622**	**$131,670**	**4,621**	**$131,650**	**4,621**	**$131,650**	**$658,270**
Routine Pruning (5-year Cycle)	1-3"	$20	4	$80	3	$60	3	$60	3	$60	3	$60	$320
	4-6"	$30	22	$660	21	$630	21	$630	21	$630	21	$630	$3,180
	7-12"	$75	1,786	$133,950	1,786	$133,950	1,786	$133,950	1,786	$133,950	1,786	$133,950	$669,750
	13-18"	$120	1,736	$208,320	1,735	$208,200	1,735	$208,200	1,735	$208,200	1,735	$208,200	$1,041,120
	19-24"	$170	1,121	$190,570	1,121	$190,570	1,121	$190,570	1,121	$190,570	1,121	$190,570	$952,850
	25-30"	$225	471	$105,975	470	$105,750	470	$105,750	470	$105,750	470	$105,750	$528,975
	31-36"	$305	165	$50,325	164	$50,020	164	$50,020	164	$50,020	164	$50,020	$250,405
	37-42"	$380	59	$22,420	56	$21,280	56	$21,280	56	$21,280	56	$21,280	$107,540
	>43"	$590	23	$13,570	19	$11,210	19	$11,210	19	$11,210	19	$11,210	$58,410
Activity Total(s)			**5,387**	**$725,870**	**5,375**	**$721,670**	**5,375**	**$721,670**	**5,375**	**$721,670**	**5,375**	**$721,670**	**$3,612,550**
Replacement Tree Planting and Maintenance	Purchasing	$250	481	$120,250	481	$120,250	481	$120,250	481	$120,250	481	$120,250	$601,250
	Planting & Watering	$200	481	$96,200	481	$96,200	481	$96,200	481	$96,200	481	$96,200	$481,000
	Mulching	$25	481	$12,025	481	$12,025	481	$12,025	481	$12,025	481	$12,025	$60,125
Activity Total(s)			**1,443**	**$228,475**	**1,443**	**$228,475**	**1,443**	**$228,475**	**1,443**	**$228,475**	**1,443**	**$228,475**	**$1,142,375**
New Tree Planting and Maintenance	Purchasing	$250	156	$39,000	156	$39,000	156	$39,000	156	$39,000	156	$39,000	$195,000
	Planting & Watering	$200	156	$31,200	156	$31,200	156	$31,200	156	$31,200	156	$31,200	$156,000
	Mulching	$25	156	$3,900	156	$3,900	156	$3,900	156	$3,900	156	$3,900	$19,500
Activity Total(s)			**468**	**$74,100**	**468**	**$74,100**	**468**	**$74,100**	**468**	**$74,100**	**468**	**$74,100**	**$370,500**
Natural Mortality (1%)	Tree Removal	$314		$0		$0		$0		$0		$0	$0
	Stump Removal	$72		$0		$0		$0		$0		$0	$0
	Replacement Tree	$475		$0		$0		$0		$0		$0	$0
Activity Total(s)			**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**0**	**$0**	**$0**
Activity Grand Total			**24,846**		**24,133**		**24,130**		**23,103**		**22,488**		**118,700**
Cost Grand Total				**$1,889,207**		**$1,598,679**		**$1,598,342**		**$1,334,685**		**$1,208,800**	**$7,629,713**

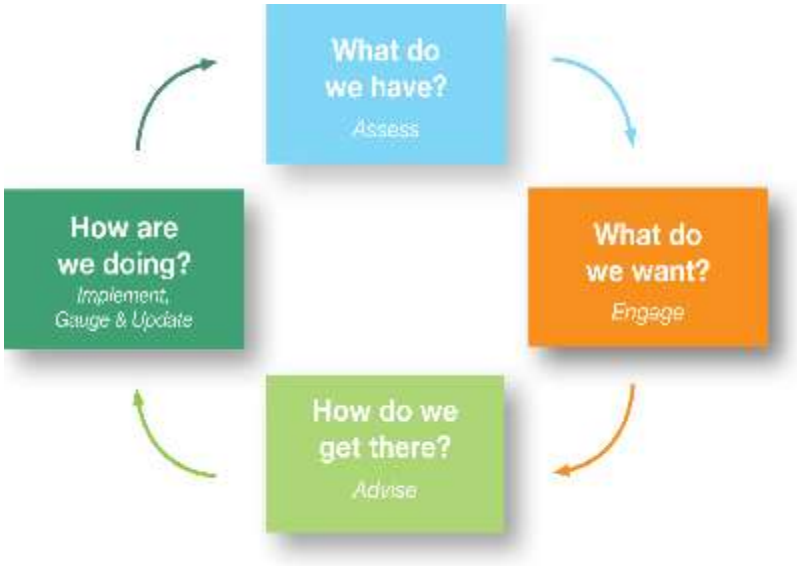
CONCLUSION

When properly maintained, the valuable benefits trees provide over their lifetime can far exceed the time and money invested in planting, pruning, and inevitably removing them. **The 56,636 public trees inventoried provide at least $322,483 in estimated annual stormwater reduction, carbon sequestration, and air pollutant removal benefits**. The full suite of benefits provided by Amherst's public trees is certainly much more valuable than can be estimated using inventory data and i-Tree Eco modeling alone. **Successfully implementing the five-year maintenance program is likely to increase the benefits the Town receives from its public tree resource over time**.

The five-year maintenance program outlined here is ambitious. Removal or pruning of Extreme, High, and Moderate Risk trees is costly, but is necessary for the health and safety of both the human and arboreal residents of Amherst. After this priority work is completed, the remainder of the work can be done over a longer period, if budgets, staffing, or equipment render it necessary. **This *Public Tree Resource Analysis and Maintenance Schedule* could potentially help the Town tree care staff advocate for an increased urban forestry budget to fund the recommended maintenance activities**.

As the urban forest grows, the benefits enjoyed by Amherst will increase as well. The Town's forestry program is well on its way to creating a sustainable and resilient tree resource, and can stay on track by setting goals, taking action to reach those goals, updating inventory data to check progress, and revising the original goals in an iterative manner. The Urban Forest Program Continuum, created by DRG and shown in the graphic, can provide guidance on the next steps for Amherst to take in their ongoing mission to provide higher levels of care for the Town's public trees – a mission that will enrich the lives of all who live, work, and recreate in the Town of Amherst.

EVALUATING AND UPDATING THIS PLAN



This *Community Forestry Management Plan* provides management priorities for the next five years. To ensure the maintenance schedule and budget remain accurate, it is important to update the tree inventory using TreeKeeper® or other asset management software as work is completed, so the software can provide updated species distribution, maintenance needs, and benefit estimates. Keeping the inventory up to date empowers the Town to assess its progress over time and set goals to strive toward by following the adaptive management cycle (flow chart, above). Below are some examples of implementing the steps of this cycle:

- Preparing planting plans far enough in advance to schedule and complete stump removal in the designated area, and to select species best suited to the available sites.
- Annually comparing the number of trees planted to the number of trees removed and the number of vacant planting sites remaining, then adjusting future planting plans accordingly.
- Annually comparing the species distribution of the inventoried tree resource with the previous year after completing planting plans to monitor recommended changes in species and genera abundance.
- Scheduling and assigning high-priority tree work so it can be completed as soon as possible instead of reactively addressing new lower priority work requests as they are received.
- Including data collection such as measuring DBH and assessing condition into standard procedure for tree work and routine inspections, so changes over time can be monitored.

URBAN FORESTRY MANAGEMENT IMPLEMENTATION MATRIX & TIMELINES

Introduction

- This section identifies the specific goals and objectives to enhance The Town of Amherst municipal tree program in the coming years. The goals are identified as ongoing, short term (1–3 years for action), medium term (3–5 years), and long term (5+ years). Specific action steps needed to reach each goal are also identified.
- The goals for the Town of Amherst were developed based on the current status of the urban forestry program in the Town.

Goals and Action Steps

Goal	Timeframe	Action Steps
Complete all priority tree maintenance work	1–3 years	Remove elevated risk trees recommended for removal. Prune elevated risk trees recommended for pruning.
Maintain young tree training pruning program as three-year cycle	1–3 years	Secure or set aside necessary funding. Organize volunteer teams that have been successful in prior planting efforts. Train staff on structural pruning techniques.
Develop a mature tree pruning program in a routine pruning cycle	5–8 years	Identify all trees recommended for routine pruning. Update list to include trees after high priority maintenance has been performed.
Maintain planting program	Ongoing	Apply for planting grants. Secure or set aside necessary funding. Consult with Towns for additional assistance. Identify high priority planting locations. Identify suitable planting sites in high priority locations. Hire contractors or train staff on tree planting. Set goals for annual planting (i.e., replace removed trees, x trees annually, x trees by set date, etc.).
Increase tree species and genus diversity	Ongoing	Routinely analyze species and genus composition of the urban forest. Identify species and genera which are overabundant. Update approved planting list and do-not-plant list to correspond to species and genus data. Plant a greater variety of tree species and genera.
Select "Right Tree for the Right Place"	Ongoing	Analyze site conditions before planting and select trees well suited to the site. Select trees which will not outgrow available space at maturity. Create and maintain approved planting lists and do-not-plant lists based on species and genera prevalence and presence of invasive threats.
Create an approved tree species planting list	1–3 years	Modify DRG-provided potential planting list using village information. Distribute list on village websites. Use list to guide tree planting decisions.

Goal	Timeframe	Action Steps
Create and enforce a do-not-plant list	1–3 years	Identify tree species and genera which are overabundant in the Town. Identify tree species which are susceptible to current or future invasive species threats. Identify tree species which are known to be invasive in the area. Create a list of these undesirable species. Use list to guide tree planting decisions. Update list as needed when species and genus distribution shift or as new information on invasive species becomes available.
Compensate for ash decline due to emerald ash borer (EAB).	1–3 years	Remove dead and dying ash trees on public property which pose a hazard. Replant with non-host species.
Update tree inventory	Ongoing	Edit inventoried trees as work is completed. Add new trees as they are planted. Remove or edit trees to stumps or vacant sites as they are removed. Remove or edit stumps to vacant sites as they are removed. Plan to conduct a full re-inventory within the next 8–10 years.
Prepare for future invasive species threats	1–3 years	Draft an invasive species management plan using guidance from this *Community Forestry Management Plan*. Identify likely areas for invasive species establishment. Routinely monitor high-priority areas to identify new invasions early. Manage new invasive species in ways which are cost-efficient, environmentally sound, and socially acceptable. Routinely check with organizations such as the United States Department of Agriculture (USDA) and the Western New York Partnership for Regional Invasive Species Management (PRISM) for updates on invasive species in your area. Increase opportunity for managers to attend local and regional tree care and pest management workshops to stay abreast of changes that might affect the tree resource.
Educate citizens about trees	Ongoing	Provide free presentations or classes during Arbor Day celebrations. Post urban forestry updates to websites. Provide approved tree planting lists and do-not-plant lists. Table or provide educational flyers at public gathering places. Evaluate the use of social media to increase public awareness.

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APPENDIX A
DATA COLLECTION AND SITE LOCATION METHODS

DATA COLLECTION METHODS

DRG collects tree inventory data using a customized ArcPad program, called Rover, loaded onto pen-based field computers. At each site, the following data fields were collected:

- Address
- Condition
- Date of Inventory
- Defects
- Further Inspection
- Growspace
- Multi-stem
- Notes
- Overhead Utilities
- Primary Maintenance
- Risk Rating
- Species
- Tree Size*

* measured in inches in diameter at 4.5 feet above ground or diameter at breast height (DBH]).

Maintenance needs are based on *Best Management Practices: Tree Risk Assessment* (International Society of Arboriculture 2011). The knowledge, experience, and professional judgment of DRG's arborists ensure the high quality of inventory data.

SITE LOCATION METHODS

Equipment and Base Maps

Inventory arborists use CF-19 Panasonic Toughbook® units with internal GPS receivers. Geographic information system (GIS) map layers are loaded onto these units to help locate sites during the inventory. The table to the right lists these base map layers, along with each layer's source and format information.

Base Map Layers Utilized for Inventory

Imagery/Data Source	Date	Projection
Shapefiles NY GIS Clearinghouse –"– Parcel Data Chautauqua County GIS	2018-2019	NAD 1983 StatePlane New York West; Feet
1ft Aerial Imagery NY GIS Clearinghouse	2016	NAD 1983 StatePlane New York West; Feet

STREET ROW SITE LOCATION

Individual street ROW sites (trees, stumps, or planting sites) were located using a methodology that identifies sites by *address number*, *street name*, *side*, *site number*, and *on street*. This methodology was developed by DRG to help ensure consistent assignment of location.

Side values for street ROW sites.

Address Number and Street Name

Where there was no GIS parcel addressing data available for sites located by a vacant lot, or by an occupied lot without a posted address number on a building, the arborist used their best judgment to assign an address number based on opposite or adjacent addresses. An "X" was then added to the number in the database to indicate that it was assigned, for example, "37X Choice Avenue."

Sites in medians or islands were assigned an address number by Rover using parcel and streets geographical data. Each segment was numbered with an assigned address that was interpolated from addresses facing that median/island. If there were multiple median/islands between cross streets, each segment was assigned its own address. The *street name* assigned to a site was determined by street ROW parcel information and posted street name signage.

Side Value and Site Number

Each site was assigned a *side value* and *site number*. Side values include *front*, *side*, *median*, or *rear* based on the site's location in relation to the lot's street frontage. The *front* is the side facing the address street. *Side* is either side of the lot that is between the front and rear. *Median* indicates a median or island surrounded by pavement. The *rear* is the side of the lot opposite of the address street.

All sites at an address are assigned a *site number*. Site numbers are not unique; they are sequential to the side of the address only. The only unique number is the tree identification number assigned to each site. Site numbers are collected in the direction of vehicular traffic flow. The only exception is a one-way street. Site numbers along a one-way street are collected as if the street was a two-way street; therefore, some site numbers will oppose traffic.

A separate site number sequence is used for each side value of the address (*front*, *side to*, *side away*, *median*, or *rear*). For example, trees at the front of an address may have site numbers from 1 through 999; if trees are located on the *side to*, *side away*, *median*, or *rear* of that same address, each side will also be numbered consecutively beginning with the number 1.

PARK AND PUBLIC SPACE SITE LOCATION

Park and/or public space site locations were collected using the same methodology as street ROW sites, however nearly all of them have the "Assigned Address" field set to 'Yes' or 'X' and have the "Park Name" field filled.

i-TREE ECO METHODOLOGY

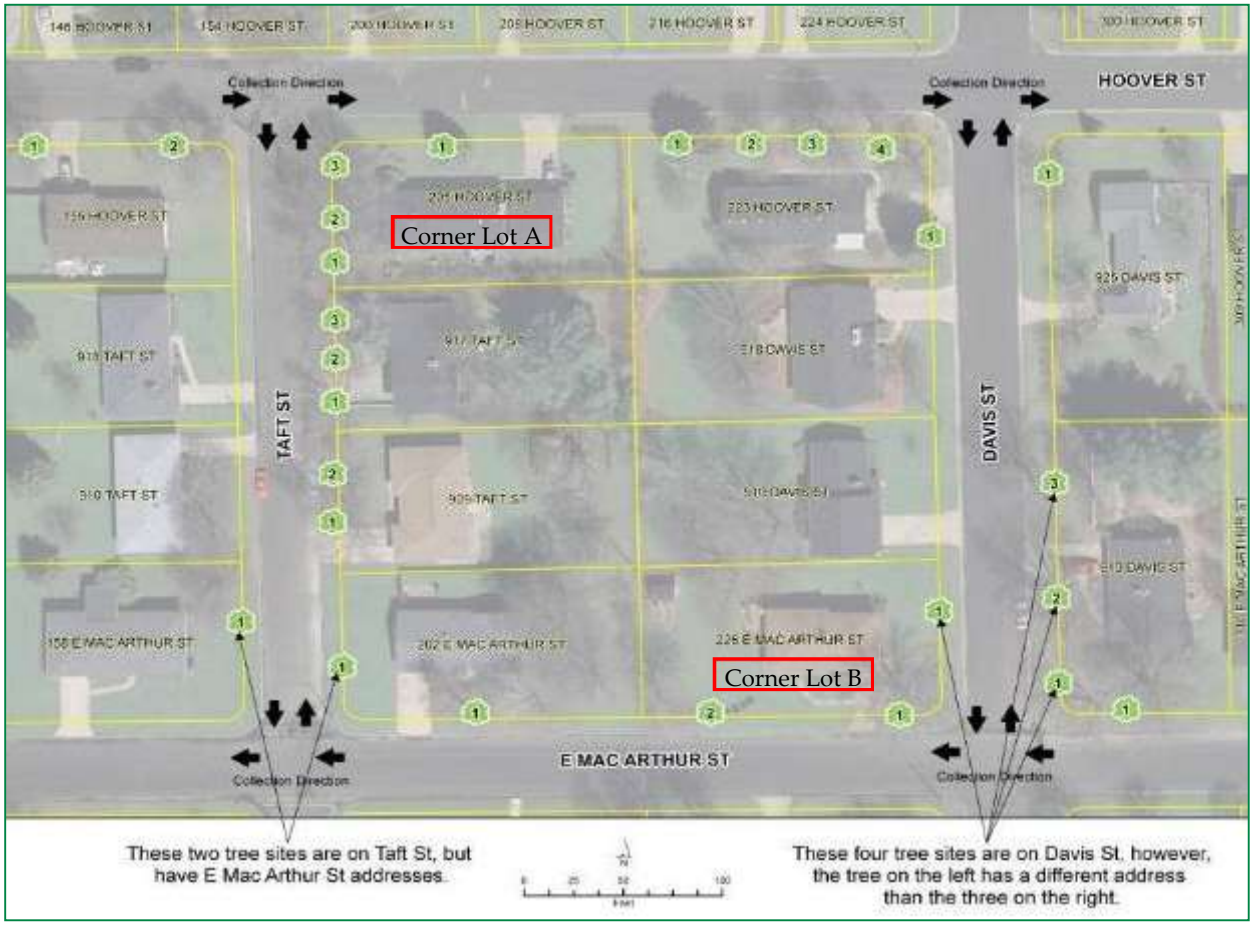
Structural value is a compensatory value calculated based on the local cost of having to replace a tree with a similar tree. In other words, it is a measurement of the value of the resource itself. The structural value of an urban forest is the sum of the structural values of all the individual trees contained within. Monetary values are assigned based on valuation procedures of the Council of Tree and Landscape Appraisers using information on species, diameter, condition, and location (McPherson 2007) and (Nowak et al. 2008).

Carbon sequestration refers to the capture and storage of carbon from the earth's atmosphere. i-Tree Eco analysis reports on the gross annual amount of carbon sequestered as well as the total amount of carbon stored over the lifetime of the tree. For this analysis, carbon storage and sequestration values are calculated at a rate of $171 per ton. Carbon storage is considered both a functional benefit and a structural benefit of trees; the carbon is physically integrated into the wood of the tree.

Air pollution removal refers to the removal of ozone (O_3), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and particulate matter less than 2.5 microns ($PM_{2.5}$). For this analysis, the pollution removal value is calculated based on the prices of $4,322 per ton of ozone, $427 per ton of sulfur dioxide, $952 per ton of nitrogen dioxide, $1,380 per ton carbon monoxide, and $150,053 per ton of particulate matter less than 2.5 microns.

Avoided runoff measures the amount of surface runoff avoided when trees intercept rainfall during precipitation events. Surface runoff from rainfall contributes to the contamination of streams, rivers, lakes, and wetlands by washing oils, pesticides, and other pollutants, either directly into waterways or into drainage infrastructure that ultimately empties into waterways. For this analysis, annual avoided runoff is calculated based on the estimated amount of intercepted rainfall and the local weather in Amherst, where annual precipitation in 2020 equaled 39.1 inches of annual precipitation. The monetary value of avoided runoff is based on the U.S. Forest Service's Community Tree Guide Series at a rate of $0.07 per cubic foot.

Site Location Example



Corner Lot A

Address/Street Name:	205 Hoover St.
Side/Site Number:	Side To / 1
On Street:	Taft St.
From Street:	E Mac Arthur St.
To Street:	Hoover St.
Address/Street Name:	205 Hoover St.
Side/Site Number:	Side To / 2
On Street:	Taft St.
From Street:	E Mac Arthur St.
To Street:	Hoover St.
Address/Street Name:	205 Hoover St.
Side/Site Number:	Side To / 3
On Street:	Taft St.
From Street:	19th St.
To Street:	Hoover St.
Address/Street Name:	205 Hoover St.
Side/Site Number:	Front / 1

Corner Lot B

Address/Street Name:	226 E Mac Arthur St.
Side/Site Number:	Side To / 1
On Street:	Davis St.
From Street:	Hoover St.
To Street:	E Mac Arthur St.
Address/Street Name:	226 E Mac Arthur St.
Side/Site Number:	Front / 1
On Street:	E Mac Arthur St.
From Street:	Davis St.
To Street:	Taft St.
Address/Street Name:	226 E Mac Arthur St.
Side/Site Number:	Front / 2
On Street:	E Mac Arthur St.
From Street:	Davis St.
To Street:	Taft St.

APPENDIX B
INVASIVE PESTS AND DISEASES

In today's worldwide marketplace, the volume of international trade brings increased potential for pests and diseases to be introduced into new habitats. Although some invasive species naturally enter the United States via wind, ocean currents, and other means, most invasive species enter the country with some help from human activities such as plant cultivation, commerce, tourism, and travel.

Once they arrive, invasive pests often grow and spread rapidly because controls, such as native predators, are lacking. Invasive pests can disrupt the landscape by pushing out native species, reducing biological diversity, killing trees, altering wildfire intensity and frequency, and damaging crops, among other actions. Some pests may even push native species to extinction.

Invasive pests and diseases have seriously harmed both rural and urban landscapes and have caused billions of dollars in lost revenue and millions of dollars in cleanup costs. Keeping these pests and diseases out of the U.S. is the number one priority of the USDA's Animal and Plant Inspection Service (APHIS). It is critical to the management of community trees to routinely check APHIS, USDA Forest Service, and other websites for updates about invasive species and diseases in your area so that you can be prepared to identify infestations quickly and manage their spread effectively. Early detection of threats can significantly reduce both the damage caused and the costs associated with management of the invasive species.

The following appendix includes key pests and diseases that are of concern for New York at the time of this plan's development. This list is not comprehensive and may not include all threats.

APHIS, Plant Health, Plant Pest Program Information
- www.aphis.usda.gov/plant_health/plant_pest_info

The University of Georgia, Center for Invasive Species and Ecosystem Health
- www.bugwood.org

USDA National Agricultural Library
- https://www.invasivespeciesinfo.gov/terrestrial/pathogens-and-diseases

USDA Forest Service Eastern Region
- https://www.fs.usda.gov/r9

ASIAN LONGHORNED BEETLE

Adult Asian longhorned beetles and egg sites.

Kenneth R. Law, USDA APHIS PPQ, Bugwood.org

The Asian longhorned beetle (ALB, *Anoplophora glabripennis*) is an exotic pest that threatens a wide variety of hardwood trees in North America. The beetle was introduced in Chicago, New Jersey, and New York City, and is believed to have arrived in the U.S. in wood pallets and other wood-packing material accompanying cargo shipments from Asia.

Adults are large (3/4- to 1/2-inch long) with very long, black-and-white banded antennae. The body is glossy black with irregular white spots. Adults can be seen from late spring to fall depending on the climate, although it is more common to spot damage caused by the beetle than the beetle itself. Common signs of ALB include sunken, softball-sized galleries; circular pencil-sized exit holes; egg sites; and frass. Boring damage from the beetle can eventually cause crown dieback and tree death and predispose the tree to mechanical damage from snow, ice, or wind.

ALB has a long list of host species, including box elder, Norway maple, red maple, silver maple, sugar maple, buckeye, horsechestnut, birch, London planetree, willow, and elm.

BEECH BARK DISEASE

Cankers on a beech caused by beech bark disease.

Linda Haugen, USDA Forest Service, Bugwood.org

Beech bark disease is the result of an insect-fugus complex which begins when a non-native beech scale insect, *Cryptococcus fagisuga*, feeds on the bark of beech trees, creating lesions through which a native canker fungi, *Neonectria* spp., can enter the tree. The scale insect, which is native to Europe, was first introduced to Nova Scotia in the 1890s and has since spread west and south across Canada and the U.S.

Cryptococcus fagisuga is a soft-bodied scale insect which secretes a white wooly wax during the nymph stage which can make infested trees appear to be covered in wool. The insects feed on the bark, leaving punctures through which the nectria canker fungi can enter. 50–85% of infected beech trees will die within 10 years of infestation. Even trees that do not succumb to the disease may be significantly structurally weakened by the nectria cankers and are prone to "beech snap", or trunk failure. Such trees pose a safety hazard within the urban environment.

The beech scale and resulting beech bark disease is found on both American beech and on European beech.

BEECH LEAF DISEASE

Dark stripes between leaf veins are a clear symptom of BLD.

Tom Macy, Ohio DNR Division of Forestry

Beech leaf disease (BLD) was first identified in Ohio in 2012. Since then, it has been found in Pennsylvania, New York, Rhode Island, Connecticut, and Massachusetts and is spreading rapidly.

The disease is caused by a nematode, *Litylenchas crenatae*, which lives within leaf tissue. Early signs of the disease include dark stripes between the veins of leaves, most noticeable when looking up through the canopy on sunny days. As the disease progresses, leaves become withered, curled, or develop a leathery texture and sections of canopy may die back. Infected trees often appear to have a thin canopy, and the disease can lead to tree mortality. Research into this disease is ongoing, and the method of spread and infection, as well as potential treatments, are not yet known. BLD affects all species of beech.

DUTCH ELM DISEASE

Elm exhibiting leaf yellowing and branch dieback due to DED.

Ward Upham, Kansas State University, Bugwood.org

Dutch elm disease (DED) was first found in Ohio in 1930. By 1959 it had killed thousands of elm. Today, DED is present in about two-thirds of the eastern U.S. and kills many of the remaining and newly planted elms annually. The disease is caused by a fungus that attacks the vascular system of elm trees, blocking the flow of water and nutrients and resulting in rapid leaf yellowing, tree decline, and death.

There are two closely related fungi that are collectively referred to as DED. The most common is *Ophiostoma novo-ulmi*, which is thought to be responsible for most of the elm deaths since the 1970s. The fungus is transmitted to healthy elm by elm bark beetles. Two species of beetle carry the fungus: native elm bark beetle (*Hylurgopinus rufipes*) and European elm bark beetle (*Scolytus multistriatus).*

The species most affected by DED is American elm, although other elms may get the disease and survive. Recent genetic manipulation has resulted in many DED-resistant American elm cultivars, such as 'Princeton', 'Valley Forge', and 'Jefferson'.

ELONGATE HEMLOCK SCALE

The elongate hemlock scale (EHS, *Fiorina externa*) was introduced from Japan and was first observed in Queens, NY as early as 1908. This invasive scale insect has been found in 16 states to date, mainly along the east coast of the U.S. It is thought to have been spread widely on infested conifer products, including holiday wreaths and Christmas trees.

EHS covering the undersides of hemlock needles.

Eric R. Day, Virginia Polytechnic Institute and State University, bugwood.org

Adult EHS are encased in white or brown waxy scales. The scales are a visible sign that a tree is infested with EHS, and needle yellowing, especially on lower branches, premature needle drop, and branch dieback are all common symptoms of EHS infestation. While these insects can kill trees outright by siphoning away nutrients and water from the tree, more commonly they weaken hosts, leaving them susceptible to other pests or environmental conditions.

EHS, despite the name, can affect spruce and fir species as well as hemlock.

EMERALD ASH BORER

Emerald ash borer (EAB, *Agrilus planipennis*) is responsible for the death or decline of tens of millions of ash trees in 14 states in the American Midwest and Northeast. Native to Asia, it likely arrived in the U.S. hidden in wood-packing materials commonly used to ship consumer goods, auto parts, and other products. The first official U.S. identification of EAB was in southeastern Michigan in 2002.

Adult beetles are slender and 1/2-inch long. Color varies but adults are usually bronze or golden green overall with metallic, emerald-green wing covers. Common signs and symptoms of EAB infestation include excessive woodpecker activity, 'blonding' (striping of outer bark by woodpeckers), stunted foliage and branch dieback, and characteristic D-shaped exit holes.

The EAB-preferred host tree species are ash, although white fringetree is also susceptible to EAB.

Blonding and damage from woodpeckers going after EAB.

David Cappaert, Bugwood.org

HEMLOCK WOOLY ADELGID

Wooly adelgid casings on a hemlock twig.

Bruce Watt, University of Maine, Bugwood.org

The hemlock woolly adelgid (HWA, *Adelges tsugae*) was first described in western North America in 1924 and first reported in the eastern U.S. in 1951 near Richmond, Virginia. It is now established from northeastern Georgia to southeastern Maine and as far west as eastern Kentucky and Tennessee.

In their native range in eastern Asia, populations of HWA cause little damage to hemlock trees, as they are preyed on by on natural enemies and some tree resistance has evolved with this insect. In eastern North America and in the absence of natural control elements, HWA often causes serious damage and death to trees. Affected trees may have grey or discolored needles, needle loss and branch dieback, and "wooly" tufts of adelgid casing present along the underside of branches near the base of the needles.

All species of hemlock are affected by HWA, but Carolina hemlock and eastern hemlock tend to sustain the most damage.

NEEDLECAST DISEASES

Needle browning and loss caused by a needlecast disease.

USDA Forest Service - North Central Research Station, USDA Forest Service, Bugwood.org

Various fungi, including *Rhizosphaera*, *Lophodermium*, and *Rhadocline*, can cause needlecast diseases. Various species of these fungi are present in locations across the globe and attack many needle-bearing species of tree, causing premature needle drop.

As trees drop infected needles, they may look sparse or thin and branch dieback will occur. Severe and prolonged infections can cause tree death and predispose the tree to other pests and diseases. Fungicide applications can help protect high-value landscape trees, but often trees which succumb to needlecast diseases are already stressed by environmental factors such as drought, heat, or poor planting locations. Improving overall tree health by selecting proper planting sites and keeping trees watered during periods of heat and drought can do much to help prevent needlecast diseases.

Needlecast diseases often affect spruce, pine, fir, and Douglas-fir.

OAK WILT

Oak wilt was first identified in 1944 and is caused by the fungus *Ceratocystis fagacearum*. While considered an invasive and aggressive disease, its status as an exotic pest is debated since the fungus has not been reported in any other part of the world.

Browning of leaves due to oak wilt.

Paul A. Mistretta, USDA Forest Service, Bugwood.org

Oak wilt is caused by a fungus that clogs the vascular system of oak and results in decline and death of the tree. The fungus is carried from tree to tree by several borers common to oak, but the disease is more commonly spread through root grafts. Oak species within the same subgenus (red or white) will form root colonies with grafted roots that allow the disease to move readily from one tree to another.

This disease affects all oak but is most devastating to those in the red oak subgenus, such as scarlet oak, pin oak, and red oak. It may also attack oak in the white oak subgenus, but spreads at a much slower pace in these trees.

RED PINE SCALE

Red pine scale (*Matsucoccus matsumarae*) is a non-native pest species of red pine (*Pinus resinosa*) which was likely introduced to the U.S. on exotic pine brought in for the 1939 New York World's Fair. Today, it is distributed throughout southern New England, New York, New Jersey, and eastern Pennsylvania.

Cottony white masses wedged in the bark is a sign of red pine scale.

Allison Kanoti, Maine Forest Service, Bugwood.org

This scale insect feeds through the bark, leeching nutrients and water from the tree and leading to foliage changing slowly from light green to yellow to red. Symptoms generally appear on individual branches first and gradually spread to the entire crown. Cottony white filaments may be easily visible on branches when infestations are heavy. The feeding of the insects weakens host trees, predisposing them to attack by bark beetles and other pests which, in conjunction with red pine scale, may kill the tree.

As the name suggests, red pine scale affects red pine, Japanese red pine, Japanese black pine, and Chinese pine.

SPONGY MOTH

Spongy moth (*Lymantria dispar*, formerly called European gypsy moth) is native to Europe and first arrived in the United States in Massachusetts in 1869. This moth is a significant pest because its caterpillars will devour the leaves or needles of more than 300 species of trees and shrubs. Spongy moth caterpillars defoliate trees, which makes the host trees vulnerable to diseases and other pests that can eventually kill the tree.

Spongy moth caterpillars can be identified by the blue and red dots along their backs.

John Ghent, John Ghent, Bugwood.org

Males are brown with a darker brown pattern on their wings and have a 1/2-inch wingspan. Females are slightly larger with a 2-inch wingspan and are nearly white with dark, saw-toothed patterns on their wings. Although they have wings, the female of the species cannot fly. Spongy moth is named for the fuzzy, light-brown, spongy-looking egg masses laid by females and easily spotted on tree bark during the winter.

Spongy moth prefers approximately 150 primary hosts but feeds on more than 300 species of trees and shrubs. Many preferred hosts are found among the birch, cedar, larch, poplar, oak, and willow.

SOUTHERN PINE BEETLE

The southern pine beetle (SPB, *Dendroctonus frontalis*) is the most destructive insect pest of pine in the southern U.S. Trees are killed when beetles construct winding egg galleries underneath the bark. These galleries effectively girdle the tree and destroy the conductive tissues that transport nutrients and water throughout the tree. The beetles also carry blue staining fungi on their bodies that clog the water conductive tissues which transport water within the tree. Signs of attack on the outside of the tree include pitch tubes and boring dust, known as frass, caused by beetles entering the tree.

Pitch tube with expelled SPB.

Erich G. Vallery, USDA Forest Service - SRS-4552, Bugwood.org

Infested trees have only recently been found in Massachusetts, but this insect could have significant impacts on pitch pine forests in the state. Other species at risk from SPB include Norway spruce and eastern white pine.

SPOTTED LANTERNFLY

The spotted lanternfly (SLF, *Lycorma delicatula*) is native to China and was first detected in Pennsylvania in September 2014. SLF feeds on a wide range of fruit, ornamental, and woody trees, with tree-of-heaven being one of its preferred hosts. SLF is a "hitchhiker" and can be spread long distances by people who move infested material or items containing egg masses.

SLF congregating on a branch to feed.

Lawrence Barringer, Pennsylvania Department of Agriculture, Bugwood.org

Symptoms of SLF include plants oozing or weeping with a fermented odor, buildup of a sticky fluid called honeydew on the plant or on the ground underneath them, and sooty mold growing on plants. The insects themselves are often easy to spot as well, congregating in large groups on the same tree. Adults have grey upper wings which, when spread, reveal bright red and black lower wings.

Among the many trees impacted by SLF are almond, apricot, cherry, nectarine, peach, plum, apple, maple, oak, pine, poplar, sycamore, walnut, and willow, as well as grape vines and hop plants.

WHITE PINE DECLINE

White pine decline is believed to have developed around 2009 and is affecting eastern white pine throughout the east coast of the U.S. White pine decline is characterized by yellowing or browning needles, premature needle drop, thinning canopies, undersized shoots and needles, resinosis, branch dieback, and whole tree death. However, white pine decline is not the result of a single pest or disease, but rather, a complex of multiple native pests and diseases, spurred on by changing climate.

Eastern white pine exhibiting signs of white pine decline.

UMass Amherst.

White pine needle disease is the primary cause of many of the observed symptoms of white pine decline and is caused by several different fungal pathogens, including *Lecanostica acicula*, *Septorioides strobi*, *Bifusella linearis*, and *Lophophacidium dooksii*. Caliciopsis canker, another component of white pine decline, is facilitated by white pine bast scale. It is believed that increased temperatures and precipitation from May through July, caused by climate change, are boosting the concentration of these pests and contributing to white pine decline. Currently, the best management method for combating this disease complex is to improve white pine vigor through stand thinning, fertilization, and generally reducing stressors on white pines.

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APPENDIX C
RISK ASSESSMENT

Every tree, regardless of defects, condition, location, and other factors, has an inherent risk of whole or partial tree failure. Risk assessment seeks to provide a metric of the level of risk associated with any given tree in order to allow for risk management to be undertaken by a tree manager. The *ANSI A300 (Part 9)* standards and the associated publication *Best Management Practices: Tree Risk Assessment, Second Edition* (ISA 2017) provide an organized, systematic, and reproducible method for assessing tree risk.

Trees can have multiple modes of potential failure with varying levels of risk associated with each. During the inventory, the mode of failure with the greatest associated risk was recorded as the overall risk rating for the tree. The specified time frame for the risk assessment was one year.

Risk ratings can help tree managers set priorities and organize tree work. Generally, trees with higher risk ratings should be maintained or removed first, to lower the risk and liability associated with these trees. It is up to the tree manager to decide what level of risk is acceptable and under what circumstances.

LEVELS OF RISK ASSESSMENT

Arborists assess tree risk using different tools and at different levels of detail. ISA best management practices (BMPs) suggest three levels of risk assessment, from least to most intensive.

Level 1: Limited Visual Assessment

A walk-by or drive-by assessment designed to quickly scan a large population of trees and identify those which need a more advanced assessment due to defects with an imminent or probable likelihood of failure. Level 1 assessments do not result in risk ratings, but rather provide a list of trees which should be assessed at the next level of assessment. This method may be a good option when funding for a full inventory and risk assessment is not available or after major storms when a rapid survey of damage is needed.

DRG arborists conducting a Level 2 risk assessment.

Level 2: Basic Assessment

A detailed, 360-degree visual inspection of individual trees assessing the site, roots, trunk, and branches resulting in a risk rating that can be used to prioritize tree work within a large population of trees. A rapid version of this level of assessment was used during Amherst's inventory.

Level 3: Advanced Assessment

Additional inspection following a Basic Assessment that uses specialized equipment to provide more detailed information about an individual tree, typically to help make management decisions about that specific tree. Advanced assessments may require use of a bucket truck to reach defects in the crown of the tree, equipment and experience to perform sonic tomography to map decay pockets, or sampling of diseased plant tissue for identification in a lab, to name a few examples.

PROCESS OF RISK ASSESSMENT

The primary components of a risk assessment in line with the *ANSI A300 (Part 9)* standards and the ISA's *Best Management Practices: Tree Risk Assessment, Second Edition* are as follows.

Time Frame

Tree risk should be assessed within a specified time frame. Since all trees are likely to experience whole or partial tree failure at some point during their existence, and since conditions of a tree and site can change dramatically over time, setting a specific time frame for risk assessment is essential to conveying risk acurately and determining appropriate management practices. Most risk assessments will have a specific time frame of one to five years. Predictive power decreases as time increases, so assessments are not typically done for more than a five-year period.

Likelihood of Failure

The first step in assessing tree risk involves determing the likelihood that the tree or tree part will fail within the specified time frame. Site factors such as slope, soil texture and saturation, and recent grading or tree removals are considered in tandem with tree factors such as health, species-specific failure profile, damage, and structural defects. The likelihood of failure is then characterized as either:

- *Improbable* – The tree or tree part is not likely to fail during normal weather conditions and may not fail in extreme weather conditions within the specified time frame.
- *Possible* – Failure may be expected in extreme weather conditions, but it is unlikely during normal weather conditions within the specified time frame.
- *Probably* – Failure may be expected under normal weather conditions within the specified time frame.
- *Imminent* – Failure has started or is most likely to occur in the near future, even if there is no significant wind or increased load. This category overrides the stated time frame.

Likelihood of Target Impact

The next step is to determine how likely it is that the tree or tree part in question would impact a target if it fails. This involves consideration of the potential targets located around a tree, which may include fixed structures such as houses or playground equipment with a constant occupancy rate and mobile targets such as people or vehicles with lower occupancy rates, as well as an assessment of where a tree or tree part will land if it fails. The likelihood of target impact is then characterised as either:

- *Very Low* – The chance of the failed tree or tree part impacting the specified target is remote.
- *Low* – There is a slight chance that the failed tree or tree part will impact the target.
- *Medium* – The failed tree or tree part could impact the target, but it is not expected to do so.
- *High* – The failed tree or tree part is likely to impact the target.

Combined Likelihood of Failure & Target Impact

The likelihood of failure and the likelihood of impacting a target are combined using the matrix, below, to determine the likelihood of failure impacting a target.

Likelihood of Failure	Likelihood of Impacting Target			
	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

Consequence of Failure & Target Impact

The consequences of a tree failing and striking a target are a function of the value of the target and the amount of injury, damage, or disruption that could be caused by the failure and impact. Considerations when determining potential consequences include the size of the part which may fail, the fall distance, characteristics of the target, and whether there are any structures which may protect the target. Consequences of failure and target impact are characterised as either:

- *Negligible* – Does not result in personal injury, involves low-value property damage, or disruptions that can be replaced or repaired.
- *Minor* – Involves minor personal injury, low- to moderate-value property damage, or small disruption of activites.
- *Significant* – Involves substantial personal injury, property damage of moderate- to high-value, or considerable disruption of activities.
- *Severe* – Involves serious personal injury, high-value property damage, or major disruption of important activities.

Risk Rating

The combined likelihood of of failure & target impact is then combined with the consequence of failure & target impact in the matrix, below, to produce a risk rating. There may be multiple modes of potential tree failure and multiple targets to consider, and each combination of failure and target will result in a different risk rating. The overall highest risk rating is usually used as the risk rating for the tree.

Likelihood of Failure & Target Impact	Consequences			
	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

Risk Mitigation, Prioritization, and Residual Risk

Once a risk rating is assigned, the final step is to determine whether risk mitigation is necessary and prioritize risk mitigation work. Extreme and High Risk trees should be managed first, followed by Moderate Risk trees as time and budgets allow, or as deemed necessary by the tree manager. Low Risk trees can typically be maintained during routine maintenance cycles or when time and budgets allow.

Risk mitigation can take many forms. Common methods of mitigation include tree removal or pruning to remove parts that may fail. Other forms of mitigation may include cabling and/or bracing weak branch unions, moving targets such as sheds or play equipment outside the anticipated impact zone, excluding targets from the impact zone using fencing or other barriers, and/or monitoring the tree. Ultimately, it is up to the tree manager to decide what mitigation techniques are appropriate for each tree and what level of risk is acceptable.

Residual risk is the risk remaining after mitigation, and considering the residual risk after a mitigation action may help tree managers determine the best actions to take. For example, a tree with a large dead limb over a busy intersection might have a High Risk rating, but removal of that limb would sufficiently mitigate the risk such that the residual risk is low. In this case, it may be best to remove the dead limb but retain the tree. In other cases, there may not be any mitigation option short of tree removal which will reduce risk to an acceptable level, in which case the tree should be removed.

APPENDIX D
SUGGESTED TREE SPECIES

Proper landscaping and tree planting are critical components of the atmosphere, livability, and ecological quality of a community's urban forest. The tree species listed below have been evaluated for factors such as size, disease and pest resistance, seed or fruit set, and availability. The following list is offered to assist all relevant campus personnel in selecting appropriate tree species. These trees have been selected because of their aesthetic and functional characteristics and their ability to thrive in the majority of soil and climate conditions throughout Zone 5 on the USDA Plant Hardiness Zone Map.

DECIDUOUS TREES

Large Trees: Greater than 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Acer rubrum	red maple	Red Sunset®
Acer nigrum	black maple	
Acer saccharum	sugar maple	'Legacy'
*Aesculus flava**	yellow buckeye	
Betula nigra	river birch	Heritage®
Carpinus betulus	European hornbeam	'Franz Fontaine'
*Castanea mollissima**	Chinese chestnut	
Celtis occidentalis	common hackberry	'Prairie Pride'
Cercidiphyllum japonicum	katsuratree	'Aureum'
*Diospyros virginiana**	common persimmon	
*Fagus grandifolia**	American beech	
*Fagus sylvatica**	European beech	(numerous exist)
Ginkgo biloba	ginkgo	(male trees only)
Gleditsia triacanthos inermis	thornless honeylocust	'Shademaster'
Gymnocladus dioica	Kentucky coffeetree	Prairie Titan®
*Juglans regia**	English walnut	'Hansen'
*Larix decidua**	European larch	
Liquidambar styraciflua	American sweetgum	Cherokee™
Liriodendron tulipifera	tuliptree	'Fastigiatum'
Maclura pomifera	osage-orange	'White Shield','Witchita'
*Magnolia acuminata**	cucumbertree magnolia	(numerous exist)
*Magnolia macrophylla**	bigleaf magnolia	
Metasequoia glyptostroboides	dawn redwood	'Emerald Feathers'
Nyssa sylvatica	black tupelo	
Platanus × acerifolia	London planetree	'Yarwood'
*Platanus occidentalis**	American sycamore	
Quercus alba	white oak	
Quercus bicolor	swamp white oak	
Quercus coccinea	scarlet oak	
Quercus ellipsoidalis	northern pin oak	

Large Trees: Greater than 45 Feet in Height at Maturity (continued)

Scientific Name	Common Name	Cultivar
Quercus frainetto	Hungarian oak	
Quercus imbricaria	shingle oak	
Quercus lyrata	overcup oak	
Quercus macrocarpa	bur oak	
Quercus montana	chestnut oak	
Quercus muehlenbergii	chinkapin oak	
Quercus phellos	willow oak	
Quercus robur	English oak	Heritage®
Quercus rubra	northern red oak	'Splendens'
Quercus shumardii	Shumard oak	
Quercus texana	Texas oak	
Styphnolobium japonicum	Japanese pagodatree	'Regent'
Taxodium distichum	common baldcypress	'Shawnee Brave'
Tilia americana	American linden	'Redmond'
Tilia cordata	littleleaf linden	'Greenspire'
Tilia tomentosa	silver linden	'Sterling'
Ulmus parvifolia	Chinese elm	Allée®
Zelkova serrata	Japanese zelkova	'Green Vase'

Medium Trees: 31 to 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Aesculus × carnea	red horsechestnut	
Cladrastis kentukea	American yellowwood	'Rosea'
Eucommia ulmoides	hardy rubbertree	
Koelreuteria paniculata	goldenraintree	
Ostrya virginiana	eastern hophornbeam	
Parrotia persica	Persian parrotia	'Vanessa'
Phellodendron amurense	amur corktree	'Macho'
Prunus maackii	amur chokecherry	'Amber Beauty'
Prunus sargentii	Sargent cherry	
Quercus acutissima	sawtooth oak	
Quercus cerris	European turkey oak	
Sorbus alnifolia	Korean mountainash	'Redbird'

Small Trees: 15 to 30 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Acer buergerianum	trident maple	Streetwise®
Acer campestre	hedge maple	Queen Elizabeth™
Acer cappadocicum	coliseum maple	'Aureum'
Acer ginnala	amur maple	Red Rhapsody™
Acer griseum	paperbark maple	
*Acer pensylvanicum**	striped maple	
Acer truncatum	Shantung maple	
*Aesculus pavia**	red buckeye	
Amelanchier arborea	downy serviceberry	(numerous exist)
Amelanchier laevis	Allegheny serviceberry	
Carpinus caroliniana	American hornbeam	
Cercis canadensis	eastern redbud	'Forest Pansy'
Chionanthus virginicus	white fringetree	
Cornus kousa	Kousa dogwood	(numerous exist)
*Cornus mas**	corneliancherry dogwood	'Spring Sun'
Corylus avellana	European filbert	'Contorta'
*Cotinus coggygria**	common smoketree	'Flame'
*Cotinus obovata**	American smoketree	
Crataegus phaenopyrum	Washington hawthorn	Princeton Sentry™
Crataegus viridis	green hawthorn	'Winter King'
*Franklinia alatamaha**	Franklinia	
Halesia tetraptera	Carolina silverbell	'Arnold Pink'
*Magnolia × soulangiana**	saucer magnolia	'Alexandrina'
*Magnolia stellata**	star magnolia	'Centennial'
*Magnolia tripetala**	umbrella magnolia	
*Magnolia virginiana**	sweetbay magnolia	Moonglow®
Malus spp.	flowering crabapple	(disease resistant only)
Oxydendrum arboreum	sourwood	'Mt. Charm'
Prunus subhirtella	Higan cherry	pendula
Prunus virginiana	common chokecherry	'Schubert'
Styrax japonicus	Japanese snowbell	'Emerald Pagoda'
Syringa reticulata	Japanese tree lilac	'Ivory Silk'

Note: * denotes species **not** recommended for use as street trees.

CONIFEROUS AND EVERGREEN TREES

Large Trees: Greater than 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Abies balsamea	balsam fir	
Abies concolor	white fir	'Violacea'
Chamaecyparis nootkatensis	Nootka falsecypress	'Pendula'
Cryptomeria japonica	Japanese cryptomeria	'Sekkan-sugi'
Ilex opaca	American holly	
Picea omorika	Serbian spruce	
Picea orientalis	Oriental spruce	
Pinus densiflora	Japanese red pine	
Pinus strobus	eastern white pine	
Pinus sylvestris	Scotch pine	
Psedotsuga menziesii	Douglasfir	
Thuja plicata	western arborvitae	(numerous exist)
Tsuga canadensis	eastern hemlock	

Medium Trees: 31 to 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Chamaecyparis thyoides	Atlantic whitecedar	(numerous exist)
Juniperus virginiana	eastern redcedar	
Pinus bungeana	lacebark pine	
Pinus flexilis	limber pine	
Thuja occidentalis	eastern arborvitae	(numerous exist)

Small Trees: 15 to 30 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Ilex × attenuata	Foster's holly	
Pinus aristata	bristlecone pine	
Pinus mugo mugo	mugo pine	

Dirr's Hardy Trees and Shrubs (Dirr 2013) and *Manual of Woody Landscape Plants (5th Edition)* (Dirr 1988) were consulted to compile this suggested species list. Cultivar selections are recommendations only and are based on DRG's experience. Tree availability will vary based on availability in the nursery trade.

April 2023

Planting Plan

Town of Amherst, New York

Prepared for:

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APPENDIX

A. Recommended Species for Future Planting

ACKNOWLEDGMENTS

This project supports the Town of Amherst's vision to promote and enhance community well-being through public tree conservation and improved forestry management practices. This *Community Forestry Management Plan* offers expert recommendations for preserving and expanding urban canopy so the environmental, economic, and social benefits it provides continue for generations.

Amherst is thankful for the grant funding it received from the New York State Department of Environmental Conservation in cooperation with U.S. Forest Service through its Urban and Community Forestry (U&CF) Grant Program. The U&CF Grant Program is designed to encourage communities to create and support sustainable urban forestry programs throughout the United States. In addition, the Town would like to thank the following individuals:

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INTRODUCTION

The street and public space trees of the Town of Amherst, New York are an integral part of the Town's infrastructure, no less than its streets, utilities, and sidewalks. Planting trees is a major investment; however, unlike other components of urban infrastructure, the public tree population will increase in value as trees mature, provided that new trees are planted to replace removed trees and proactive maintenance is performed to improve overall condition over time.

Urban trees provide benefits to the community which can far exceed the time and money invested in their planting, pruning, protection, and removal. Trees help improve air and water quality, provide shade and windbreaks, which reduce energy costs, and help reduce stormwater runoff and erosion. Trees also provide an array of psychological and social benefits, including reduced stress and mental fatigue, increased recreational opportunities, and enhanced community pride. The Town of Amherst recognizes these benefits and has held the Arbor Day Foundation's Tree City USA status for over 23 years with the intention of maintaining and growing the community's urban forest.

Despite the importance of trees to a community, maintaining the urban forest can be a challenge. The numerous threats to urban trees, including invasive species, development, and difficult growing conditions, can lead to decreased canopy coverage and increased management costs. This planting plan can help the Town offset these losses by proactively increasing the Town's stocking level and species diversity.

STATEMENT OF PURPOSE

The purpose of this *Public Tree Planting Plan* is to provide guidelines for the implementation of an organized public tree planting effort within the Town of Amherst, New York. As stated in the Town's local law, section 179-1 of the subdivision regulations, The Town of Amherst recognizes that there is a direct and important relationship between the existence of trees in the Town and the health, safety, and welfare of the community. Given the environmental, economic, and aesthetic importance of woodlands and trees to the community, it is the Town's goal to improve and enhance existing tree canopy cover by promoting tree plantings on public and private lands. The public tree inventory and subsequent *Community Forestry Management Plan* prepared by Davey Resource Group, Inc. "DRG" in 2023 provides information on suitable planting locations along with general recommendations on the size and species of trees for each site. This Planting Plan, in turn, provides specific and in-depth guidelines for the future plantings, allowing for more effective use of funds and more accurate budget projections. Implementation of this planting plan will aid in increasing canopy cover and species diversity within the Town of Amherst.

The 2023 Town of Amherst tree inventory identified a total of 2,072 potential vacant planting sites— 2,050 in the Town's ROW and 22 in the Town's parks. There were 479 vacant sites identified as "do not replace", as they did not meet the Town's tree planting specifications. The identification and analysis of these sites will inform future development of the Town of Amherst's urban forest and community. Data analysis of site density and distribution will allow the Town to target planting efforts in geographic locations that maximize community benefits.

Vision

The Town of Amherst is committed to increasing tree canopy cover throughout the Town by preserving woodlands, street, and park trees where possible and by actively encouraging tree plantings on public and private lands. The Town of Amherst will use a systematic and organized approach to planting which will allow the Town to replace trees which must be removed due to poor condition or development pressures, increase the tree canopy over time, and improve the survivability of new plantings through appropriate follow-up care during establishment and early growth. The Town will focus on:

- Diversifying new plantings to reduce the damage caused by insects and diseases.
- Planting large-stature trees, where possible, to maximize the benefits provided by the urban forest.
- Planting in key locations where the impacts of greater canopy cover will be most beneficial to the citizens of Town.

UNDERSTANDING POTENTIAL PLANTING SITES AND PARAMETERS

Potential planting sites, also called "vacant sites", are located by street and address. The sites are defined as areas suitable for tree planting within the existing ROW, as defined above. The size of each site is determined by the growing space available and are spaced accordingly. The following specifications are a combination of DRG's planting protocols and the Town's Chapter 179, Article VI Tree laws.

- *Small Vacant Sites:* The smallest dimension of the planting site is between 3 to 5 feet; 20 feet is kept between existing infrastructure or surrounding trees.
- *Medium Vacant Sites:* The smallest dimension of the planting site is between 6 to 8 feet; 30 feet is kept between existing infrastructure or surrounding trees.
- *Large Vacant Sites:* The smallest dimension of the planting site is 8 feet and greater; 40 feet is kept between existing infrastructure or surrounding trees.

Planting site parameters are determined based on an original agreement utilizing the experience from Town of Amherst personnel and DRG Inventory Urban Foresters. Some of these parameters are:

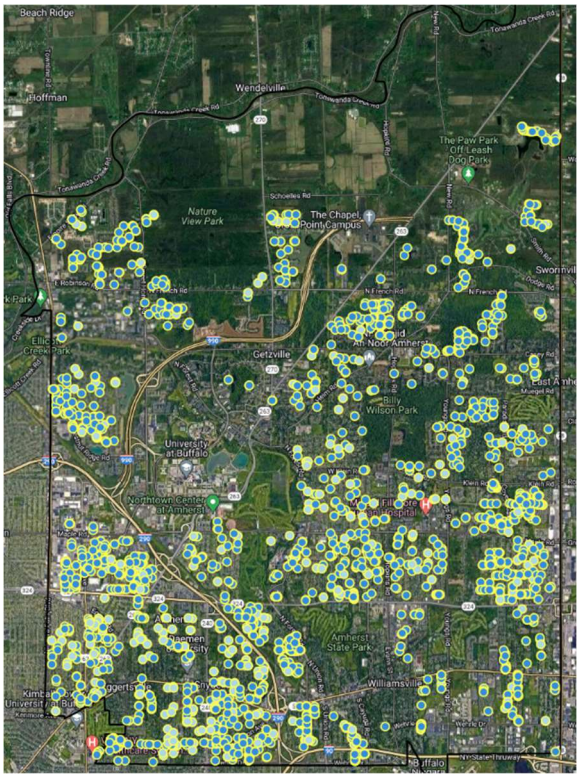
- No planting of a tree within 40 feet of any intersection or crosswalk.
- No planting of a tree within 100 feet of any stop signs.
- No planting of a tree within 10 feet of any fire hydrant.

- No planting 25 feet from streetlight.
- No planting within 2 feet from gas, electric, water pipe, or valve.
- No planting withing 4 feet from Oil Fill Pipe.
- Trees should maintain 20 to 30 feet apart depending on species.
- Sites should not obstruct important traffic signs.
- Sites should not obstruct major road signage.
- Clear vision shall be maintained on corner lots.

The overall landscape and existing planting scheme were also considered for the spacing and sizes of recommended planting sites. Where any types of overhead utility wires exist, planting sites are recorded as small, regardless of the available growing space. The growing space size can be a limiting factor of the growth and natural habit of trees and dictates which species are suitable for any given site. It is most beneficial ecologically and economically to plant the largest tree possible in each site.

Priority Planting by Inventoried Sites

The Town of Amherst's tree inventory identified a total of 2,072 vacant planting sites, comprised of 479 large vacant sites, 1,224 medium vacant sites, and 369 small vacant sites (see Map 1).

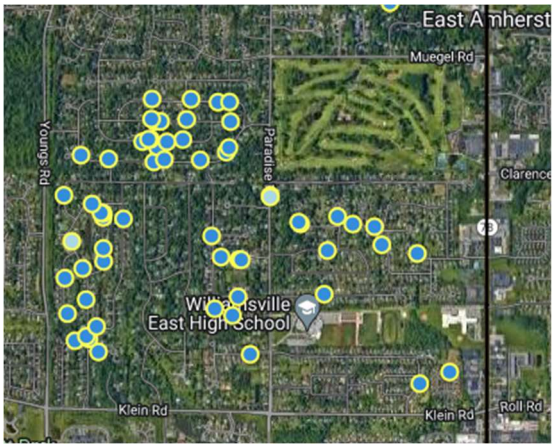


Map 1. Recorded vacant planting sites in the Town of Amherst, NY

Priority areas should include locations with many people but relatively low tree cover. Generally, these are areas with a high density of vacant planting sites. Performing group plantings in areas with a high density of vacant sites will help save costs through increased operational efficiencies during installation and will also help maximize benefits to the community and the urban forest.

The Town of Amherst can further narrow down priority areas by focusing on communities that have many large vacant planting sites. Over the life of the tree, large trees are more economical to plant. Research by Geiger (2003) found that the benefits provided by large trees can outweigh the costs of maintaining them by eight to one. By focusing on planting large stature, broadleaf trees, the Town will increase tree cover and maximize socioeconomic and environmental benefits. An example of such areas is displayed in Maps 2 and 3 below.

Map 2. Concentration of 39 large vacant planting sites in central west neighborhood in Amherst, NY

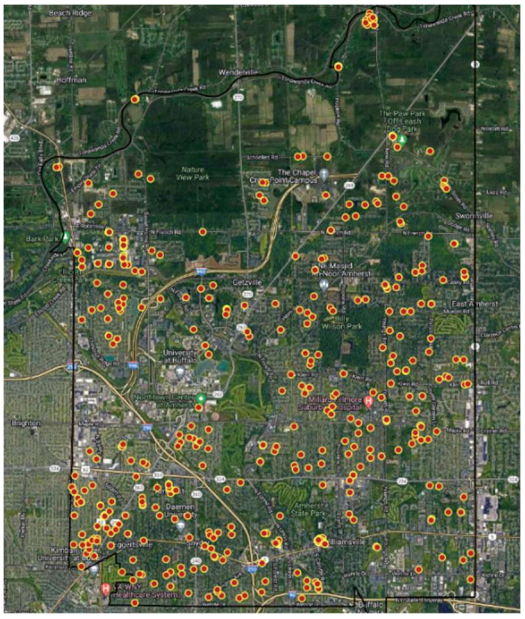


Map 3. Concentration of 61 large vacant planting sites in central east neighborhood in Amherst, NY

The trees inventoried cover approximately 482.7 acres of the Town of Amherst, NY and provide 5.072 square miles of leaf area. The Town of Amherst can get a more detailed understanding of the amount and distribution of tree canopy cover in each community by performing an urban tree canopy assessment. A canopy assessment will allow the Town to strategically set goals and targets to increase canopy cover by prioritizing urban tree canopy projects that achieve the highest return on investment.

Stumps

Within the public tree inventory of the Town of Amherst, 510 stumps were identified (see Map 4). Based on the inventory findings, trees recommended for removal with high or moderate risk ratings should be removed as soon as possible and replaced as much as possible. Stump removals, however, because of the lower risk, should be spread out over time as costs allow. Once removed, these areas can be used as tree planting sites.



Map 4. Recorded stumps in the Town of Amherst, NY

Suggested Species Characterization

A list of suggested species is provided in the management plan and is meant to be a guideline for selecting which species to plant during future street tree plantings. The suggested species have been categorized by mature height classes (small, medium, and large) that match the potential planting site size designations. The size of the site refers to the mature size of a tree suitable to be planted in that particular site. Selecting trees from this list will help to ensure that appropriately sized trees are planted in a site suitable to sustain the tree's natural habit. The Town of Amherst's suggested tree species list can be found in Appendix C.

PLANTING CONSIDERATIONS

Site Characteristics and Species Selection

Proper site evaluation, planning, and execution can result in a more resilient urban forest. The site characteristics need to be taken into consideration before a tree species is selected. "The Right Tree in the Right Place" is a mantra for tree planting used by the Arbor Day Foundation and many utility companies nationwide. Trees come in many different shapes and sizes, and often change dramatically over their lifetimes. Some grow tall, some grow wide, and some have extensive root systems. It is necessary to visit a site location before choosing a tree species. Planting sites have unchangeable characteristics that will limit the type of species that can grow and thrive in that location. Important site characteristics that should be considered include:

1. *Hardiness Zone: Plant tree species that thrive in the Town's hardiness zone.* The zones are determined by the average annual minimum temperature for each area. The Town of Amherst occurs in Zone 6a of the USDA Hardiness Zone Map, which identifies the climatic region where the average annual minimum temperature is between -10 to 0 (F). It is important to choose species that are adapted to the region's seasons. Lists of species based on this Hardiness Zone are provided in Appendix C

2. *Soils:* The soil will impact the type of tree that can be planted at the location. The soil pH, particle size (sand, silt, clay), soil moisture retention, soil salinity, soil compaction, and percent organic matter will all influence the survivability of the planted tree. Soil should be tested before selecting a species. Be sure that the soil used at planting is suitable for the chosen species.
3. *Site Conditions:* Take note of the direction the planting site faces. North or east aspects are generally cooler, moister, and shadier than south and west aspects. Certain species can grow in full sun, while others are more shade tolerant. Another important site characteristic is irrigation and position. Certain planting locations receive more water and may have constant moisture, while others are consistently dry. It is important to plant either flood-tolerant or drought-tolerant species in those locations. Trees near the water may also need to be tolerant to be salt tolerant.
4. *Site Traffic:* The level of vehicular or foot traffic should be noted. Hardier species will need to be planted in areas that experience high levels of vehicle and pedestrian use.
5. *Neighborhood:* Determine if the neighborhood is industrial, residential, or landscaped.
6. *Surrounding infrastructure:* It is best to account for all possible interferences the tree may encounter over the course of its life. Any buildings, traffic lights, stop signs, surrounding trees, overhead powerlines, and underground utilities should be noted.

It is important to evaluate existing trees in the surrounding area to see which trees are doing well and which are stressed or in poor condition. While no two sites are exactly alike, it may provide some insight into the type of species that should be encouraged or avoided in that planting location. Another important consideration is to avoid over-planting a single species. Low species diversity can lead to severe losses in the event of species-specific epidemics. The ideal distribution for a tree population should follow the 10-20-30 rule for species diversity: a single species should represent no more than 10% of the population, a single genus no more than 20%, and a single family no more than 30% of the population.

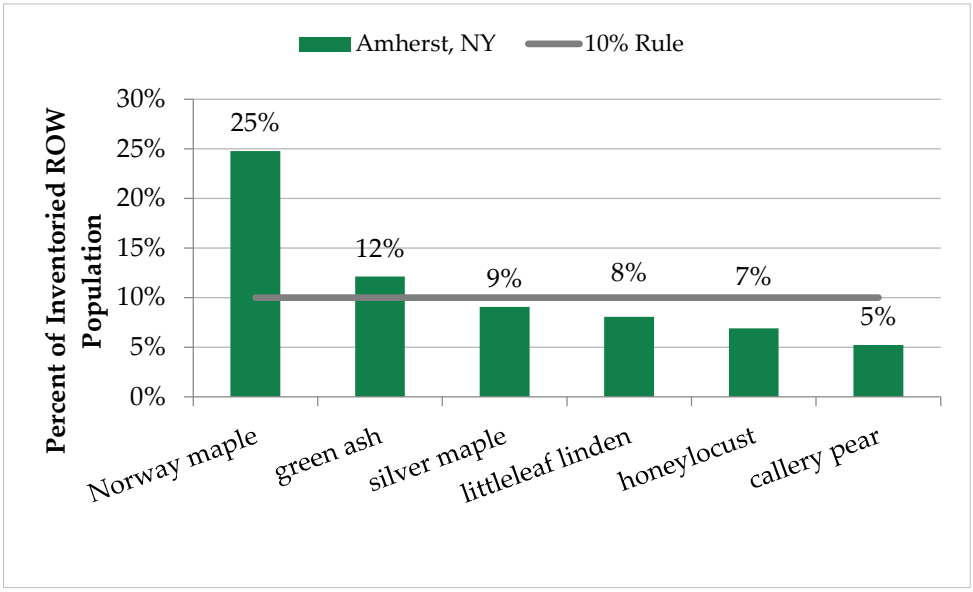


Figure 1. Five most abundant species among the inventoried trees and the 10% rule.

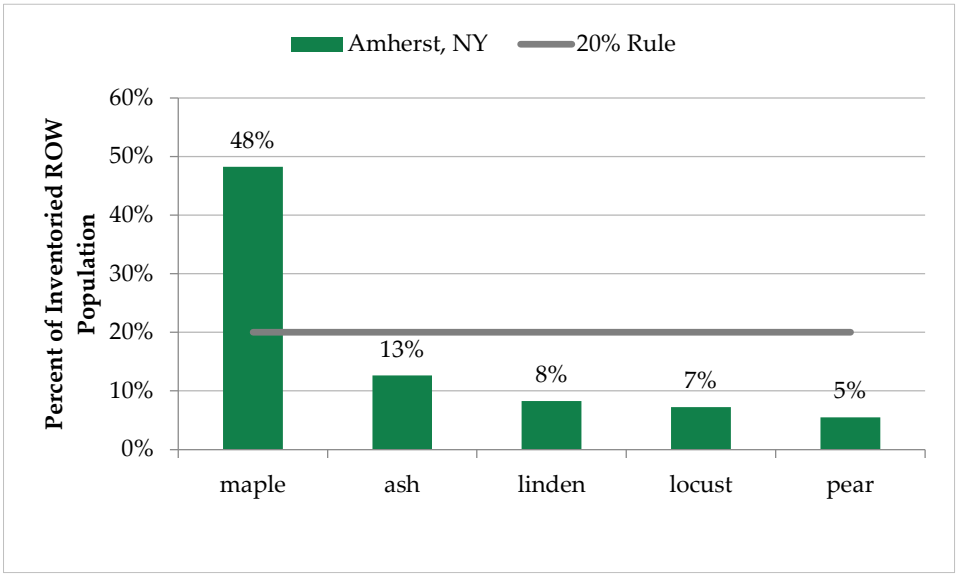


Figure 2. Five most abundant genera among the inventoried trees and the 20% rule.

In the Town of Amherst, on the species level, Norway maple is the most abundant species, comprising 25% of the population, followed by green ash at 12%. All other species make up less than 10% of the inventoried trees. At the genus level, maple comprise 48% of the tree population, which means that almost half of the inventoried trees are of the maple genus. Maple are susceptible to invasive pests, including Asian longhorned beetle, spotted lanternfly, and winter moth, making the Town of Amherst susceptible to significant canopy loss in the event of an infestation.

A list of species suitable for the climate of Town of Amherst is included in Appendix C. Trees on this prospective planting list have been selected based on their maintenance requirements, adaptability to specific planting sites, and suitability to the restrictive conditions of the urban environment. The list is sorted by mature tree size and suitability for park versus street locations. The Town should focus on planting species outside of the maple genus for the foreseeable future until the species distribution is more favorable. The Town should focus on high-quality tree species that can tolerate the local site conditions.

FIVE-YEAR PLANTING PLAN

This chapter details the activities that will constitute the Five-Year Planting Program for the Town of Amherst. Headings in this chapter include:

- Developing an Effective Planting Program.
- Young Tree Training Program.
- Five-Year Planting Plan and Budget.

Stocking Potential

The potential tree population of the inventoried sites is 56,852 trees which includes 2,072 vacant planting sites and 511 stumps. This means that the Town of Amherst's urban forest (excluding park/public space trees) is 90% stocked. Stocking is a traditional forestry term used to measure the density and distribution of trees. This means that, of the total number of sites in the public ROW, 90% currently have a living tree present. DRG generally recommends that the urban forest be at least 90% stocked so that no more than 10% of the existing planting sites remain vacant. The Town meets that goal and should make every effort to maintain a high stocking level.

Full Stocking Potential

Full tree stocking can be an elusive goal, since mortality of young and old trees continues to make planting sites available. Nevertheless, it is worth the effort because working toward full stocking can help make other less glamorous aspects of urban forestry more palatable, especially removals.

The Town of Amherst has a stocking level of 89%. With a total of 2,072 vacant planting sites over a 5-year period, and 511 stumps, the Town of Amherst would reach its full stocking potential of 100% stocked in five years following the desired planting schedule of 516 trees per year. This goal, however, assumes that no trees are removed, no new streets are added, and all of the new plantings survive. A more accurate formula for determining the planting rate *for such a goal comes from the textbook Urban* Forestry: Planning and Managing Urban Greenspaces by Robert W. Miller (1997) and is written as:

$$N = \frac{R + (V/G)}{S}$$

Where:

N = number of trees to be planted annually

R = number of trees to be removed annually

V = existing vacant sites

G = years remaining to achieve full stocking potential goal

S = expected planting survival rate

For example, the Town of Amherst has 2,551 available planting sites scattered throughout its existing ROW. If it is known that an average of 748 trees per year will be removed (this number is based on the Five-Year Urban Forestry Management Program budget, the average number of Removals in Years 1 through 5) and the planting survival rate over that period is 85%, the Town will achieve full stocking in approximately 5 years if it follows its current planting plan of 1,480 trees per year:

$$N = \frac{748 + (2{,}551/5)}{0.85} = 1{,}480 \text{ trees/year}$$

Procuring Plant Material

Good quality trees establish more quickly, are less likely to experience significant transplant shock, and live longer in the landscape. To ensure quality material, the Town Forester should visit the local nursery and inspect trees prior to purchase. The buyer should perform a 360-degree inspection of the stem, branches, and roots. Shade trees should have one dominant trunk and major branches should not touch. All branches should be less than $\frac{2}{3}$ trunk diameter.

The tree wrap should be removed from the stem so that the trunk can be inspected for hidden wounds. On balled and burlapped (B&B) trees, ensure the root balls are intact and the minimum root ball sizes for tree caliper are in accordance with the American National Standards and Standards for Nursery Stock. Adhering to these standards will help with tree survivability. The table below is the suggested height range and minimum root ball diameter by caliper size in the *American Standard for Nursery Stock, Z-60.1*.

Table 1. Suggested Height Range and Minimum Root Ball Diameter by Caliper Size

Caliper Size	Average Height Range	Minimum Root Ball Diameter	Minimum Root Ball Depth
2 in.	12 to 14 ft.	24 in.	14 in.
$2\frac{1}{2}$ in.	12 to 14 ft.	28 in.	17 in.
3 in.	14 to 16 ft.	32 in.	19 in.
$3\frac{1}{2}$ in.	14 to 16 ft.	38 in.	23 in.
4 in.	16 to 18 ft.	42 in.	25 in.
$4\frac{1}{2}$ in.	16 to 18 ft.	48 in.	29 in.
5 in	18 ft. and up	54 in.	32 in.

The area where the topmost roots meet the trunk, referred to as the root collar or root flare, should be visible. If the root flare is buried, the topmost roots are not receiving enough oxygen. This can cause root decay, especially if the tree is planted in an area with heavy irrigation. Buried root flares can also cause stem girdling roots. If the trunk emerges from the soil like a telephone pole, remove the excess soil away from the base of the trunk to expose the root flare. If possible, it is best not to purchase trees that were planted too deeply.

The representative buyer for Town of Amherst should reject any tree with a particular defect that cannot be easily corrected, and any tree that exhibits signs of pests or pathogens. If the trees are to be delivered directly from the nursery without prior inspection, the Town of Amherst should have a signed written agreement with the nursery that the trees will be inspected upon delivery with the right to reject trees with obvious defects.

The Tree Planting Process

Tree planting should follow the guidelines provided in the International Society of Arboriculture *(ISA) Best Management Practices - Tree Planting, Second Edition (2014)* and the associated ANSI A300 Part 6 documents. The standards outline the most up-to-date knowledge on tree planting practices that help increase survivability in transplanted trees. For more detailed accounts on planting procedures, the documents can be purchased for $15 each on the ISA website.

Step 1. Digging the Hole

The depth of the planting hole is determined by the depth and firmness of the root ball. The depth should be measured at the base of the root flare to the bottom of the ball. The soil at the bottom of the planting site should be firm enough to prevent soil settling. Planting holes should be dug 1.5 to 2 times wider than the root ball. Ensure surrounding soil is not compacted, as this will prevent future root spread.

Step 2. Installing the Tree

For balled and burlapped material, place the tree in the hole by lifting and carrying it by the root ball so that the ball will not be loosened. A forklift with nursery jaws may be needed for larger caliper material. Set the tree straight and in the center of the planting site. Cut and remove rope or wire from at least the top 2/3 of the root ball and remove as much as the burlap and twine as possible. The more wire and burlap removed, the better. The tree shall be installed so that the trunk or root flare is flush with the finished grade after soil settling has taken place. Any obvious circling or girdling roots should be pruned at planting.

Step 3. Backfilling the Hole

In landscaped areas, with good quality soil, the hole should be backfilled with the soil originally removed from the hole. In industrial and heavily trafficked areas, soil may need to be replaced with more nutrient-rich, uncontaminated soil. If uncertain, soil testing is recommended. The hole should be backfilled in stages, watering in between filling, to help soil settle and prevent large air pockets which may cause the tree to tilt after planting. In particularly dry areas, building a berm of soil in a circle around the planting hole can help retain water when it rains. At no point should the topsoil be touching the trunk of the tree. The root flare should remain visible after backfilling.

Step 4. Mulching

Applying a layer of mulch to the surface of all planting sites helps protect tree roots from weather extremes, ameliorates water retention, and suppresses competition from weeds. The use of a natural forest product, such as shredded bark or wood chips, also helps with a steady nutrient supply as the material decomposes over time. Be sure that the mulch is natural in color and not dyed. Mulch should be applied at a depth of three to four inches at the time of planting. The mulch should be spread on the perimeters of the planting site, with little to no mulch on top of the root ball itself. This is to ensure roots are receiving adequate water. Mulch should not be touching the base of the tree. Contact with the stem creates moisture pockets, which can harbor fungi and bacteria.

Step 5: Staking

The need to stake trees is dependent on the ability of the tree to stand up on its own and the location of the planting. Once the tree can stand on its own and the root ball is anchored, stakes should be removed. Generally, stakes should be removed after one year. Stakes should be attached to the tree with loose, flexible material such as ArborTie. Staking materials should be removed within a year of tree installation. Leaving staking materials on a tree for prolonged periods of time can result in stem girdling and poorly developed stem taper and root systems due to decreased sway in the wind. If staking materials must be left for more than a year, they should be checked biannually to ensure they are not girdling the tree.

Step 6: Watering

Consistent watering in the first growing season is crucial for successful tree establishment. Newly planted trees should receive 3 gallons per inch of trunk diameter, 2 to 3 times per week, for the first growing season. As the tree becomes established, the volume should increase but the frequency can be diminished. The tree should be watered on a weekly basis in the second growing season and on a bi-monthly basis in the third growing season. By year four, the tree's root system should be adequately established. Watering bags may help provide a consistent source of water released slowly over time but must be installed correctly and checked to ensure they are releasing water.

YOUNG TREE TRAINING PROGRAM

The Town of Amherst has 13,808 young trees that can be put on an early pruning schedule to create a strong structure and improve the overall health and appearance of the trees. These include young trees under 10" DBH. Any new trees planted in the Town of Amherst should be included in the YTTP. The Town of Amherst's Tree Board is encouraged to reach out to local volunteer groups to set up a tree care program that is carried out on an annual basis. They should coordinate with the parks department, local garden clubs, local schools, or businesses to schedule tree training days. A certified arborist, either from parks or the tree board, or hired on a per day basis, should be present to train the volunteers and guide them as they prune the young trees. Tree training does not apply to multi-stem trees and evergreen trees.

Guidelines on Young Tree Training

Equipment needed:

- Hand pruners for branches up to 3/4 inch wide.
- Hand Saw for branches up to several inches wide.
- Pole pruner or reach pruner for branches higher in the canopy.
- Gloves and safety glasses.

It is important that the tools are sharp and clean before pruning begins.

Training Schedule

Suggested Minimum Pruning Cycle
At planting
Year 2 or 3
Year 5 or 6
Year 8 to 10

The Young Tree Training Program should be put on a three-year cycle. One third of the Town's young trees can be trained each year. In year 8 or 10, the tree will likely require minimal pruning.

Time of Pruning

Pruning in the winter months while the tree is dormant is recommended. Pruning in the winter and early spring, prior to bud break, encourages new growth, while summer pruning slows growth.

Location of Pruning Cut

At the base of each branch, where the branch meets the stem of the tree, you will find overlapping branch and trunk wood. This swollen section is referred to as the branch collar. If the tree is less than 2 inches in diameter, the branch collar may not yet be visible.

Right above the branch collar, where the branch and trunk connect (usually making a V shape), is the branch bark ridge. This area is a unique barrier, known as the branch protection zone. This section holds chemical properties that help seal off the wound to reduce the spread of decay into the trunk.

When removing a branch, it is important to make the cut just to the outside of the branch collar. Leaving the branch collar intact will ensure the tree is equipped to defend itself against potential pests invading the open wound.

Reduction cuts, which reduces the size of the branch, should always be made at the nodes of the branch.

How to Prune Young Trees

Step 1. Perform a 360-degree inspection around the tree and assess the overall form and structure of the tree.

Step 2. Remove all broken, dying, diseased, and dead branches.

Step 3. Select a leader and cut back or subordinate any competing leaders. The leader is the central stem of the tree; follow the stem from bottom to top and carefully identify the leader. The most upright, vertical branch is a good candidate.

Step 4. Select the lowest permanent branch and loosely tie with flagging tape. Branches don't grow up the tree as the tree matures; therefore, any branch on a young tree will remain at the same height years later. The Town should determine an acceptable clearance height and select the lowest branch at that height. The lowest branch should be healthy, well attached, and not more than half the size of the stem.

Step 5. Select scaffold branches and remove or reduce competing branches. Ensure the scaffold branches are well attached, less than half the diameter of the main stem, and well spaced, both vertically and radially. Walk around the tree and determine which are good candidates for scaffold branches. Tie loose flagging tape around selected branches to help gain a visual of the tree after pruning. Prune any branches with included bark, crossing branches, or branches too close to the chosen scaffold branch. Small branches should remain between the larger scaffold branches if present.

Step 6. Select temporary branches below the lowest permanent branch. Temporary branches will eventually be removed as the tree grows but are important to retain when the tree is young. Vigorous temporary branches can be reduced, or pruned back, to slow the grow. The temporary branches can be removed in year 4, when the tree has fully established.

Young Tree Training Program Budget

The cost per tree is estimated based on volunteer groups participating in the training program. The cost assumes the hiring of a certified arborist to train and guide volunteers, as well as the equipment cost associated with the program, divided by the number of trees trained per year. Year 3 has double the number of trees because trees trained in Year 1 need to be pruned again in Year 3.

Table 2. Young Tree Training Budget for First Five Years of Program

Activity Cost		Year 1		Year 2		Year 3		Year 4		Year 5	
Activity Cost	Cost/tree	Count	Cost	Count	Cost	Count	Cost	Count	Cost	Count	Cost
Young Tree Training Program (3-year Cycle)	$3	2,761	$8,283	2,761	$8,283	5,522	$16,566	5,522	$16,566	5,522	$16,566

5-Year Planting Budget

The inventory has indicated vacant planting sites are suitable for new trees. Planting sites have been identified specifically by address number, street, side, and site number in the inventory. By setting a goal to plant trees in all of these sites, the Town will be headed toward the full stocking of its street tree population. Table 2 represents the costs associated with a planting program over the course of five years. The planting cost includes purchasing, planting, watering, and maintaining the tree. At the rate of estimation of plantings per year, it will take the Town five years to plant all identified vacant sites.

Table 3. Cost Breakdown of Planting Existing Vacant Sites

Year	Total Planting Cost	Number of Trees	Total Cost
1	$475.00	516	$245,100.00
2	$475.00	516	$245,100.00
3	$475.00	516	$245,100.00
4	$475.00	516	$245,100.00
5	$475.00	516	$245,100.00

REFERENCES

Geiger, J. (2003). The case for large trees vs. small trees. *Urban Forest Research, Fall 2003.* Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service, Davis, CA.

APPENDIX A
RECOMMENDED SPECIES FOR FUTURE PLANTING

Proper landscaping and tree planting are critical components of the atmosphere, livability, and ecological quality of a community's urban forest. The tree species listed below have been evaluated for factors such as size, disease and pest resistance, seed or fruit set, and availability. The following list is offered to assist all relevant community personnel in selecting appropriate tree species. These trees have been selected because of their aesthetic and functional characteristics and their ability to thrive in the soil and climate conditions throughout Zone 6 on the USDA Plant Hardiness Zone Map.

DECIDUOUS TREES

Large Trees: Greater than 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Acer rubrum	red maple	Red Sunset®
Acer saccharum	sugar maple	'Legacy'
*Aesculus flava**	yellow buckeye	
*Betula alleghaniensis**	yellow birch	
*Betula lenta**	sweet birch	
Betula nigra	river birch	Heritage®
Carpinus betulus	European hornbeam	'Franz Fontaine'
*Carya illinoensis**	pecan	
*Carya lacinata**	shellbark hickory	
*Carya ovata**	shagbark hickory	
*Castanea mollissima**	Chinese chestnut	
Celtis laevigata	sugar hackberry	
Celtis occidentalis	common hackberry	'Prairie Pride'
Cercidiphyllum japonicum	katsuratree	'Aureum'
*Diospyros virginiana**	common persimmon	
*Fagus grandifolia**	American beech	
*Fagus sylvatica**	European beech	(Numerous exist)
Ginkgo biloba	ginkgo	(Choose male trees only)
Gleditsia triacanthos inermis	thornless honeylocust	'Shademaster'
Gymnocladus dioica	Kentucky coffeetree	Prairie Titan®
*Juglans nigra**	black walnut	
*Larix decidua**	European larch	
Liquidambar styraciflua	American sweetgum	'Rotundiloba'
*Liriodendron tulipifera**	tuliptree	'Fastigiatum'
*Magnolia acuminata**	cucumbertree magnolia	(Numerous exist)
*Magnolia macrophylla**	bigleaf magnolia	
Metasequoia glyptostroboides	dawn redwood	'Emerald Feathers'
Nyssa sylvatica	black tupelo	
*Platanus occidentalis**	American sycamore	
Platanus × acerifolia	London planetree	'Yarwood'
Quercus alba	white oak	

Large Trees: Greater than 45 Feet in Height at Maturity (Continued)

Scientific Name	Common Name	Cultivar
Quercus bicolor	swamp white oak	
Quercus coccinea	scarlet oak	
Quercus lyrata	overcup oak	
Quercus macrocarpa	bur oak	
Quercus montana	chestnut oak	
Quercus muehlenbergii	chinkapin oak	
Quercus palustris	pin oak	
Quercus imbricaria	shingle oak	
Quercus phellos	willow oak	
Quercus robur	English oak	Heritage®
Quercus rubra	northern red oak	'Splendens'
Quercus shumardii	Shumard oak	
Styphnolobium japonicum	Japanese pagodatree	'Regent'
Taxodium distichum	common baldcypress	'Shawnee Brave'
Tilia americana	American linden	'Redmond'
Tilia cordata	littleleaf linden	'Greenspire'
Tilia × euchlora	Crimean linden	
Tilia tomentosa	silver linden	'Sterling'
Ulmus parvifolia	Chinese elm	Allée®
Zelkova serrata	Japanese zelkova	'Green Vase'

Medium Trees: 31 to 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Aesculus × carnea	red horsechestnut	
Alnus cordata	Italian alder	
*Asimina triloba**	pawpaw	
Cladrastis kentukea	American yellowwood	'Rosea'
Corylus colurna	Turkish filbert	
Eucommia ulmoides	hardy rubber tree	
Koelreuteria paniculata	goldenraintree	
Ostrya virginiana	American hophornbeam	
Parrotia persica	Persian parrotia	'Vanessa'
Phellodendron amurense	amur corktree	'Macho'
Pistacia chinensis	Chinese pistache	
Prunus maackii	amur chokecherry	'Amber Beauty'
Prunus sargentii	Sargent cherry	
*Pterocarya fraxinifolia**	Caucasian wingnut	
Quercus acutissima	sawtooth oak	
Quercus cerris	European turkey oak	
*Sassafras albidum**	sassafras	

Small Trees: 15 to 30 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Acer buergerianum	trident maple	Streetwise®
Acer campestre	hedge maple	Queen Elizabeth™
Acer cappadocicum	coliseum maple	'Aureum'
Acer ginnala	amur maple	Red Rhapsody™
Acer griseum	paperbark maple	
Acer nigrum	black maple	
*Acer pensylvanicum**	striped maple	
Acer triflorum	three-flower maple	
*Aesculus pavia**	red buckeye	
Amelanchier arborea	downy serviceberry	(Numerous exist)
Amelanchier laevis	Allegheny serviceberry	
*Carpinus caroliniana**	American hornbeam	
Cercis canadensis	eastern redbud	'Forest Pansy'
Chionanthus virginicus	white fringetree	
Cornus alternifolia	pagoda dogwood	
Cornus kousa	Kousa dogwood	(Numerous exist)
Cornus mas	corneliancherry dogwood	'Spring Sun'
Corylus avellana	European filbert	'Contorta'
*Cotinus coggygria**	common smoketree	'Flame'
*Cotinus obovata**	American smoketree	
*Crataegus phaenopyrum**	Washington hawthorn	Princeton Sentry™
Crataegus viridis	green hawthorn	'Winter King'
*Franklinia alatamaha**	Franklinia	
*Halesia tetraptera**	Carolina silverbell	'Arnold Pink'
Laburnum × watereri	goldenchain tree	
Maackia amurensis	amur maackia	
*Magnolia × soulangiana**	saucer magnolia	'Alexandrina'
*Magnolia stellata**	star magnolia	'Centennial'
*Magnolia tripetala**	umbrella magnolia	
*Magnolia virginiana**	sweetbay magnolia	Moonglow®
Malus spp.	flowering crabapple	(Disease resistant only)
Oxydendrum arboreum	sourwood	'Mt. Charm'
Prunus subhirtella	Higan cherry	'Pendula'
Prunus virginiana	common chokecherry	'Schubert'
*Staphylea trifolia**	American bladdernut	
Stewartia ovata	mountain stewartia	
*Styrax japonicus**	Japanese snowbell	'Emerald Pagoda'
Syringa reticulata	Japanese tree lilac	'Ivory Silk'

Note: * denotes species that are **not** recommended for use as street trees.

CONIFEROUS AND EVERGREEN TREES

Large Trees: Greater than 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Abies balsamea	balsam fir	
Abies concolor	white fir	'Violacea'
Cedrus libani	cedar-of-Lebanon	
Chamaecyparis nootkatensis	Nootka falsecypress	'Pendula'
Cryptomeria japonica	Japanese cryptomeria	'Sekkan-sugi'
× *Cupressocyparis leylandii*	Leyland cypress	
Ilex opaca	American holly	
Picea omorika	Serbian spruce	
Picea orientalis	oriental spruce	
Pinus densiflora	Japanese red pine	
Pinus strobus	eastern white pine	
Pinus sylvestris	Scotch pine	
Pinus taeda	loblolly pine	
Pinus virginiana	Virginia pine	
Psedotsuga menziesii	Douglas-fir	
Thuja plicata	western arborvitae	(Numerous exist)
Tsuga canadensis	eastern hemlock	

Medium Trees: 31 to 45 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Chamaecyparis thyoides	atlantic whitecedar	(Numerous exist)
Juniperus virginiana	eastern redcedar	
Pinus bungeana	lacebark pine	
Pinus flexilis	limber pine	
Pinus parviflora	Japanese white pine	
Thuja occidentalis	eastern arborvitae	(Numerous exist)

Small Trees: 15 to 30 Feet in Height at Maturity

Scientific Name	Common Name	Cultivar
Ilex × *attenuata*	Foster's holly	
Pinus aristata	bristlecone pine	
Pinus mugo mugo	mugo pine	

Dirr's Hardy Trees and Shrubs (Dirr 2013) and *Manual of Woody Landscape Plants (5th Edition)* (Dirr 1988) were consulted to compile this suggested species list. Cultivar selections are recommendations only and are based on DRG's experience. Tree availability will vary based on availability in the nursery trade.

Further Species Recommendations from UTC

A Selection of Tree Species Suitable for Amherst, NY
That Contribute to Stormwater Interception

Tree Species* and Mature Size		
Scientific Name	Common Name	Size
Acer rubrum	red maple	large
Acer × freemanii	Freeman maple	large
Aesculus flava	yellow buckeye	large
Aesculus hippocastanum	horsechestnut	large
Celtis occidentalis	common hackberry	large
Carpinus betulus	European hornbeam	large
Corylus colurna	Turkish hazelnut	large
Liriodendron tulipifera	tulip tree	large
Magnolia acuminata	cucumber tree magnolia	medium
Magnolia macrophylla	bigleaf magnolia	medium
Picea abies	Norway spruce	large
Platanus occidentalis	American sycamore	large
Pseudotsuga menziesii	Douglas fir	large
Tilia americana	American linden	large
Tilia cordata	littleleaf linden	large
Tilia platyphyllos	bigleaf linden	large
Tilia tomentosa	silver linden	large
*Ulmus americana***	American elm	large
Zelkova serrata	Japanese zelkova	large

This species list is not inclusive of all trees recommended and/or suitable for Amherst's climate. While all trees will contribute ecosystem benefits to some degree, these species were simply identified by i-Tree researchers as being in the top 10% of species for contribution to stormwater interception.

** *Seek disease-resistant varieties only.*

DAVEY Resource Group

April 2023

INVASIVE SPECIES MANAGEMENT PLAN

Town of Amherst, New York

Prepared for:
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ACKNOWLEDGMENTS

This project supports the Town of Amherst's vision to promote and enhance community well-being through public tree conservation and improved forestry management practices. This *Community Forestry Management Plan* offers expert recommendations for preserving and expanding urban canopy so the environmental, economic, and social benefits it provides continue for generations.

Amherst is thankful for the grant funding it received from the New York State Department of Environmental Conservation in cooperation with U.S. Forest Service through its Urban and Community Forestry (U&CF) Grant Program. The U&CF Grant Program is designed to encourage communities to create and support sustainable urban forestry programs throughout the United States. In addition, the Town would like to thank the following individuals:

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Shawn Lavin, Councilmember
Michael Szukala, Councilmember

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Dominic Creamer, Highway Department Crew Chief/Forester
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SECTION 1: CURRENT STATE OF INVASIVE SPECIES MANAGEMENT IN THE TOWN OF AMHERST

SECTION 1.1: INTRODUCTION

Trees provide tremendous benefits to the people who live, work, and play beneath their canopies. They reduce stormwater runoff, decreasing erosion and preventing leaching of soil nutrients while protecting waterways and wetlands from agricultural runoff and decreasing municipal stormwater control budgets. They remove airborne pollutants, decreasing instances of respiratory issues and reducing the associated costs of those illnesses. They reduce heating and cooling costs, provide shade over impervious urban surfaces, moderate urban temperatures, and decrease instances of heat-related illness. Trees also provide less immediately tangible benefits, increasing the value of properties on which they're located and raising the perceived value of consumer goods. They provide wildlife habitat and help connect fragmented natural areas. They reduce the length of hospital stays, speed recovery from illness, and provide enriching recreational opportunities. All of which is to say: trees provide immense value to the communities in which they are located and merit investments of time and resources to care for, promote, and preserve them.

Today's forests are at risk from a wide range of factors, including invasive species. Invasive species are plants, animals, or pathogens which are not native to a particular ecosystem and which, as a result of their introduction, cause or are likely to cause harm to the economy, environment, or human health. Invasive species may cause economic harm through reduced agricultural yields, disruption of fisheries, loss of recreation opportunities and tourism, decrease in wood and forest products, disrupted trade, and rising management costs. Environmental harm may be caused through reduction in native biodiversity and ecosystem services, and human health may be impacted through injury or illness directly caused by the invasive species, or through degradation of air, water, or soil quality or altered flood regimes, to name just a few.

Although the risk posed to Amherst's forests by any individual invasive species may seem minor, one only needs to look back at the devastation caused by Dutch elm disease (DED, Ophiostoma novo-ulmi) during the mid- to late-1900s or the more recent ravages of emerald ash borer (EAB, *Agrilus planipennis*) to see how much damage invasive species can cause when left unchecked.

SECTION 1.2: BACKGROUND

The Town of Amherst, New York, encompasses an area of 53.6 square miles just to the northeast of the city of Buffalo. Amherst is home to over 130,000 residents, who benefit from the Town's urban and woodland tree population. As Amherst has many parks, the Town offers a unique mix of urban and rural recreational areas for residents and the community to enjoy. The preservation of a natural environment is important to the developers and Homeowner Associations within Amherst, such that certain neighborhoods will restrict the building of fences and sheds to maintain a woodland like appearance. To continue with the Town's dedication to recreational and natural areas, Amherst has been planning on developing a world class park by combining the Audubon Recreation Center with the Westwood Country Club, and plans on revitalizing the waterfront located along Ellicott Creek and Tonawanda Creek. As the Town of Amherst furthers their plans for Amherst Central Park and a revitalized waterfront, plans and policies should be developed to protect the Town's natural resources.

Prior impacts of invasive species have been felt in Amherst in the past with the most recent example being the ongoing EAB infestation. Amherst took action in 2012 to treat ash trees using chemical injections (such as Tree'Age) within the public urban resource. During the 2020 and 2022-2023 inventory conducted by Davey Resource Group, Inc. "DRG", 7,232 ash trees (genus *Fraxinus*) were identified along streets and in public parks throughout Amherst. Of these trees, 6,970 were green ash (96% of the total ash population), which are the most susceptible ash species to infestation from EAB. Due to the Town's diligence in their treatment of ash trees, most of the ash trees that were recorded during this inventory are in fair condition. Green ash trees are the second most common species of trees among streets, making up 12% of the total street tree population. Of the total population of ash trees, only 167 trees were found to be dead during this inventory, and 753 ash trees were recommended for removal (10% of the total ash tree population). These numbers, however, do not include the total of privately owned ash trees that have been removed or treated for EAB. Despite treatment, many trees have already been removed specifically due to EAB; since 2018, 795 ash trees have been removed. Without treatment, it is likely that thousands of ash trees would have required removal due to EAB infestations throughout the Town of Amherst, requiring a major investment from public and private entities to remove dying and dead trees. As ash trees made up 12% of the inventoried public trees during 2020-2023, EAB could cause massive losses to the Town's urban forest if the treatment of ash trees stops.

Current Town management of the EAB infestation includes the removal of dead and dying trees as they become hazardous, and chemical injection treatments of Tree'Age to approximately 2,104 ash trees a year, or roughly one third of the total ash tree population. Although these chemical treatments have been effective overall, they are costly, require professional knowledge to administer correctly, and can only protect a small number of high-value trees. The Town of Amherst typically spends about $65,000 per year (starting in 2012) just to treat the ash tree population. Many more invasive species are already present in or near Amherst, and the Town needs a plan in place to proactively manage new invasive species to prevent similar losses and costs in the future.

The Town of Amherst has an agreement with Prism to monitor the boat launches and offer education to its numerous visitors. The Boat Stewards perform voluntary boat inspections to remove visible aquatic plants and animals from all types of watercraft. Removal of aquatic plants and animals will help to prevent the transport and spread of aquatic invasive species. Stewards will also be responsible for public education and distribution of educational materials. The stewards will work Thursday-Sunday's and Holidays from Memorial Day weekend to Labor Day. The stewards work four 10-hour days from 7:00 a.m.-5:30 p.m. The stewards work remotely and will be visited periodically by Lead Stewards who are their direct supervisors. I coordinate the program full-time and two seasonal Lead Stewards help supervise our 20 seasonal Boat Stewards.

This program is run in coordination with our many other partner boat steward programs throughout New York. Last summer across the state, steward programs conducted 155,000 inspections with an acceptance rate of 97%. These programs are voluntary and boaters do not have to participate if they choose not to. The stewards set up a small foldable table which they keep education and outreach materials on a lawn chair. They keep their materials needed within their vehicles. They spend most of their time walking throughout the Park interacting with boaters, giving a short survey, looking for aquatic invasive species and educating the general public. Although these programs are new to WNY, they are quite established in other parts of the State with the Adirondacks (https://www.adkwatershed.org/invasive-species/stewardship-program) having one for over 20 years and the Finger Lakes https://www.hws.edu/fli/projects_steward.aspx) going on their 7th year.

SECTION 1.3: PURPOSE

The intent of this document is to provide guidance to help the Town of Amherst develop a comprehensive plan for managing invasive species. An effective invasive species management plan should be flexible, to allow the management of many different types of invasive species in many different circumstances; should take a systematic approach to invasive species education, monitoring, and management; and should provide guidelines for assessing past treatments and their efficacy and incorporating lessons learned into future management.

An invasive species management plan will aid the Town in their stated goal to build "community character, through the management of growth and change…while accommodating quality new development"; specifically, their objective is to "preserve natural resources, maintain green space throughout Amherst, and revitalize older neighborhoods and commercial corridors".

SECTION 1.4: VISION

"To protect native habitats, and to manage invasive species because of their negative impacts to wildlife, tree species, recreational opportunities, and crops"—Amherst Invasive Plant Species Committee

Amherst aims to protect their existing trees and forested lands and improve the quality of care provided to the Town's public arboreal resource over time. The Town has previously established an invasive plant committee to help identify the needs of the community regarding management of invasive species. As Amherst continues to work on projects to develop a world class park and revitalize the waterfront, instituting an invasive species management plan will assist in protecting its public lands and parks from invasive threats. Amherst intends to do this through proactive steps, such as planning and monitoring, to find invasive species infestations early and manage them effectively, thereby protecting the woodlands and urban trees of the Town for future generations.

SECTION 2: INVASIVE SPECIES OF CONCERN

The list of invasive species known to be present in western New York is extensive and can be found at the western New York Partnership for Regional Invasive Species Management (WNY PRISM) website (http://www.wnyprism.org). The invasive species detailed in this report were chosen based on several factors: 1) species which were frequently reported in Amherst using the New York iMapInvasives database (https://www.nyimapinvasives.org); 2) species which are uncommon in Amherst but were considered early detection priorities in 2021 by WNY PRISM; 3) species which were discussed as invasive species of concern during interviews with Town personnel; and 4) species which are not currently present in western New York but which were considered approaching region priority species in 2021 by WNY PRISM and which have the potential to significantly impact the Town's trees.

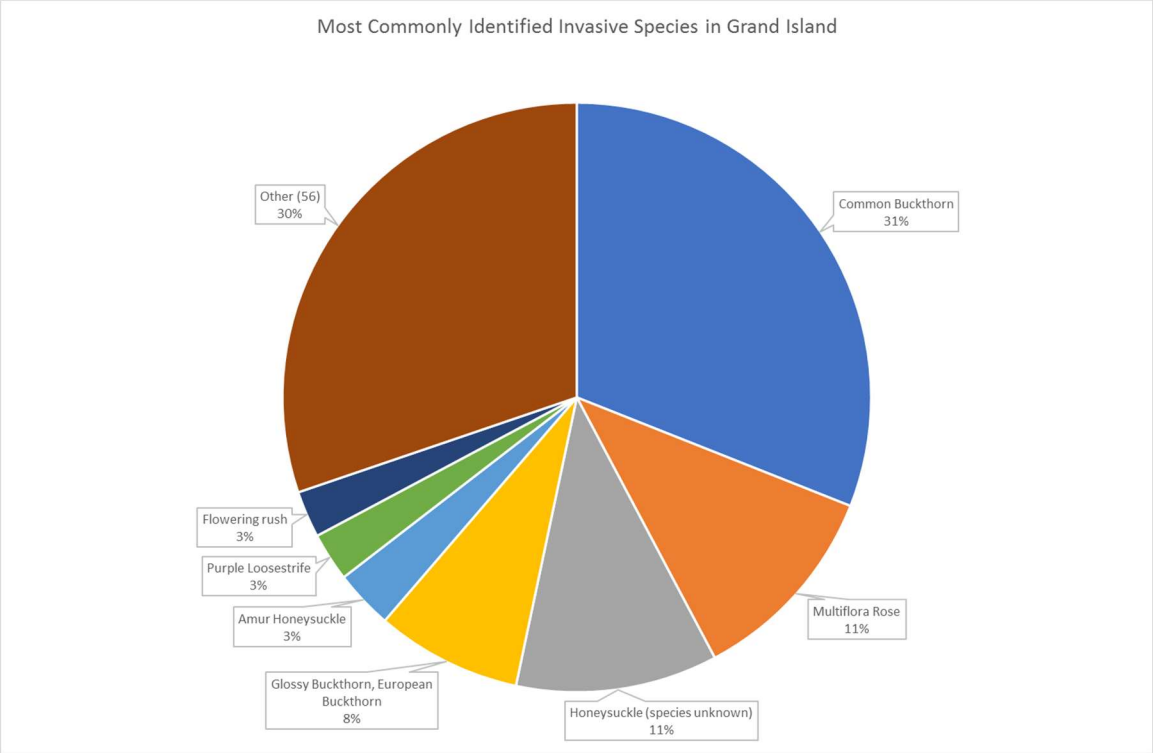

Figure 1. Pie chart of invasive species identified within Grand Island.

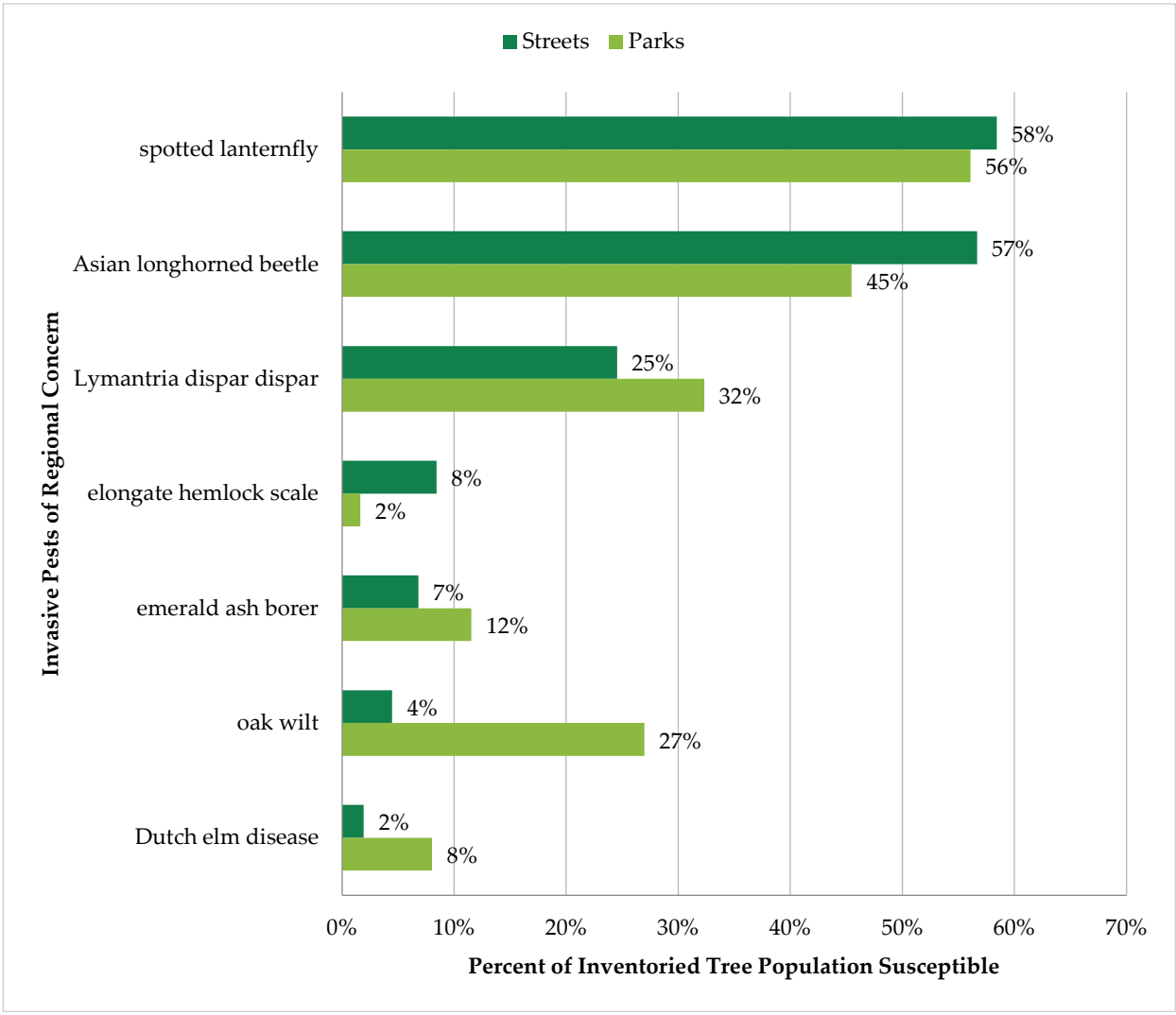

Figure 2. Bar chart of invasive tree pests/diseases with greatest potential to damage inventoried trees in Amherst.

The most commonly identified invasive species in Amherst included buckthorn, honeysuckle, multiflora rose, purple loosestrife, and flowering rush (Figure 1). WNY PRISM identifies annual survey priorities for invasive species which are currently present in the WNY PRISM area but which are not yet well established. The 2021 list of early detection species for western New York can be found in the top half of Table 1. Of these 9 species, only water hyacinth has been identified in Amherst and is further discussed in Section 2.1. A second list of survey priorities is also provided by WNY PRISM for species which are not yet present within western New York, but which are considered to be at high risk of potential introduction to the region. These are listed in the bottom half of Table 1. Due to the large population of Town trees that are susceptible to Asian longhorned beetle and spotted lanternfly (Figure 2), as well as the amount of agricultural land present in Amherst that could be affected by spotted lanternfly, these two emergent invasive species are discussed in Section 2.2.

Table 1. WNY PRISM priority species for 2021

Early Detection Priority Species	
Scientific Name	Common Name
Ampelopsis brevipenduculata	Porcelain Berry
Aralia elata	Japanese Angelica Tree
Brachypodium sylvaticum	Slender False Brome
Cytisus scoparius	Scotch Broom
Eichhornia crassipes	Water Hyacinth
Microstegium vimineum	Japanese Stiltgrass
Nympoides peltata	Yellow Floating Heart
Persicaria perfoliata	Mile-a-Minute Vine
Pistia stratiotes	Water Lettuce
Approaching Region Priority Species	
Scientific Name	Common Name
Aldrovanda vesiculosa	Waterwheel
Anoplophora glabripennis	Asian Longhorned Beetle
Channa argus	Northern Snakehead
Galega officinalis	Goatsrue
Hypophthalmichthys molitrix	Silver Carp
Hypophthalmichthys nobilis	Bighead Carp
Impatiens glandulifera	Himalayan Balsam
Lycorma delicatula	Spotted Lanternfly
Oplismenus undulatifolius	Wavyleaf Basket Grass

SECTION 2.1: INVASIVE SPECIES IDENTIFIED IN AMHERST

Purple Loosestrife

Purple loosestrife (*Lythrum salicaria*) is an aquatic herbaceous perennial plant with showy purple flowers present from July through September. It can grow in most wet habitats, including marshes, wet meadows, riverbanks, and pond and reservoir edges. It can spread rapidly through prolific seed production and vegetative reproduction and new areas may become infested as seeds are moved by water. Purple loosestrife form large monocultures and inhibit the growth and establishment of native aquatic plants. The dense stands of the plant deter nesting by waterfowl, other birds, amphibians, and turtles and trap sediments, raising the water table and clogging waterways, which may reduce recreational opportunities and harm other aspects of managed wetlands.

Hand-pulling is an option for the management of smaller loosestrife infestations, although the entire root crown must be removed to prevent regrowth. Chemical treatments are a possibility for smaller infestations, although they tend to be too non-selective and expensive for larger treatments. Several biocontrol agents, two leaf beetles, and two weevils have been introduced in the United States to help manage loosestrife infestations and have been somewhat successful. Whether using manual or chemical methods, retreatment over many years is necessary to exhaust the seed bank. Due to its widespread distribution and the difficulty of management, purple loosestrife is also a Tier 4 species.

Common Reed

Phragmites, also known as common reed (*Phragmites australis*), is a tall perennial grass which occurs in wetlands and disturbed and degraded soils. Common areas to find this invasive species include roadsides, in ditches, or in dredged areas. The plant, with its characteristic feathery plume of purple to brown flowers, can grow up to 15 feet tall and spreads readily through rhizomes, stolons, and seeds. Monocultures of this invasive species can alter local hydrology and reduce local biodiversity by eliminating native plants needed to support a thriving ecosystem. Native species of *Phragmites* look very similar to the invasive species and care should be taken before any management is underway to ensure proper identification of the plant.

Due to the persistent nature of *Phragmites*, long-term management is required to contain or eradicate this invasive plant. Chemical treatments tend to work best on newer and less well-established populations, often in conjunction with mowing prior to chemical applications, which reduces the quantity of herbicide necessary for treatment and lessens the likelihood of herbicide drift off the target vegetation. Manual removal is not recommended, as removal of the entire root mass is necessary for effective management, and disturbing the root system can easily lead to propagules (plant parts which can detach and become new plants) being carried to new locations through water or disturbed soil. Repeated mowing can have some short-term positive impacts on *Phragmites* population reduction, and repeated breakage of stems during high-water years may kill portions of *Phragmites* colonies. Burning has also been shown to be somewhat effective at controlling *Phragmites* infestations, as have manipulations of the water table where feasible. Planting or maintaining vegetation which competes with *Phragmites* can help prevent new infestations and lowering nutrient loads can also help prevent *Phragmites* spread. Any plan to remove *Phragmites* should include a follow-up restoration plan, as the root systems of the plant help stabilize soils and removal may lead to erosion. *Phragmites* is considered a Tier 4 species and management of it should be site-specific, goal-specific, and value-driven.

Yellow Iris

Yellow Iris (*Iris pseudacorus*) is an herbaceous perennial that has showy flowers from April to June and can grow between 3-4' in height. Yellow iris can grow well in freshwater wetlands and along the edges of lakes, ponds, rivers, and streams, and will tolerate high acidity in their environment. *Iris pseudacorus* spreads quickly via rhizomes, which can survive for over ten years in the soil or over 3 months if dried. These plants generally do not flower until their third year of growth. The leaves are sword-like with a raised midrib, and blades are dark to blue-green with a pointed tip. The flower is typically pale to bright yellow or cream colored. *Iris pseudacorus* can also spread via seeds, which are able to float for over a year. The main dispersal method for seeds is through water by currents.

Yellow iris forms large, clonal populations that displace native species and offers nutrient-poor forage for native wildlife. It can spread quickly via rhizomes, and root systems of these plants will form dense mats. This compacts the soil and inhibits the germination of other species. Thick growths of *Iris pseudocrus* can reduce the habitat available to native fish and waterfowl species and can clog irrigation systems and streams. This plant is also toxic to livestock and other animals and can cause skin irritation by contact with its sap. Mechanical management practices include the complete removal of *Iris pdeudacorus* and the rhizome, or constant mowing to exhaust the plant's energy supply and deplete its ability to sprout from rhizomes are recommended for the removal of small clumps. Otherwise, glyphosate herbicides that are approved for aquatic use also can be effective for the removal of this plant. *Iris pseudacorus* is considered a Tier 4 invasive species due to the spread and difficulty of removing this plant.

Water Chestnut

Water chestnut (*Trapa natans*) is a fast growing, floating annual with stems that can reach 16 feet in length. Seeds germinate in the spring and produce 10 to 15 stems with submerged and floating leaves. These stems then terminate in floating rosettes. Each rosette can produce up to 20 fruits, which each contain a seed that can remain viable in sediment for 12 years. Each stem is anchored to the bottom of a body of water by numerous branching roots. The rosette can sprout a single, small white flower. The fruits of *Trapa natans* grow underwater and have four sharp spines. Water currents can displace the nuts of *Trapa natans,* and the nuts may become tangled in the feathers of waterfowl. Water chestnut will colonize areas of freshwater lakes, ponds, slow-moving streams and rivers, and prefer high nutrient waters with soft substrate for rooting, and a neutral to alkaline pH.

Water chestnuts will form a nearly impenetrable floating mat of vegetation, which creates hazards for boaters and water recreators. These mats will block light from penetrating the water and reduce, and eventually kill, the growth of native plants below. Oxygen can then be depleted as these plants either reduce plant growth, or take up oxygen during decomposition, potentially killing fish. These plants can lead to a loss in economic revenue by impeding swimming, boating, commercial navigation, fishing, waterfowl hunting, and reducing shoreline property value. Early detection is critical for the management of water chestnut, and can prevent high impact infestations. Small populations can be controlled using hand-pulling methods, but large infestations require the repetitive use of mechanical harvesters or aquatic herbicides to deplete the seed bank. *Trapa natans* is a Tier 3 species, as it has spread too wide for eradication, but can still be contained.

*Waterthymes (*Hydrilla*)*

Waterthymes, or hydrilla (*Hydrilla verticillata*), is a submerged perennial herb that roots in the river bottom. Stems of hydrilla can reach up to 25 feet in length. Once the stems of hydrilla reach the water's surface, it will grow horizontally and form mats. This species can be found in freshwater lakes, ponds, rivers, impoundments, canals, and drainage ditches. Hydrilla has low light requirements and can be found in low or high nutrient water. As this plant has low light requirements, it can invade darker or deeper water where native species typically do not grow before spreading into shallow water and outcompeting native species. Waterthymes is an aggressive grower and stems can grow up to an inch per day in length.

As hydrilla forms thick surface mats, it eliminates waterfowl breeding sites and fish spawning sites. Hydrilla infestations also reduce the amount of dissolved oxygen and can result in fish population dieback. This plant can block intakes for water treatment, power generation, and industrial facilities. Prevention of hydrilla establishment is the most effective control for this plant. This plant is considered a Tier 2 invasive—the highest levels of eradication should be taken to prevent the spread of hydrilla. Other practices, such as mechanical removal, physical habitat manipulation, herbicides, and bio-controls, can be used to contain and eradicate populations of *Hydrilla verticulata.* Basic boat cleaning techniques can prevent the spread of hydrilla.

Tree-of-Heaven

Tree-of-Heaven (*Ailanthus altissima*) is a deciduous tree that has pinnately compound leaves that are 1 to 4 feet in length, with 10 to 40 leaflets per leaf. Tree-of-Heaven can reach heights of 100 feet. *Ailanthus altissima* has small, yellow-green flowers that appear in clusters towards the late spring and early summer. Tree-of-Heaven has been noted to have a pungent odor when leaves and branches are broken that smells of burnt or rotten peanut butter. *Altissima* is typically found in disturbed urban environment, where it thrives. It is tolerant of acidic soils and air pollution but is shade intolerant. This tree can generally be found in the urban environment along powerlines and along the Rights-of-Way of streets, as well as in riparian zones, open areas, forest openings, and forest edges.

Tree-of-Heaven grows and spreads quickly via a robust root system and root fragments that will resprout. It also leaches allopathic chemicals into the soil, which inhibits the growth of other plants. Removal of the Tree-of-Heaven can be complicated; mowing sprouts and seedlings is not effective as it encourages growth and density of the plant. Manual removal can be effective for small seedlings and young trees, only if the entire root is removed. Herbicide applications typically provide the most consistent and effective results in terms of control; particularly, basal bark herbicide applications. It is possible to slow and prevent spread, and contain this species, by selectively removing female trees from the environment. Management of these trees will require a multi-year effort to eradicate and remove the species from the environment. This species is considered Tier 4; it is widespread and difficult to eradicate. Tree-of-Heaven also serves as the preferred host of the spotted lantern fly, another invasive species that is of concern to Amherst, NY.

Curly Pondweed

Curly pondweed (*Potamogeton cripus*) is a submerged perennial with many native look-a-likes. The leaves of curly pondweed are rigid, reddish-green, and are oblong shaped. These leaves are finely toothed and have wavy edges. The stems of the curly pondweed are flat, reddish-brown, and can grow from 1–16 ft in length. The main reproduction method of curly pondweed is from turions, winter buds. This plant can be found in low light and low temperature conditions and will invade both shallow and deep waters.

New plants from curly pondweed form under ice and are typically one of the first plants to emerge in the spring. As these plants emerge early in the season, they will die-off during the mid-summer, which can result in a critical loss of dissolved oxygen within water sources, leading to fish and plant population diebacks. Physical, chemical, or mechanical techniques can be used to remove this plant. WNY PRISM considers this plant a Tier 4 invasive, such that eradication is not possible and management efforts should focus on containment.

Water Hyacinth

Although only five reports of water hyacinth (*Eichhornia crassipes*) have been confirmed in Amherst, it is included here due to the fact that it is considered a PRISM Tier 2 species, meaning that it is considered a good candidate for complete eradication within the western New York region, provided that rapid response to new infestations is provided. Water hyacinth is a free-floating aquatic perennial with shiny, curved, round leaves and purple-black roots which dangle below the surface of the water. It produces showy purple flower stalks that rise around a foot above the plant and can invade all freshwater habitats This invasive species can reproduce rapidly, even doubling its numbers in a single week, and forms dense floating mats which block light from penetrating the water surface, leading to oxygen depletion and reduction in aquatic biodiversity. The mats also impede recreational uses of waterways and render them unsuitable for waterfowl, and provide ideal habitat for mosquito breeding, which may impact human health through the more rapid spread of mosquito-borne illnesses.

As a Tier 2 species, water hyacinth is considered a good candidate for eradication, both locally and throughout the western New York region. It can be easily hand pulled, although mechanical harvesters or chemical applications may be more efficient for management when the infestation is large. Several fungi and insect species are available as biological control agents as well. To ensure that management methods are successful, cost-effective, and minimally disruptive to the environment, early detection and rapid response are key (see Section 3.2).

Emerald Ash Borer

Emerald ash borer (EAB, *Agrilus planipennis*) is an iridescent green beetle less than 1 inch long. It hosts on ash trees, laying eggs in bark crevices which hatch into larvae that feed on the phloem of the tree, creating characteristic S-shaped galleries. The adults eventually burrow out of the tree, leaving behind tiny D-shaped exit holes. The feeding and tunneling of the larvae eventually girdles the tree, causing dieback and death of infested ash trees, and may also reduce stability of the infested tree parts, leading to increased instances of branch or trunk failure. EAB has killed tens of millions of ash trees since its introduction to the United States, resulting in decreased canopy cover, loss of wildlife habitat, reduction of ecosystem services, and has affected wood and forest goods production.

EAB is too mobile and abundant to effectively eradicate or contain, although management may help slow the spread of the insect. Individual trees along streets, in yards, or in parks that are in relatively good condition can be chemically treated with systemic insecticides to protect them from infestation. Treatments must be repeated, generally every one to three years, and are most effective when the trees being treated are young and have good vigor. Mature or damaged trees, as well as trees which are already heavily infested, are not good candidates for chemical treatments. Dead and dying ash trees should be removed when located in places that present a hazard to the public, as dead ash trees tend to drop limbs. Dead and dying ash trees located away from public use areas can be left to create snags and decompose, returning nutrients to the soil. Several different strategies for management of ash trees in urban settings exist, including complete removal of all ash trees as they die, complete removal of ash trees preemptively, and treatment of ash trees to prevent infestation. In any instance where ash trees are removed, they should be replaced with a non-susceptible tree to help return lost ecosystem service benefits in the future. Four species of wasp have been deployed as biocontrol agents in 30 states and, although they can help reduce EAB populations, are not able to eradicate the invasive species. Education of the public is key to help reduce the accidental movement of EAB in firewood, logs, nursery stock, and other ash products and to prevent the establishment of new infestations.

Water Lettuce

Water lettuce (*Pistia stratiotes*) is an aquatic plant that usually can be found free-floating. Leaves resemble open heads of lettuce and are light green, thick, pubescent and have parallel veins and scalloped edges. Water lettuce cannot tolerate salt water and is limited by cold winter temperatures. This plant is typically found in ponds, lakes, and quiet rivers and streams. Water lettuce produces a green berry that turns brown at maturity.

Pistia stratoides creates thick mats as it grows, which blocks light from reaching other native plants, slowing or preventing their growth. These mats can hinder boaters and swimmers and reduce dissolved oxygen concentrations as they die off and decomposes disrupting local fish populations. This plant can also restrict water flow for irrigation and flood control canals. Small infestations of these plants can easily be controlled by manual hand pulling and larger infestations can be removed using harvesters. Chemical control can also be used to manage populations. Water lettuce is a Tier 2 invasive and makes a good candidate for eradication.

SECTION 2.2: POTENTIAL FOR FUTURE INFESTATION

Asian Longhorned Beetle

Asian longhorned beetle (ALB, *Anoplophora glabripennis*) is a large, attractive, black-and-white beetle native to Asia. Although its primary host in its native range is poplar (*Populus*), in the United States, it has a wider host range which includes maple (*Acer*), ash (*Fraxinus*), poplar, birch (*Betulus*), willow (*Salix*), and elm (*Ulmus*). Infestations of ALB have been found in New York, Ohio, Massachusetts, Illinois, New Jersey, and most recently in South Carolina. These wood-boring beetles lay eggs below the bark and larvae feed on the cambium layer, disrupting the flow of water and nutrients throughout the tree, leading to crown dieback and eventual tree mortality. Trees infested with ALB are more prone to partial or whole tree failure due to the weakened wood caused by larval tunnelling, which can lead to increased concerns about public safety and potential liability for tree managers. The most effective method of preventing the continued spread of the insect is removal and destruction of infested trees, leading to large losses of canopy and the benefits provided by trees in urban settings. If the beetle were to become widespread in the Northeast, it could severely damage multiple industries, including maple syrup manufacturing and seasonal tourism for leaf color.

Due to relatively low natural dispersal rates, ALB infestations are good candidates for eradication. The current method of management involves accurate identification of infested trees which are subsequently physically removed and chipped or burned to ensure no living beetles or larvae remain. Chemical preventative measures have been implemented in the past, but research is still ongoing into their efficacy, and infested trees cannot be saved or cured through chemical treatments. Preventative measures include quarantines of infested areas, restrictions on the movement of firewood and other wood products, and public education about ALB and the use of local firewood. It is important to note that ALB is not currently known to exist within the western New York region; however, PRISM has designated it a Tier 1 invasive species, indicating that it has the potential to arrive in the area, and education about it is needed to ensure that, should it arrive, infestations are identified quickly and rapid response can be deployed. If you believe you have found ALB, it should be reported to the DEC Forest Health Department (foresthealth@dec.ny.gov) or can be logged at the iMapInvasives website (https://www.nyimapinvasives.org).

Spotted Lanternfly

Spotted lanternfly (SLF, *Lycorma delicatula*) is a planthopper insect native to China and southern Asian countries. It goes through a number of distinctive life phases ending with an approximately 1" long adult with showy red lower wings. Despite its distinctive appearance, it is well camouflaged when its wings are not spread and can be easily transported in any life stage through normal human movements of vehicles and goods. The egg casings, which are inconspicuous and look like small gobs of cement, are particularly likely to be transported by human movements. Many areas of Pennsylvania are currently infested with this agricultural pest, which can feed on more than 65 different species of plant, but particularly prefer those which have high sugar content such as grapevine, fruiting trees, and maple (*Acer*). Without natural predators in the United States, SLF populations can grow very rapidly, causing over-feeding on host plants. While feeding may not kill host plants outright, it can weaken them and leave them susceptible to secondary infections. In addition, SLF excrete a substance similar to honeydew, which encourages other pests, such as sooty mold and wasps, to congregate in infested areas. At high densities, SLF disrupts recreational activities as they cover surfaces and deter outdoor pursuits. This invasive species is poised to become a serious agricultural pest in the United States.

As with ALB, SLF is not currently known to be present in western New York. It is also considered a Tier 1 species and monitoring should be done to detect any new infestations early. Management methods vary depending on whether it is found inside or outside a quarantine zone. Within quarantine zones, the primary management practice involves careful checking for and removal of any egg casing or SLF nymphs or adults from all surfaces that are going to be transported outside the quarantine zone. Although it feeds on many species, there is some evidence that SLF have a close association with an invasive tree species, tree-of-heaven (*Ailanthus altissima*), and certain prevention and management programs have focused on removal of this prime host material. Any potential sightings of SLF should be reported to the DEC or PRISM. Stands of tree-of-heaven can also be reported to spottedlanternfly@agriculture.ny.gov and should be considered high-priority targets of monitoring for SLF.

Spongy Moth

Spongy moth (*Lymantria dispar dispar*) is a non-native insect from France that was introduced to the United States in 1869 for silk production. The larval stage of the moth will emerge in the spring from eggs that were laid the previous summer. These caterpillars will feed on tender, new leaves, moving onto older, tougher leaves as it ages. Caterpillars will grow to be about 2.5 inches in length and have five pairs of raised blue spots and six pairs of red raised spots. The caterpillars have hairs on their backs that can cause some skin irritation if touched. Female moths are white with brown markings, do not fly, and lay light brown, fuzzy-looking egg masses. These egg masses can be found on tree trunks, firewood, branches, or in a sheltered outdoor place, like lawn furniture. Each egg mass contains between 600–700 eggs. Male moths are brownish.

Outbreaks of spongy moth occurs in cycles of about every 10–15 years in New York; population numbers will rise and fall depending on predator-prey interactions between small mammals, acorns, and spongy moth. Years when population numbers are low, there is minor damage to leaves. Years with high populations will have high levels of forest defoliation and noticeable leaf damage. There is a multitude of management options regarding spongy moth. During years with low populations, simply killing adults and caterpillars will help reduce their numbers. Egg masses can also be destroyed by scraping them off of trees and structures and dropping the masses into detergent.

Kudzu

Kudzu (*Pueraria lobata*), is a climbing, perennial, woody vine that has the potential to reach upwards of 100 ft. in height. Kudzu can be found growing along field edges, roadside, and near river corridors. *Pueraria* forms long, hairy vines from a central root and has dark-green, alternate compound leaves. Each leaf is composed of three oblong to cordate shaped leaflets, and kudzu growing in full sunlight will produce red, purple, or magenta flowers. Kudzu reproduces both asexually and sexually; wherever nodes from horizontal come in contact with soil, this vine will start a new root crown. Vines will spread out from these new root crowns in any direction, and growth begins the following spring. Kudzu has very large tap roots that can grow down 12 feet and can weigh hundreds of pounds. Seeds typically only form on vertical spreading vines, in clusters of 20–30 hairy pods. Only 1–2 seeds from each pod are viable, but they may take several years to germinate.

Kudzu colonizes areas quickly, as it is prolific growing. Specific climate factors do need to be reached in order for kudzu to grow successfully; higher than average heat and humidity create the right conditions for greater colonization. It is known for growing over existing vegetation and hard surfaces to reach additional light. Because of this, kudzu can impact native communities by outcompeting, crowding out, and physically crushing vegetation. Eradication of kudzu is the most common form of management, as kudzu can grow up to nearly a foot per day and can require 5 to 10 years of concentrated effort to remove each root crown to completely eradicate a well-established population. Larger populations will take more time and effort to completely remove. When using chemical methods of eradication, herbicide applications are most affected if used frequently during the spring to defoliate and diminish starch reserves in the plant. Physical or mechanical methods of removal can take years to eradicate a population and may be ineffective in the long term. Conservation grazing of kudzu, along with chemical applications of herbicide, can be an effective method to eradicate and control kudzu growth. As *Pueraria lobata* is not currently found in western NY, it is a Tier 1 species. Due to its prolific spread and extreme difficulty to eradicate, it is advised that the highest level of early detect survey efforts and removal is made.

Table 2. Summary of invasive species of concern in Amherst

Invasive Species	
Common Name	Botanical Name
Asian longhorned beetle	*Anoplophora glabripennis*
buckthorn	*Rhamnus cathartica*
	Frangula alnus
common reed	*Phragmites australis*
emerald ash borer	*Agrilus planipennis*
flowering rush	*Butomus umbellatus*
honeysuckle	*Lonicera japonica*
	Lonicera maackii
	Lonicera x bella
	Lonicera morrowii
	Lonicera tatarica
multiflora rose	*Rosa multiflora*
purple loosestrife	*Lythrum salicaria*
spotted lanternfly	*Lycorma delicatula*
water hyacinth	*Eichhornia crassipes*

SECTION 3: MANAGING INVASIVE SPECIES

SECTION 3.1: PREVENTION

Non-native invasive species tend to have characteristics, such as aggressive reproduction or spread and lack of natural predators, which make them challenging to eradicate or manage once established. Even in circumstances where management or eradication is possible, the resources required may render the management strategy infeasible. A much more economical and effective approach to managing invasive species is to prevent their introduction or establishment in the first place.

The below elements can fall under the umbrella of invasive species prevention.

Education and Identification Outreach and Training

Both vegetation managers, those hired by the Town as well as independent contractors, and individual citizens, need access to education on why invasive species are harmful, how to spot invasive species of concern for Amherst, and how to report and manage invasive species on public and private properties. Amherst has a publicly accessible website (http://www.grand-island.ny.us), a Facebook page, and a parks Instagram page where bulletins about invasive species could be posted for public consumption. Educational courses or fliers could also be provided at the Amherst Town Hall. Town staff should be provided with regular updates and continuing education on invasive species. Many professional organizations, such as the International Society of Arboriculture (ISA), offer annual conferences where updates on invasive species can be obtained and experiences with managing invasive species can be shared.

Preventing the Deliberate Planting of Invasive Species

Amherst should compile a list of non-native invasive plants to avoid planting, and this list should be considered when planning any public landscaping or tree planting projects. The list should also be made available to the public through the channels discussed above. Future tree ordinances or other legislation could codify compliance with do-not-plant lists. A comprehensive do-not-plant list should consider not only trees, but also shrubs, grasses, and aquatic plants which are considered invasive in the Amherst area.

Preventing the Introduction of Seeds/Eggs/Organisms into an Area

There are many methods by which propagules of invasive species can enter a new area. Amherst should consider by which routes invasive species are most likely to enter the Town and how to prevent such introductions. Examples of this element include checking incoming boats for invasive aquatic plants and checking nursery stock for invasive insects before planting. Educating citizens and Town staff on the ways in which invasive species travel and what to look for can aid in this task.

Developing Local Ordinances to Address Invasive Species

Local ordinances, such as a tree ordinance, can help prevent invasive species introduction. Such ordinances may include lists of species that are prohibited from planting, dictate the methods in which private landowners are required to report or manage invasive species, or determine standard practices for invasive species management within public areas of the Town. Some examples of local ordinances which address tree preservation and invasive species prevention can be found on the Sustainable City Code website (https://sustainablecitycode.org/brief/require-native-trees-and-removal-of-invasive-trees-3/).

Early Detection and Eradication of Small Populations of Invasive Species

Infestations of invasive species which are detected early, while they affect a relatively small geographic area, may be possible to eradicate. Routine monitoring during other urban forestry activities as well as tips from the public can help identify infestations before they become widespread. This topic will be further discussed in Section 3.2.

Periodically Inspecting High Risk Areas

Amherst should identify areas at high risk of infestation. Such areas may include transportation corridors such as I-290, recently disturbed areas such as new housing developments, and locations where previous infestations have undergone control measures. The Town should also identify species at particular risk of infestation by invasive species, such as ash trees currently unaffected by EAB or species susceptible to other imminent invasive threats in the region (see Section 2.2). These areas and species should be routinely inspected, either by Town staff, contractors (such as through an Inventory Pest Evaluation and Detection [IPED] survey), or by volunteer groups.

Maintaining Healthy and Vigorous Trees and Other Vegetation

Invasive species are uniquely suited to take advantage of already weakened individuals or communities of plants. Maintaining healthy and vigorous trees and communities of native vegetation can help limit the opportunities for invasive species to become established by ensuring that ecological niches are already filled by native vegetation. Additionally, maintaining healthy trees and vegetative communities provides other benefits, such as reduced stormwater runoff, improved carbon storage capacity, and increased pollutant removal. Establishing routine pruning cycles for urban trees, planning and creating landscapes of plants which are well suited to site and climate conditions, and managing utility corridors to promote the growth of native plant communities are all examples of this element of invasive species prevention.

Minimizing Disturbance of Desirable Vegetation

Areas where native or desirable vegetation have been disturbed provides opportunities for invasive species to establish. Many invasives are extremely good at colonizing disturbed sites and soils and thrive under conditions which often reduce the viability of native plant communities. Development plans which minimize the amount of disturbance to desirable vegetation, development of low-mow or no-mow plant communities in utility corridors and along public rights-of-way, and protection of delicate habitats such as wetland boundaries are all examples of this element of invasive species prevention.

Mulching, Revegetation, or Treating Areas of Bare Soil

As mentioned above, many invasive plant species are well adapted to poor, disturbed, and bare soils and can easily establish in areas in which native vegetation struggles. Planning in advance of soil disturbances to mulch, revegetate, or otherwise treat bare soils can reduce the chances of invasive species establishing after disturbance.

Periodically Evaluating the Effectiveness of Prevention Efforts

No single technique will be completely effective at preventing the establishment of invasive species within Amherst. The methods which work best will be dependent on local factors, including land use, citizen involvement, which invasive species are present, and many more environmental and social factors. To be effective in preventing invasive species infestations, Amherst should periodically assess and evaluate the effectiveness of prior invasive species prevention efforts and base future efforts on new information gleaned from these assessments as well as new developments within the scientific community.

SECTION 3.2: EARLY DETECTION AND RAPID RESPONSE

Invasive species can be difficult to identify when populations are still small. Many, such as tiny insects and fungi, may not be noticed until their effects become obvious on the landscape, as was the case with the EAB infestation in Amherst. Other species may begin as non-invasive but later become invasive as they adapt to local conditions, are spread by wildlife, or when exponential population growth allows them to spread rapidly. Although prevention or exclusion of invasive species from an area is considered the best defense, it may not be possible due to the easy movement of people and goods, and by extension, hitchhiking invasive species, that occurs in today's globalized world environment. When complete exclusion of invasive species is not possible, early detection of and rapid response to new infestations is the best management strategy.

Early Detection

Early detection of invasive species involves surveillance to identify new populations as soon as possible after their introduction. Finding these small populations before they have time to reproduce and spread widely allows for easier and more cost-effective management of the infestation to occur. Tactics to aid in early detection of invasive species include targeting areas where their introduction is highly likely, such as transportation corridors or ports of entry, municipal campgrounds, and areas which border residential properties. Other areas to monitor closely for invasive species include those with high ecological value where significant impacts of an infestation are likely to be felt and vulnerable habitats or recently disturbed areas. Amherst should ensure that any staff which handle vegetation management, such as parks staff, are trained to recognize early signs and symptoms of invasive species infestations so they can monitor key locations during other routine operations. In addition, educating the public to identify signs and symptoms of infestation can help Town staff cover larger areas more thoroughly. For example, the successful education of Worcester, Massachusetts residents of the signs and symptoms of Asian longhorned beetle (ALB, *Anoplophora glabripennis*) infestation in trees helped contain the ALB infestation there and continues to help in the ALB eradication effort.

Rapid Response

Rapid response involves the systematic effort to eradicate, control, or contain an invasive species while the infestation is still constrained to a small area. In order to be ready to respond to reports of an invasive species, Amherst should prepare response strategies in advance. Since every invasive species is different and may require different methods to eradicate, control, or contain it, Amherst should consider which invasive species are of greatest concern to the Town and should plan response strategies ahead for when an infestation occurs. When determining which invasive species are the greatest concerns, the Town should consider which invasive species exist in and around western New York as well as adjacent regions of Canada and should consider which invasive species the Town is most susceptible to. For example, the 2022 Amherst Tree Inventory identified an overabundance of maple (*Acer*) within the Town, which increases the Town's susceptibility to invasive species which host on maple trees, such as ALB or spotted lanternfly.

SECTION 3.3: MANAGEMENT

If the establishment of an invasive species cannot be prevented, the next step is to manage the infestation appropriately. There are three basic strategies for managing an invasive species, and the most effective strategy or combination of strategies will vary depending on the invasive species in question, the extent of the infestation, site conditions, the resources available to manage the infestation, and so on.

Eradication

Eradication is the complete elimination of a population of invasive species within a defined geographic area. This is a more viable option for certain invasive species which spread slowly or which are detected very early in the infestation process. ALB, for example, has been successfully eradicated in several locations, including Illinois, New Jersey, and Boston, Massachusetts. However, for invasive species which spread readily and rapidly, such as emerald ash borer (EAB, *Agrilus planipennis*), or which are not detected until they are well established in an area, eradication may not be physically or economically feasible. In such cases, containment or impact reduction may be better strategies.

Containment

Containment is the process or goal of limiting the spread of an infestation to a defined geographic area. While this management strategy is often more cost effective and feasible than complete eradication of an invasive species, confining an invasive species to a defined area requires constant monitoring and control methods applied at the boundary of the infested area, which may also be costly and difficult to achieve. Examples of the containment strategy include restricting activities in certain areas or at certain times of year or inspecting and cleaning clothing and equipment to minimize movement of the invasive species or propagules. Early detection and rapid response to new pockets of infestation is necessary with this strategy to prevent spread of the invasive species outside the defined area.

Impact Reduction

Impact reduction involves the management of local ecosystems rather than the invasive species in order to reduce the impact caused by the infestation to a level necessary to meet site management goals. This strategy may be the best approach when an invasive species is well established or widespread and eradication or containment are not possible for logistical or economic reasons. Planting diverse tree species or selecting plant species that are less susceptible to invasive insects and diseases are examples of the impact reduction strategy.

Management Methods

While eradication, containment, and impact reduction are management strategies, management methods refer to the measures employed to carry out management strategies. They may include physical, chemical, biological, and cultural methods. Generally, a combination of these methods is necessary for effective management of invasive species, in what is known as integrated pest management (IPM). IPM methods aim to manage destructive agents such as invasive species at tolerable levels using a variety of preventative, management, and regulatory strategies which are ecologically and economically efficient as well as socially acceptable.

A combination of the three management strategies and many different management methods may be necessary to achieve desired goals and is often more effective than attempting any single strategy or method alone. The ALB infestation in Worcester, Massachusetts is an example of a situation where all three management strategies have been employed with some success. The area around the infestation was designated a quarantine zone and the movement of potentially infested materials out of the quarantine zone is restricted. This has limited the chances of ALB spreading into woodlands surrounding Worcester and has effectively contained the infestation to a designated geographic area. When pockets of infested trees are discovered, the trees are removed and chipped to eradicate the infestation. This process has, over time, resulted in fewer and fewer active pockets of infestation being found within the quarantine zone. Finally, the City of Worcester has altered their planting lists and aimed to plant more diverse trees, particularly those which are not targeted by ALB in order to reduce the impact that the beetle has had and could potentially have in the future.

SECTION 3.4: MONITORING

Monitoring involves the periodic inspection of sites to detect new invasions or evaluate the success of prior management plans. Early detection of new invasions provides the best chance of effective management with the lowest costs, and evaluation of prior management can offer insights into what works and what may need to be improved or altered in the future to meet management goals. Monitoring can be quite informal or can be rigidly structured to meet the needs of the community and the challenges presented by a particular invasive species. In Amherst, resources for formal monitoring are limited. Instead, Town staff should conduct routine inspections and monitoring for invasive species during other routine maintenance activities, such as tree pruning or grounds maintenance activities. The Town may also be able to mobilize the public to help monitor for specific invasive species through outreach and education. Invasive species can be reported by the public through the New York iMapInvasives website (https://www.nyimapinvasives.org), and Town staff can periodically check the interactive map to track invasive species reports in Amherst.

SECTION 3.5: RESTORATION

Restoration of urban forest ecosystems to establish or maintain healthy plant communities can help prevent the establishment of new invasive species or the reestablishment of invasive species after removal. The goal of urban forest restoration is to reestablish some of the structure and function of a natural forested environment that has been lost through development, mismanagement, or neglect. Examples of urban forest restoration may include the elimination of mowing and raking in a park to reestablish a natural forest floor, planting non-invasive and site appropriate species to decrease erosion, or planting a rain garden in a residential yard. Restoration of natural environments has ancillary benefits as well, including increased carbon uptake, reduction in stormwater runoff and erosion, improved wildlife habitat, and increased biodiversity. Landscapes which more closely resemble natural ecosystems also tend to require less maintenance once established than highly manicured landscapes. For example, while a grass lawn requires frequent watering, mowing, and fertilizer and pesticide treatments to keep it looking pristine, a natural forest floor tends to regulate itself effectively without the need to mow, water, fertilize, or treat for pests. However, for urban forest ecosystem restoration to be successful in the long term, community support is necessary.

SECTION 3.6: COMMUNICATION AND EDUCATION

Effective communication and education has been alluded to frequently in prior sections. At a base level, vegetation managers working for the Town must have knowledge about invasive species of concern in western New York, how to identify them and the damage they may cause, and how to most effectively manage them. Citizens should be provided with education on these topics as well, to tap into the power of a large pool of potential monitors and to encourage private landowners to manage invasive species on their own properties. In fact, communication with and education for private landowners is crucial in effective invasive species management, because invasive species do not respect property boundaries. Any management of invasive species done on public lands will be ultimately less effective or fail entirely if the same invasive species is not managed on adjacent private lands.

SECTION 4: GOALS, TIMEFRAMES, AND ACTION ITEMS

Ultimately, the choice of management strategies and methods for any given invasive species infestation will have to be determined based on analysis of the invasive species in question, the location of the infestation, the harm the invasive species may do versus the harm management may do, and the resources available for management, among others. There is no one-size-fits-all solution to invasive species management. However, the goals and action items listed in Table 3 will help erect a framework for invasive species management in Amherst.

Table 3. Goals, timeframes, and action items

Goal	Timeframe	Action Items
Remain up to date on invasive species threats	Ongoing	Routinely check WNY PRISM, NYS DEC, and USDA for invasive species of concern
		Attend professional conferences (e.g., ISA) and talks on invasive species and management
		Provide information to Town staff
Identify sources of funding	1–3 years	Set aside annual budget funds for invasive species management (ISM)
		Apply for grants through DEC if needed
Connect with important partners	1–3 years	Educate Town boards on ISM
		Reach out to local groups for help with monitoring
		Establish contacts within organizations like the DEC or WNY PRISM
Develop an early detection and monitoring program	1–3 years	Educate Town staff on invasive species of concern
		Look for invasive threats during routine park and ROW management
		Establish volunteer monitoring group
		Educate local groups and clubs on invasive species of concern
		Solicit citizen help through pest alerts
		Establish method for citizens to report potential invasive species sightings
Manage current infestations	Ongoing	Use WNY PRISM information to locate infestations
		Assess the need for management
		Apply appropriate management methods for infestation type, size, and location
		Assess prior management effectiveness
		Revise future plans based on prior success or failure
Manage EAB infestation	Ongoing	Remove dead and dying ash trees as needed
		Treat high-value ash trees on public property to prevent EAB
		Identify and treat specimen woodland ash trees to provide seed bank for ash regeneration
		Replant new nonhost trees to compensate for ash tree losses
Prepare for future invasive threats	Ongoing	Remain up to date on local invasive species threats
		Prepare rapid response plans for invasive species of concern
		Monitor for new infestations
		Deploy rapid response plans as needed to manage new infestations

Goal	Timeframe	Action Items
Educate citizens about invasive species	Ongoing	Use Town websites to post pest alerts
		Provide educational opportunities associated with Arbor Day
Reduce opportunities for invasive establishment	Ongoing	Develop and enforce a do not plant list
		Increase tree species and genus diversity
		Minimize soil disturbances during construction
		Plan to plant, mulch, or otherwise restore areas disturbed during construction
		Develop ordinances to minimize soil disturbance and restore disturbed areas due to construction
		Educate citizens on invasive species threats and how invasive species move
		Post signage at major boat put-in/take-out points to remind boaters to check for invasive species
		Alert citizens to invasive species reporting methods, such as the iMap Invasives tool

SECTION 5: ADDITIONAL RESOURCES

5.1 FUNDING

- DEC Urban and Community Forestry Grants can be used to conduct tree maintenance such as tree removals (https://www.dec.ny.gov/lands/5285.html)
- The DEC Invasive Species Grant Program has provided funding for invasive species management as recently as 2019 (https://www.dec.ny.gov/animals/115742.html)
- WNY PRISM maintains a list of funding opportunities for the western New York region, which can be accessed here: https://www.wnyprism.org/resources/funding-opportunities/

5.2 MANPOWER

- Citizens can report invasive species sightings at the New York iMapInvasives website (https://www.nyimapinvasives.org/). Managers can also use this database to locate potential infestations.
- WNY PRISM holds volunteer work days for invasive species removal (https://www.wnyprism.org/get-involved/volunteer/)

5.3 EDUCATION

- Cornell Cooperative Extension (https://cals.cornell.edu/cornell-cooperative-extension)
- Western New York PRISM (https://www.wnyprism.org/)
- Erie County Invasive Species Task Force (https://www2.erie.gov/environment/index.php?q=invasive-species)
- New York State Department of Environmental Conservation (https://www.dec.ny.gov/animals/265.html)
- National Invasives Species Information Center (https://www.invasivespeciesinfo.gov/)
- https://www.dec.ny.gov/docs/lands_forests_pdf/wispfactsheet.pdf

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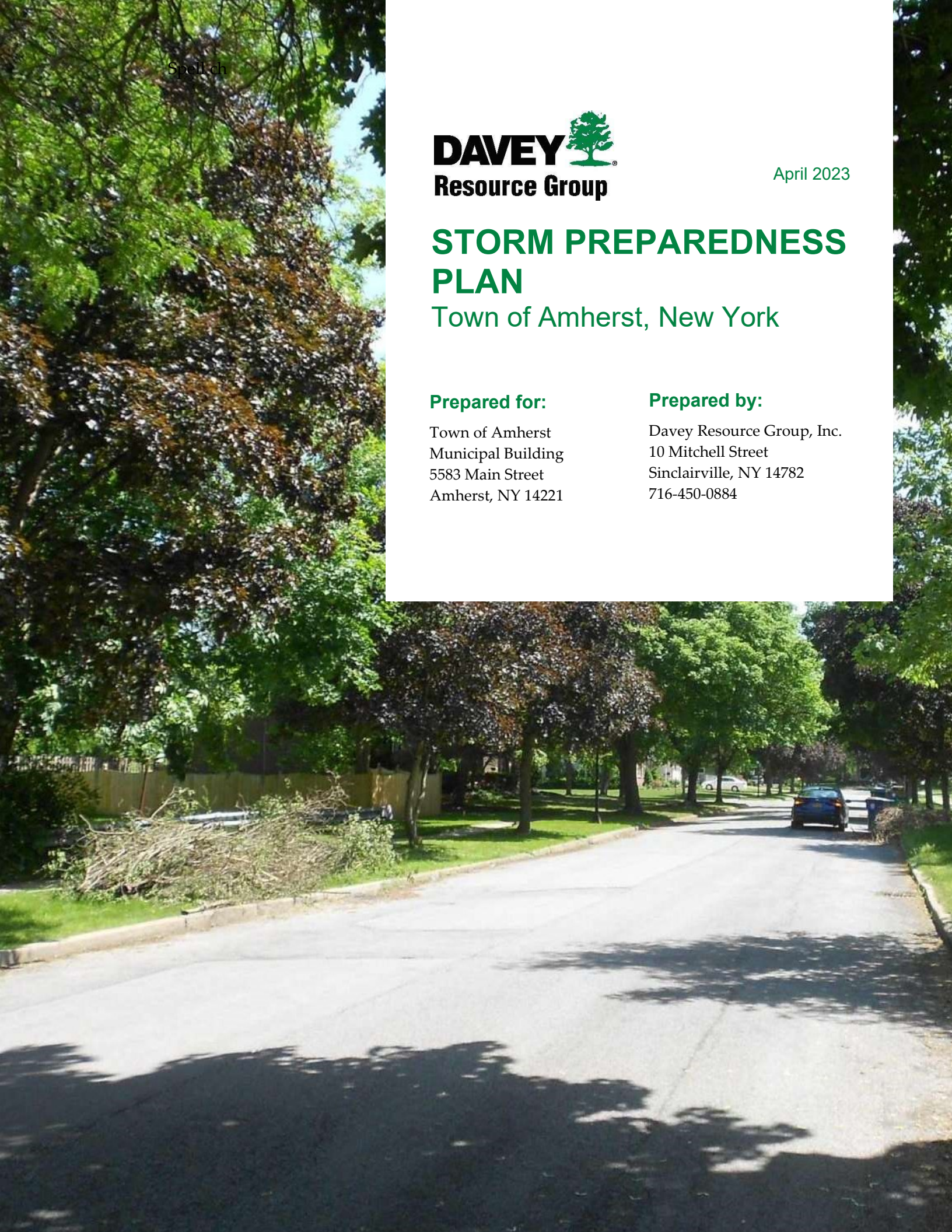

April 2023

STORM PREPAREDNESS PLAN

Town of Amherst, New York

Prepared for:

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Municipal Building
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Amherst, NY 14221

Prepared by:

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A. Storm Response Categories for the Urban Forest
B. Recommendations for Storm Preparedness
C. Debris Removal Emergency Management Plan

ACKNOWLEDGMENTS

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Section 1:

Introduction

SECTION 1: INTRODUCTION

The purpose of an emergency storm preparedness plan is to mitigate, respond to, and recover from an emergency or natural disaster in a timely manner. This Storm Preparedness Plan will review the key components of an effective storm preparedness plan, assess Amherst's current storm preparedness, and offer recommendations to improve storm preparedness in the future.

Severe weather can cause catastrophic damage and create significant volumes of vegetative debris that require processing. To prepare, proactive municipalities have developed emergency response and recovery plans. Traditionally, these plans address serious public safety and health issues, but commonly overlook the necessity of addressing trees and woody debris in the mitigation efforts.

When catastrophic disasters, such as tornadoes, ice storms, and severe straight-line winds strike, large quantities of debris are produced. Trees and vegetation may account for nearly 30% of this debris volume. Beyond the task of collecting and disposing of this debris are additional urban forest management considerations, including increased threat to life, hindrance to life-saving efforts, power outages, and personal and public property damage. The impacts of these additional tree-related considerations are not always quantifiable but can overwhelm a Town's storm response services and slow down the recovery process[1].

LOCAL WEATHER AND CLIMATE

The Town of Amherst, New York lies in a climate zone that exhibits four distinct seasons. This creates the potential for rapid changes in temperature, humidity, and barometric pressure and sets the stage for severe weather events such as tornadoes, flooding, thunderstorms, hail, high winds, ice, and snow. Amherst's Köppen climate classification is Dfa which is characterized as a humid, continental region with a hot summer and cold to bitterly cold winter[2]. The coldest month is January or February, with an average around 19°F, while the hottest month tends to be July or August with an average temperature of around 77°F[3]. Amherst averages around 28 inches of annual rainfall and nearly 60 inches of annual snowfall. Wind speeds reach a high during January, with an average speed of 11 miles per hour, and are lowest in July, averaging only 6.7 miles per hour[4]. High levels of precipitation combined with strong winds may raise the likelihood of damage being done to trees, particularly during severe storms, as trees are more likely to fall during high wind events when the roots are under stress and the soil is wet.

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[1] Barker, R., Gonzalez, G., Hillman, A., Hyde, G., Veselka, W. E., Woodcock, P. J., Vogel, C., LaHaie, J., Cline, K. W., & Gulick, J. (2014, October 1). Urban Forestry Best Management Practices for Public Works Managers: Urban Forest Management Plan. American Public Works Association.

[2] *New York Climate.* WeatherSTEM. (2017). Retrieved February 10, 2023, from https://learn.weatherstem.com/

[3] *Cheektowaga, New York.* Weatherbase. (n.d.). Retrieved February 10, 2023, from https://www.weatherbase.com/weather/weatherall.php3?s=725280&units=us

[4] *Amherst, NY - climate & monthly weather forecast.* Weather U.S. Retrieved February 10, 2023, from https://www.weather-us.com/en/new-york-usa/amherst-climate#rainfall

SEVERE WEATHER EVENTS

The severe weather events most commonly experienced in New York include winter storms, thunderstorms, and tropical storms[5]. Along with precipitation, these types of events often include high winds and flooding that can cause partial or whole tree failure, particularly in trees with pre-existing defects. Full canopies on trees when severe thunderstorms are most common during late spring to summer, and the accumulation of ice and snow on branches throughout winter can increase the dynamic loading experienced by trees and their parts during severe weather events, increasing the chances of failure.

Even relatively low wind speeds can cause tree damage in trees that are fully leafed out. Wind speeds from 39 to 54 miles per hour can cause small, healthy limbs to break as well as damage larger dead or weakened branches. At 55 to 63 miles per hour, large, healthy branches will break and shallowly rooted trees may be uprooted. Widespread tree damage with trees snapped or uprooted can occur at wind speeds of 64 miles per hour or greater[6]. Full tree failure may occur at even lower wind speeds if the soil is heavily saturated, while much higher wind speeds may be required to cause damage when trees are not leafed out.

The National Oceanic and Atmospheric Administration (NOAA) reports that on average, about 10 tornadoes are confirmed in the state of New York each year. However, the threat of a tornado, and the resulting damage that occurs, is relatively rare in Amherst. Since 1950, 23 tornadoes have been reported to touch down in Erie County, and only a few of these impacted the Town. Other high wind events are more common in New York. Between 2012 and 2022, 79 high wind events were recorded in Erie County, with measured gusts between 50 and 64 miles per hour. A further 149 thunderstorm events were recorded during the same time period, which produced gusts from 50 to 60 miles per hour.

Throughout Western New York, late fall through early spring produces some of the worst damage after storms due to the added pressure snow and ice add to the typical storm event. A total of 38 winter storms, 8 blizzards, and 3 ice storms have been recorded in Erie County from 2012 to 2022[7]. These types of storms, in addition to producing strong wind gusts, frequently produce large quantities of ice and snow which may build up on trees, exacerbating wind loading and leading to tree damage.

While any individual type of severe weather event may seem uncommon, when considered together, severe weather is not a rarity for Amherst. Many types of weather events can produce the high winds required to cause significant damage to the Town's urban forest. Proactive maintenance is the best form of preparation a community can take for the potential damage brought by severe weather.

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[5] *Types of disaster in New York*. Broome County New York. (n.d.). Retrieved February 10, 2023, from https://www.gobroomecounty.com/planning/types

[6] National Oceanic & Atmospheric Administration. (2016, July 27). *Estimating Wind Speed*. National Weather Service. Retrieved February 10, 2023, from https://www.weather.gov/pqr/wind

[7] National Oceanic and Atmospheric Administration. (n.d.). Storm events database. National Centers for Environmental Information. Retrieved February 10, 2023, from https://www.ncdc.noaa.gov/stormevents/choosedates.jsp?statefips=36%2CNEW%2BYORK

IMPACTS OF CLIMATE CHANGE

The most recent report from the Intergovernmental Panel on Climate Change (IPCC) states that greenhouse gas emissions from human activities are driving global warming and climate change. The United States has been warming at a rate of between 0.31 and 0.54°F each decade since 1970, with temperatures in the northeast warming more rapidly than the rest of the country. The average temperature across New York has risen 3°F since 1970, with winters warming three times faster than summers. The northeastern U.S. has experienced a 70% increase in heavy precipitation between 1958 and 2010. Annual precipitation and heavy precipitation events are expected to increase throughout New York, particularly during winter and spring; however, there has been less rain during summer and fall, leading to an increase in drought conditions during the hot season[8].

Global climate change has sparked a sense of urgency for urban forestry professionals, as weather and climate are integrally tied to urban forest health. Climate change in the northeastern United States is likely to impact urban forests in several ways:

- Increased drought conditions lead to more stress on urban trees, weakening natural resistance to extreme weather events, pests, and diseases.
- More storm damage and subsequent loss of trees.
- Poorly or infrequently managed trees are more susceptible to breakage in storms.
- Premature post-storm tree removals on private land tend to occur, often because of fear and lack of professional assessment.
- More frequent power outages from trees situated next to power lines.
- Increased instances of flooding, leading to more uprooting as well as damage and death of root systems from prolonged saturation[9].

A comprehensive community forest management plan, such as that laid out in the Community Forestry Management Plan produced by Davey Resource Group, Inc. "DRG", can greatly reduce storm hazards through proper planting and preventative maintenance practices. However, when disasters occur, a Storm Preparedness Plan as an addendum to other municipal plans can provide solid data, facts, and protocols to ensure the continuity, or timely recovery and restoration, of essential services.

FUNDING AND BUDGET FOR URBAN FOREST EMERGENCIES

While the scope of this plan does not permit detailed budgeting estimates, Amherst is strongly encouraged to analyze past catastrophic storm events and secure enough regular funding and contingency funding to support an adequate response for various levels of storm damage. Information on storm emergency categories can be found in Appendix A. Storm and emergency response will require funding for staff overtime, contractual services, and equipment rental.

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[8] New York State Department of Environmental Conservation. (n.d.). Climate change effects and impacts. Climate Change Effects and Impacts. Retrieved February 10, 2023, from https://www.dec.ny.gov/energy/94702.html

[9] Safford, H.; Larry, E.; McPherson, E.G.; Nowak, D.J.; Westphal, L.M. (August 2013). *Urban Forests and Climate Change*. U.S. Department of Agriculture, Forest Service, Climate Change Resource Center. www.fs.usda.gov/ccrc/topics/urban-forests

Removal of debris from public property is eligible for reimbursement from the Federal Emergency Management Agency (FEMA) under most cases when a federal disaster has been declared and when it constitutes an immediate threat to life, public safety, or improved property. This includes the removal of tree debris including downed limbs and trees and the pruning or removal of trees to remove imminent hazards such as hanging limbs or trees so damaged that they are structurally unstable. Any tree debris located on public Rights-of-Way (ROW) are eligible. This includes material that originated on private property that falls or is dragged to the ROW by residents during a specified period[10].

To receive FEMA funding, it is critical to be prepared and fully document all losses and money spent. Most damage assessments through FEMA must be done immediately after the disaster event. The calculated dollar amount is then sent to the County Emergency Management Director. FEMA has a public assistance program that is open to municipal departments and nonprofit hospitals. These grants can be applied for to assist with a variety of damages, including debris removal and emergency protective measures[11].

The Town of Amherst has an approved storm plan to assist in Emergency debris removal. The Town Forester and Highway Superintendent play the main role in organizing the removal. The document identifies locations for storage of debris until it can be properly disposed. The document can be found in Appendix C.

It is recommended the Amherst Highway and Parks Department staff receive safety and technical training through in-the-field and classroom methods. To ensure safe and effective work, staff should receive regular and updated training sessions for first-aid, CPR, chainsaw use, tree risk assessment, and minimum approach distances for energized electric lines. These topics should be considered as basic minimum training requirements. Additional training should be provided to key Town personnel in topics that include electric hazard assessment (EHAP), aerial lift training, advanced climbing, crane operations, and aerial rescue. Consider having key staff members receive training to become ISA Certified Arborists. Develop annual "scenario training" with tree emergency response topics and situations. The Tree Care Industry Association (TCIA) offers additional safety training that should be considered[12].

[10] U.S. Dept. of Homeland Security, Federal Emergency Management Agency, Public assistance: Debris management guide (2007). Washington, D.C.

[11] Federal Emergency Management Agency. (n.d.). *Assistance for governments and private non-profits after a disaster*. FEMA.gov. Retrieved February 22, 2023, from https://www.fema.gov/assistance/public

[12] Tree Care Industry Association. (n.d.). *Safety: TCIA - advancing tree care businesses*. TCIA. Retrieved February 22, 2023, from https://www.tcia.org/TCIA/Safety/TCIA/Safety

Section 2:

Tree Population Characteristics

Related to Storm Damage

SECTION 2: TREE POPULATION CHARACTERISTICS RELATED TO STORM DAMAGE

Any tree, in any condition, can fail if the loads applied to the tree or tree part exceed the load-carrying capacity of that tree. However, some tree species are more prone to breaking and splitting in storms and high winds than others, typically due to inherent qualities of their wood. Prior maintenance, or lack of maintenance, can influence a tree's susceptibility to storm damage. Trees under stress from insect and disease pressures or in poor condition with crown, trunk, or root defects are also more likely to fail in a storm[13]. Using Amherst's complete public tree inventory, these factors can be analyzed to assess the vulnerability of the urban forest to storm-related damage.

TREE RISK

All trees, regardless of age, size, species, and other factors, pose some level of risk of failure and associated damage to a target. For many, if not most trees, this risk is low and the benefits provided by the tree outweigh the risks associated with it remaining on the landscape. However, some trees have a higher level of risk associated with them, usually due to tree condition or defects and the presence of a high-value target that the tree could impact when it fails.

Trees with a risk rating of Extreme or High are expected to fail under normal weather conditions within the specified time frame for the assessment. Extreme weather conditions further increase the possibility that these trees will fail, causing injury, damage, or interruption of services. Trees with an elevated level of risk (Extreme or High Risk rating) should be removed or pruned as soon as possible to reduce risk and liability for the Town. Trees with a Moderate Risk rating may also be more likely to fail during extreme weather events than trees with a Low Risk rating and should be considered for pruning or removal after all Extreme and High Risk trees have been mitigated.

Amherst has no Extreme Risk trees, few High Risk trees, and a larger number of Moderate Risk trees (Table 1).

Table 1. Risk rating of trees in Amherst as of the end of the 2023 inventory update.

Risk Rating	Number of Trees	Percent of Trees
High	83	0.1%
Moderate	2,546	4.5%
Low	54,027	95.1%
N/A*	154	0.3%
Total	56,810	100.0%

* Note that all trees with a risk of N/A do not currently have a risk rating assigned to them.

[13] Dunster, J. A., Lilly, S., Matheny, N., & Smiley, E. T. (2017). Tree Risk Assessment Manual (2nd ed.). International Society of Arboriculture.

Recommendations

- Remove or prune the 83 High Risk trees immediately to reduce risk and liability, improve public safety, and limit the chance of these trees failing during extreme weather events.
- Assess the 2,546 Moderate Risk trees and decide the best way to manage these trees. Some may need to be removed, others pruned, and others may require interventions such as cabling and bracing to support weak branch unions in otherwise healthy trees. Proactively maintaining these trees will limit the chance of them failing during extreme weather events.
- Conduct risk assessments for the 154 trees with a risk rating of N/A.
- Conduct routine monitoring of the public tree population to identify trees with elevated levels of risk. Ideally, this should be done every year and/or after extreme weather events. Level 1 assessments via walk-by or drive-by surveys are an efficient and cost-effective method to keep track of the risk associated with public trees.

TREE AGE

As trees age, they become larger and less flexible. They also tend to have greater proportions of dead and dying branches than younger trees due both to natural processes, such as retrenchment, and external factors like pests and diseases. These factors make older trees more susceptible to failure during extreme weather conditions than young trees[14].

Amherst's inventoried tree population overall trends toward the industry recommended "ideal", with more young and established trees than maturing and mature trees[15] (see Section 1 of Amherst's CFMP for more discussion on age classes and age distribution). Only 25% of the inventoried public trees are maturing or mature, and thus more susceptible to storm damage (Figure 1, Table 2).

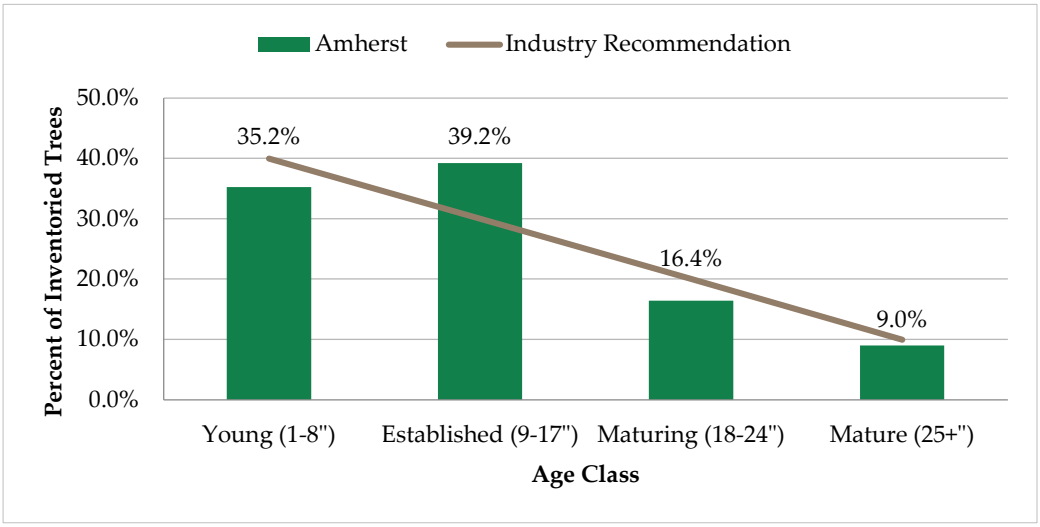

Figure 1. Age structure of Amherst's public trees. Trees with No DBH did not have a recorded diameter measurement.

[14] Kampf, E., & Duryea, M. L. (2021, July 27). *Wind and Trees: Lessons Learned From Hurricanes.* Ask IFAS. Retrieved February 22, 2023, from https://edis.ifas.ufl.edu/publication/FR173#TOP

[15] Richards, N.A. 1983. "Diversity and Stability in a Street Tree Population." Urban Ecology 7(2):159–171.

Table 2. Age structure of Amherst's public trees

Age Class	Diameter Range (DBH)	Number of Trees	Percent of Trees	Industry Recommended Percent
No DBH	0"	246	0.4%	N/A
Young	1-8"	20,082	35.1%	40.0%
Established	9-17"	22,326	39.1%	30.0%
Maturing	18-24"	9,360	16.4%	20.0%
Mature	25+"	5,146	9.0%	10.0%
Total		57,160	100.0%	100.0%

Recommendations

- Maintain an age structure close to the industry recommended "ideal" of 40% young, 30% established, 20% maturing, and 10% mature. Sustained planting efforts are needed to maintain this type of age structure.
- Proactively train young and established trees to aid in the development of good form and strong structure. Common defects such as weak branch attachments, codominant stems/limbs, overly dense crowns, and overextended branches should be the target of a young tree training program. This type of maintenance when trees are young can significantly reduce tree susceptibility to storms and lower program costs by limiting emergency tree maintenance needs as trees mature[16].
- Proactively prune maturing and mature trees on a regular basis to remove defective parts which may fail during storms.

TREE CONDITION

Unhealthy trees and trees weakened by drought, pests, disease, or other stressors are more susceptible to storm damage than healthy trees[14]. Qualitative data about overall tree health and vitality were collected in the *Condition of Wood* data field as part of Amherst's public tree inventory. Condition categories used in the inventory included Excellent, Good, Fair, Poor, and Dead.

Trees in Good or Excellent condition (28.3% of the inventoried trees, Table 3) are less likely to be damaged during storms. Trees in Poor or Dead condition (8.5%) are more likely to be damaged and need to be either removed or maintained to improve condition and reduce the likelihood of storm damage occurring. Trees in Fair condition (63%) could also benefit from proactive pruning to improve condition and remove defects which may increase tree susceptibility to storm damage.

[16] Fazio, J. R. (Ed.). (n.d.). How to Prune Young Shade Trees. *Tree City USA Bulletin, 1*. Retrieved February 23, 2023, from https://www.arborday.org/trees/bulletins/documents/001-summary.pdf.

Table 3. Wood condition of Amherst's public trees

Condition of Wood	Number of Trees	Percent of Trees
Excellent	984	1.7%
Good	15,131	26.6%
Fair	35,806	63.0%
Poor	4,299	7.6%
Dead	486	0.9%
N/A	104	0.2%
Total	56,810	100.0%

Recommendations

- Remove all dead trees from public streets and from maintained areas of public parks.
- Assess the condition of the 104 trees with a *Condition of Wood* status of N/A.
- Remove or prune trees in Poor condition.
- Proactively prune trees in Fair condition on a regular basis to remove defective parts which may fail during storms.

Condition of Wood

Excellent: trees in excellent condition have no defects, signs of stress, pests, or disease, and have strong form and structure.

Good: trees in good condition may have minor issues such as dead twigs or small branches (<2" diameter).

Fair: trees in fair condition may have some issues which are likely to improve with time or maintenance (e.g., dead branches >2" diameter that can be removed during pruning, minor trunk wounds that the tree can heal over time).

Poor: these trees have more significant issues which are not likely to improve with time or maintenance (e.g., large sections of dead canopy, decay cavities in the stem or roots).

Dead: dead trees show no signs of life.

GROWING SPACE AND LOCATION

The amount of root space available to a tree can impact susceptibility to storm damage. Trees which have insufficient soil volume or rooting space for their mature stature are more likely to be uprooted during storms[17]. Likewise, trees which have sustained root damage due to soil compaction during construction[18], root cutting for hardscape replacement, grade changes, and other means[19] are also more likely to fail at the root plate during severe weather. Prior pruning can also affect susceptibility to storm damage – utility pruning, while essential to keeping trees from interfering with electric distribution, can result in unbalanced tree crowns which can predispose trees to storm damage[20].

[17] Gilman, E. F. (2020, January 24). *Rooting Space Restrictions*. Landscape Plants. Retrieved February 23, 2023, from https://hort.ifas.ufl.edu/woody/root-space.shtml

[18] Morris, L. (n.d.). How Compaction Affects Tree Root Growth and Structure. Athens, Georgia, USA; Warnell School of Forestry and Natural Resources, University of Georgia.

[19] Ogle, C. (2021). Chapter 11: Structural Defects, Tree Failure, and Risk. In *Tree Steward Manual*. essay. Retrieved February 23, 2023, from https://pressbooks.lib.vt.edu/treesteward/.

[20] Kempter, G. (2022). In Defense of Utility Pruning. *TCI Magazine*. Retrieved February 23, 2023, from https://tcimag.tcia.org/tree-care/safety/in-defense-of-utility-pruning/.

Less than 1% of Amherst's public trees are planted in a growing space with a minimum dimension of 3 feet or less (Table 4), a highly restricted planting space. A further 29.7% of the public trees have a limited growing space, with a minimum dimension of between 4 and 8 feet. 45.8% of the trees have a somewhat limited growing space (9–15 feet), and the remaining 23.9% of Amherst's public trees have adequate root space (16+ feet minimum dimension). Trees, particularly large stature trees, located in places with restricted root space, are more prone to uprooting during storms than trees with adequate root space.

Table 4. Growing space type and minimum dimension for Amherst's inventoried public trees

Growing Space Type	Minimum Growing Space Dimension					Total	Total Percent
	No Data	3 feet or less	4-8 feet	9-15 feet	16 feet or more		
Island	9	0	158	468	755	1,390	2.4%
Median	41	9	1,741	1,853	820	4,464	7.9%
Natural Area	7	0	1	28	223	259	0.5%
Open/Restricted	42	1	779	2,212	6,649	9,683	17.0%
Open/Unrestricted	66	2	225	670	3,175	4,138	7.3%
Raised Planter	2	0	2	3	22	29	0.1%
Tree Lawn/Parkway	108	32	13,960	20,747	1,955	36,802	64.8%
Well/Pit	0	0	8	37	0	45	0.1%
Total	275	44	16,874	26,018	13,599	56,810	100.0%
Total Percent	0.5%	0.1%	29.7%	45.8%	23.9%	100.0%	

8.4% of Amherst's public trees (4,775 trees) are located below three-phase or single-phase electric distribution lines. These trees may be more prone to storm damage if they are improperly pruned by the utility owner or a contractor working for the utility owner. Unbalanced crowns, lion-tailing, and other improper pruning practices can weaken tree structure and lead to storm damage. Compounding this issue is the fact that these trees near major overhead electric distribution lines are more likely to cause power outages in the event of partial or whole tree failure.

Recommendations

- Whenever possible, enlarge the growing space available for trees and provide adequate root space and soil volume to support a mature tree.
- Enact tree protection measures during construction projects to keep heavy equipment and subsequent soil compaction outside the critical root zone.
- Avoid cutting tree roots for hardscape replacement or installation projects and monitor contractors doing this work to ensure they follow contract stipulations. If tree roots must be disturbed, assess whether the root loss will compromise the root system and remove the tree if necessary.

- Work with local utility owners to ensure that utility foresters, whether employed directly by the utility or contracted by the utility, are pruning trees using ANSI A300 pruning standards and associated best practices.
- Select the right tree for the right place. Ensure that the tree selected will have sufficient root space and soil volume for its mature size, and avoid planting trees which will attain heights over 30 feet under or near overhead utility lines.

TREE SPECIES

Tree species vary in form, structure, branching habits, wood strength, and other factors that can influence their susceptibility to storm damage. Trees species with shallow root systems, large and dense crowns, or acute branch angles are more likely to be uprooted or sustain other damage in high wind events than deep-rooted or small trees with better branching structure. During snow and ice storms, fine-branching trees will accumulate heavy loads of snow more easily than course-branching trees and will sustain more damage[21].

Three studies assessing species' levels of resistance to storm damage are summarized in Table 5 and detailed in Appendix A. These studies use different metrics (e.g., high vs resistant vs excellent) and aren't always in agreement, but may help to paint a picture of which species should be planted for future storm resilience and which should be planted less often.

Table 5. Storm damage resistance levels

Wind*		
Level of Resistance	Number of Trees	Percent of Trees
High	14	0.0%
Medium-High	589	1.0%
Medium-Low	15,579	27.4%
Low	3,098	5.5%
Snow and Ice**		
Resistant	21,378	37.6%
Intermediate	4,127	7.3%
Susceptible	19,700	34.7%
Wind, Snow, and Ice***		
Excellent	1,250	2.2%
Good	27,802	48.9%
Poor	10,439	18.4%
Very Poor	8,613	15.2%

*Kampf & Duryea 2021

**Hauer et al. 1994

***Johnson County K-State Research and Extension. (n.d.). *Trees' Resistance to Wind, Ice and Snow*. Olathe, KS.

[21] Hauer, R. J., Hruska, M. C., & Dawson, J. O. (1994). Trees and Ice Storms - The Development of Ice Storm-Resistant Urban Tree Populations. Urbana, Illinois, USA; Department of Forestry, University of Illinois at Urbana-Champaign.

Green ash (*Fraxinus pennsylvanica*), silver maple (*Acer saccharinum*), and Bradford pear (*Pyrus calleryana* 'Bradford'), which combined account for over a fourth (26.5%) of the trees inventoried in Amherst's urban forest, all have been shown susceptibility to storm damage. However, over a third (36.4%) of the inventoried trees are Norway maple (*Acer platanoides*) or littleleaf linden (*Tilia cordata*) which each show resistance to storm damage. Although selecting storm damage resistant species is recommended whenever possible, it is essential to consider other factors into as well. For example, Amherst's Norway maple population already far exceeds the industry recommended maximum of 10%; therefore, new plantings should be limited. Promoting tree species diversity will decrease risk of devastating canopy loss in the event of a storm or other disturbance events such as drought or pest introduction.

Recommendations

- Strive towards the industry recommended standard of the urban forest's tree population consisting of no more than 10% of one species, 20% of one genus, or 30% of one family.
- Systematically remove and replace tree species susceptible to storm damage with more resistant species. Proactively remove and replace ash trees, which are susceptible to both storm damage and emerald ash borer.
- Select tree species with reported resistance to storm damage whenever possible for new plantings.

SECTION 3. DEBRIS REMOVAL PRIORITIES

Severe weather events can cause large amounts of woody debris to be deposited on and around public roadways. The same weather events also tend to increase the need for emergency vehicles, including fire trucks and ambulances, utility workers, and Highway and Parks Department staff to travel public roadways. Both during and after extreme weather events, clearing of major roadways is essential to allow emergency vehicles to travel unimpeded. Creating prioritized storm plan routes would allow Amherst emergency personnel to deliver services quickly and safely during severe weather and would allow for smooth evacuation in the event of an emergency evacuation. Major Town roads, like Sheridan Drive, Main Street, and Getzville Road, should be prioritized to ensure accessibility, with residential neighborhoods as a secondary priority.

SECTION 4. PARTNERS

Successful creation, implementation, and execution of a Storm Preparedness Plan will require the resources and expertise of a variety of external partners. Multiple partnerships are a reality in storm response given the variety of legal, jurisdictional, and operational missions within a municipal boundary. Partnerships can present challenges but can also result in an effective and efficient response when the expertise and resources of each partner are acknowledged, and roles are properly delineated.

The following is a brief description of Amherst's major partners in a storm emergency and during recovery efforts:

1. **Utility Agencies**

   Electric distribution lines in Amherst are controlled by National Grid, who is a key partner during a storm emergency. Only Electrical Hazards Awareness Program (EHAP) trained staff are qualified to work around energized lines. They have the resources to mobilize quick and appropriate responses to emergency situations involving trees and utilities. During a widespread storm event, Amherst will likely also need to communicate and coordinate with the New York Public Service Commission. Where whole trees or limbs are down or resting on energized lines, rescue and clean-up efforts cannot proceed until power lines have been addressed by the trained personnel of these agencies. Prioritization of where utility agencies respond first generally are: three-phase aerial electric lines; single-phase aerial electric lines; secondary electric lines; and then service (or residential) drops.

2. **New York State Department of Transportation (NYSDOT) and Erie County Division of Highways (ECDOH)**

   The NYSDOT and ECDOH are responsible for the safety and maintenance of interstate and state routes and county routes within the Town of Amherst, respectively. During a storm emergency, they can respond with staff and equipment to clear state-owned ROW and assist with Town streets if authorized. The NYSDOT and ECDOH will likely have a priority of clearing routes which may affect debris staging or removal patterns for Amherst. Check with the local district DOT authority to determine their responsibilities and the municipal expectations for each storm category (Appendix A).

3. **Contractors**

   Labor and equipment for storm related events should be available from local contractors. It is advisable to have contractors, such as tree service companies, debris processing companies, and equipment and tool rentals, already under contractual agreements with the municipality before a storm event occurs. It is also important to ensure contractors have the proper insurance and certifications to complete the necessary work. During an emergency, the Town can enter into new emergency contracts and modify existing contracts to supply the personnel and equipment necessary to efficiently deal with storm mitigation efforts.

SECTION 5. DISCUSSION

The Town of Amherst has a significant number of trees that are at an elevated risk of failure during severe weather events. All elevated risk trees recommended for pruning or removal should be attended to as soon as possible. By allocating the necessary resources required to do so, Amherst Highway and Parks Department staff can work to mitigate the public safety risk associated with these trees. Once these trees have been addressed, low risk trees with poorer condition ratings, pre-existing defects, and pruning recommendations should be considered a maintenance priority. Routine inspections and pruning will also help ensure that future risk is minimized. Special attention should be paid to trees which have the potential to impact aerial electrical lines, as the failure of these trees may result in power interruptions or electrical hazards. Future planting efforts should take storm damage susceptibility into consideration when choosing which species to plant, as well as growing space and proximity to other objects which may be damaged in the event of tree failure.

Tree species with an elevated chance of failure during storms are located throughout the Town. Neighborhoods with large numbers of highly susceptible trees should be prioritized for proactive storm preparedness maintenance to mitigate the potentially devastating impacts of a storm on these parts of the Town. These neighborhoods should also be considered priorities for debris removal after storms, as they are likely to have more downed woody debris than neighborhoods with smaller populations of storm-vulnerable species. A quick filter is supplied in DRG's TreeKeeper® software to aid the Town of Amherst in identifying large-diameter trees in poor condition.

Proactive pruning and other maintenance can help prevent trees along vital roadways from becoming hazards or dropping significant woody debris into important routes during storms. High-volume roads should be identified as priority storm plan routes to be considered priorities for clearing after storms to enable emergency vehicles to traverse the Town efficiently.

The recommendations found in Appendix B aim to prepare the Town of Amherst for future storms – although the occurrence of severe weather cannot be controlled, the severity of a storm's impact on the urban forest can be mitigated with the creation and implementation of an effective storm preparedness plan. A comprehensive plan that explicitly considers the urban forest will equip the Town of Amherst to effectively manage future severe weather events from both an operational and financial perspective.

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APPENDIX A
STORM RESPONSE CATEGORIES FOR THE URBAN FOREST

STORM EMERGENCY CATEGORIES IN THE URBAN FOREST

Storm severity and resulting damage in the urban forest will vary; the degrees of response and resources needed to respond will vary as well. For planning purposes, severe weather can generally be classified into three classes: Class I, II, and III. The following descriptions of these classes and the responses are offered for Town consideration and adoption as part of an official emergency response plan.

Class I – Minor Storm Event

Class I storms are those that are moderate in severity municipality-wide and/or those which are more severe, but damage is restricted to very few locations or a small geographic area.

Damage reports and service requests are made to the government department directly by citizens and from staff inspections. Damage is corrected, and debris is disposed of by municipal staff and contractors on site or following customary procedures.

Generally, Class I storms require no outside assistance for parks or streets personnel, and only limited (if any) assistance from contractors or others. Storm damage remediation and clean-up are achieved by municipal staff and/or contractors, require no additional funding or special equipment, and are completed quickly.

Class I – Storm Mitigation Procedures

- Municipal urban forestry staff receive calls/reports from citizens and partnering agencies.
- Municipal urban forestry staff inspect and determine appropriate mitigation; utility companies are called as required.
- Municipal urban forestry staff and/or contractors immediately resolve damage and dispose of debris.
- Municipal urban forestry staff perform a final inspection, complete a work order, and/or otherwise note the occurrence in the tree inventory database.

Class II – Large Storm Event

Class II storms are those that are long in duration or are severe enough to cause widespread damage. Damage mitigation may also include trees on private property that fall into or threaten the public ROW or other property. Mitigation priority areas will be major roads, public health and services facilities, and areas or sites where public safety is at risk.

Class II storms exceed the normal staff and resources of the municipality and/or contractors alone. Damage mitigation for these storms will usually require the assistance of outside contractors and from other government departments. The assistance will come in the forms of additional staff and equipment, communication assistance, public safety measures, electrical hazard reduction, and customer service.

Class II Storm Mitigation Procedures

- Municipal urban forestry staff assess damage and immediately communicate with police and fire to determine the extent of the damage.
- The informal Emergency Operations Center should be convened to receive calls/reports and to coordinate mitigation response.
- Municipal urban forestry staff inspect damage, determine mitigation levels and needs, and set work priorities.
- Municipal urban forestry staff designate personnel and equipment resources under the guidance of the EOC leader.
- Municipal urban forestry staff and contractual staff resolve damage, process debris on site where appropriate, or transport debris to storage sites.
- Municipal urban forestry staff will make the final inspection and update the tree inventory database.
- Debris is processed appropriately.
- Municipal urban forestry staff should communicate with the citizens about its response activities and status using the Town's website and social media platforms.

Class III – Catastrophic Storm Event

Class III storms will be rare but can occur. Generally, these will result from hurricanes or snowstorms and widespread ice storms. Damage will be severe and widespread on both public and private property.

A "State of Emergency" will likely be called during and after a Class III storm event. A full EOC should be convened by municipality officials. Other local, state, and federal emergency management agencies will become involved, as well as the Department of Transportation and natural gas and electric utility providers. It will become necessary to identify municipal funding that can be used to finance additional contractual services, equipment, and staff over time for the mitigation efforts.

Mitigation priorities will be first determined by public safety, health, and welfare needs. Primary streets and highways that provide for evacuation and/or access to hospitals, shelters, police, fire and rescue stations, and other facilities providing vital public services should be the first priorities when clearing roads.

The second priority of streets and highways to be cleared of debris are those that provide access to components of the public and private utility systems that are vital to the restoration of essential utility services, such as electrical power stations and substations, municipal water and sanitary sewer pumping stations, and communication stations and towers. The last priority of roadways to be cleared are residential streets and alleys/access ways.

No debris is intended to be removed during the initial emergency road-clearing operations. Rather, debris is to be moved to the side of the roadway that will allow for a minimum of one lane of traffic in each direction and not create conflict with future utility restoration efforts by others.

Class III - Storm Mitigation Procedures

- Municipal urban forestry staff assess damage and immediately communicate with the EOC and the designated municipal staff leader to determine the extent of the damage. County and State Emergency Management agencies may also be in the communication channels.
- Municipal urban forestry staff secure an additional regional tree debris disposal site(s) as needed.
- Municipal urban forestry staff inspect tree related damage, determine mitigation levels and needs, and set work priorities.
- Municipal, county, DOT, and other agencies combine sufficient and appropriate personnel and equipment resources under the guidance of the municipality to mitigate tree related situations.
- Municipality, allied agencies, and contractual staff resolve damage, process debris on site where appropriate, or transport debris to a storage site.
- Municipal urban forestry staff make a final inspection and update the tree inventory database.
- Debris is processed appropriately.
- Municipal urban forestry staff assist EOC team members and municipal leaders with completion of required state and Federal Emergency Management Agency (FEMA) forms.
- Municipal urban forestry staff should communicate with the citizens about its response activities and status and provide advice for the treatment of private trees that have been damaged using the municipal website and social media platforms.

Tree Emergency Plan Worksheet

For: Urban and Community Foresters, Community Leaders, Public Works and Parks Departments, Planners, Councils, and other Public Officials

1. Early Warning System/Weather Forecasting Service — Use an early warning procedure to enhance mitigation: communicate with the National Weather Service, a consulting meteorological firm, a designated television weather channel, or the local police department. With a procedure in place, you should have at least three hours of lead time before most tree damaging weather strikes.

Staff Lead: _____

Contact Name: _____
Address: _____
Phone: _____
Mobile: _____
FAX: _____
Email: _____ **Web Site** _____

Description of services provided:

2. Local Emergency Manager – Lead contact for a community and responsible for emergency planning and response activities.

Name: _____ **Phone:** _____
Mobile: _____

Role(s):

3. Public Relations Coordinator — This is the individual responsible for primary public relations, media contacts, citizen information and communications about the natural disaster. (Must have full knowledge of damage, community issues and capabilities, and be able to make decisions.)

Name: _____ **Phone:** _____
Mobile: _____

Alternate(s):
Name: _____ **Phone:** _____
Mobile: _____
Name: _____ **Phone:** _____
Mobile: _____

4. Disaster Planning and Response Team Members: Your team should include: mayor, selected department heads including specialists in public relations and purchasing, public works specialists (streets, wood utilization and disposal, fleet manager), utilities, parks department, other local government heads, meteorologist, local emergency managers. Include creative people on your team that can think beyond barriers that may be up. Get media involved in planning so they understand what your cleanup priorities are after a storm. Someone involved with public tree management should be part of the community emergency management team. It is critical to include individuals who can make fiscal and administrative decisions because this team will most likely serve in the storm operations command center.

Name:	Role/Responsibility:
1.	**Mayor**
2.	**Fire Chief**
3.	**Director of Public Works**
4.	**Utility Representative**
5.	**Public Relations Representative**
6.	**City Council**
7.	**County Emergency Management**
8.	**Police Chief**
9.	**Director of Parks**
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	

5. Available Disaster Response Staff and Crews: Identify and list all municipal staff and crews available for disaster response work. Consider forestry and parks departments, public works, engineering, streets and sanitation, etc. Where possible, establish teams that can be responsible for specific disaster response activities (primary route clearing, assistance to utility crews, manage debris staging sites, distribute equipment, etc.)

Staff Name:	Role/Responsibility:
1.	
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	
10.	
11.	
12.	
13.	
14.	
15.	
16.	
17.	
18.	
19.	
20.	
21.	

6. Emergency Call Out Procedure — phone contact tree for staff.

Name: ______________________ Will Contact — Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________ Will Contact — Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________ Will Contact — Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________ Will Contact — Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________
Phone: ______________________
Mobile: ______________________

Name: ______________________
Phone: ______________________
Mobile: ______________________

7. Primary transportation and evacuation corridors and routes for emergency vehicles. Identify and map for reference. Have map available and accessible, and review and update annually.

8. Critical power transmission corridor restoration sites (medical treatment centers). Identify and map for reference. Have map available and accessible, and review and update annually.

9. Identify who is responsible for decision making and priority response setting for multiple life threatening situations.

Name:_____ Phone:
Pager:_____ Mobile:_____

10. Tree Damage Clean-up Priorities — List areas that need attention after life threatening situations are abated. Share this information with key staff the will be answering phone calls from residents, businesses, etc. Create a work order form for use when receiving calls.

1.

2.

3.

4.

5.

6.

7.

8.

9.

10.

11. Procedure for Debris Staging and Removal — Identify several areas for staging and processing debris. Establish a contract or agreement securing each site. Choose a processing site that is large, flat, well-drained and accessible to roads that can support truck weights of at least 9 tons per axle. Identify ways to protect significant trees or cultural resources during processing. Potential sites include undeveloped park, industrial, cemetery, fairgrounds, agency and state land. Large parking lots (even paved lots) work well. Remember to consider noise implications near residential areas. Identify multiple sites. Annually reconfirm access and availability to these sites. Make sure the site is large enough for safety considerations (flying debris from tub grinders), if possible, identify sites that can be secured (fencing).

Site 1 – Location: _____

Contact Name/Role:

Phone: Mobile:

Site 2 – Location: _____

Contact Name/Role:

Phone: Mobile:

Site 3 – Location: _____

Contact Name/Role:

Phone: Mobile:

12. Debris and Brush Removal from Private Property — Identify how you will address this issue. A major storm makes it difficult for private property owners to remove brush and debris. Make a decision at the municipal level allowing for debris collection. Determine if your city has adequate equipment and staff available to accomplish this often enormous task. It is critical that you provide guidelines for residents. Specify the types, amounts and piling arrangement of the materials that you will accept. Cities can also assist private homeowners who must contract with private companies for trimming and removal by preparing a list of companies that are licensed, professionally trained and insured.

Person Responsible: _____
Phone: _____ **Mobile:**_____

Minor Storm Policy:

Major Storm Policy:

Listing of available tree care companies:

13. Identify Wood Utilization Options – Develop a list of companies and resources that can process the wood material generated from storm damage. When possible, establish a contract for utilization services.

Wood Utilization Contract: **Company/Organization:**

Phone: Mobile:
Utilization Service Contract: Yes / No
Description of Service:

Wood Utilization Contract: **Company/Organization:**

Phone: Mobile:
Utilization Service Contract: Yes / No
Description of Service:

14. Equipment Listing (available in-house) — Develop a list of public works and parks department equipment and vehicles available for tree clean up work. Keep it current. Include wood chippers, aerial bucket trucks, refuse packers, loaders, supervisory vehicles, chain saws, barricade and lighting equipment, hand saws and pole pruners on the list.

Person Responsible: _____
Phone:_____ **Mobile:**_____

Equipment Available	Quantity	Department/Contact
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

15. Additional Equipment and Assistance Sources — In an emergency, your city administrator may authorize the lease or rental of additional equipment for storm clean-up work. Make a list of potential vendors and keep it current. For certain equipment and assistance needs, it is critical to establish an emergency contract. Guaranteed access to large tub grinders and multiple additional tree trimming crews would be services to guarantee via an emergency contract. The city administrator may also authorize tree contractors to supplement city crews. Assemble a list of licensed and insured potential tree service contractors. Your neighbor cities may be unaffected by a storm that strikes your city. Establish a system to contact neighbor cities that could send staff and equipment to assist you in cleaning up your city.

Person Responsible: _____
Phone:_____ **Mobile:**_____

Equipment Available	Quantity	Department/Contact
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

Emergency Contract:

Organization: Contact Name:
Phone: Mobile:

Emergency Contract:

Organization: Contact Name:
Phone: Mobile:

Emergency Contract:

Organization: Contact Name:
Phone: Mobile:

16. Staff, Crew Organization and Equipment Needs – In an emergency, staff members may need to lead crews from other departments or of private contractors. Determine staff who can function in this manner.

Name	Crew#	Equipment Needed

17. Individual(s) Responsible for Record Keeping — This person does documentation and cost accounting during and after disasters. Note – define a specific accounting code for each storm event. If you define a specific code for each storm event, it will allow for effective accounting.

Name: Phone:
Mobile:

Name: Phone:
Mobile:

Storm Accounting Code:

18. Individual(s) Responsible for Damage Assessment and Damage Survey Reports — This person is familiar with FEMA and Division of Emergency Management procedures and prepares the reports needed for public assistance.

Name: Phone:
Mobile:

Name: Phone:
Mobile:

19. Disaster Budget (identify potential activities to anticipate costs)

Personnel Regular Time:

Overtime:

Equipment Owned:

Equipment Contracted:

Contracted Work:

Operational Supplies:

Disposal/Recycling:

Administrative Costs (Overhead):

20. Funding Information from Past Storms — review costs from past storms to anticipate costs for future storms and establish funding needs.

Storm: _____ **Date:** _____

Activity	**Cost**
Personnel Regular Time	
Overtime	
Equipment Owned	
Equipment Contracted	
Contracted Work	
Operational Supplies	
Disposal/Recycling	
Administrative Costs (Overhead)	
TOTAL	

Storm: Date: _____ _____

Activity	**Cost**
Personnel Regular Time	
Overtime	
Equipment Owned	
Equipment Contracted	
Contracted Work	
Operational Supplies	
Disposal/Recycling	
Administrative Costs (Overhead)	
TOTAL	

21. Individual(s) and/or Organization(s) responsible for community regreening efforts: Develop a list of contacts for use in efforts to regreen the community after storm events.

Name/Organization: Phone:
Mobile:
Organization Role:

Name/Organization: Phone:
Mobile:
Organization Role:

Name/Organization: Phone:
Mobile:
Organization Role:

Name/Organization: Phone:
Mobile:
Organization Role:

22. Listing of community and neighborhood groups that promote and support community regreening efforts

Group:	Representative:	Phone: Mobile:
Group:	Representative:	Phone: Mobile:
Group:	Representative:	Phone: Mobile:
Group:	Representative:	Phone: Mobile:
Group:	Representative:	Phone: Mobile:
Group:	Representative:	Phone: Mobile:

23. Community urban forestry comprehensive management plan —

Comprehensive forest management is your best defense against storms. Well planted and cared for trees stand up to weather better than neglected trees. Develop or modify a forest management plan to include information related to disaster preparedness. Identify critical activities such as hazard tree removal, tree pruning cycles, annual tree care needs, etc.

Name: Completed:

24. Community tree risk management plan — A tree risk management plan will provide the community with a systematic approach to accurately identify moderate to high risk trees, an initiate the timely removal or corrective treatment of hazardous trees. Communities that carry out tree risk management strategies will likely see reductions in damage after storms. Go to: http://www.na.fs.fed.us/spfo/pubs/uf/utrmm/index.htm

Name: Completed:

25. Storm Damage Assessment – If a storm is significant enough to receive a formal disaster declaration, state and/or federal funding may be available. To assist communities in the process of applying for reimbursement for storm associated costs, it is important to be able to quickly develop an estimate of damage. Consider using the Storm Damage Assessment Protocol as a tool prior to a storm. This protocol allows a community to provide an assessment of damage in a simple, credible and efficient manner. Go to: http://www.itreetools.org/applications.html

Name: Completed:

26. Contacts for additional assistance in natural disaster planning, response and recovery:

Name	Phone
Area or District Forester	
University Extension Agent	
Consulting Foresters	
City Foresters of Neighboring Cities:	
Other	

(Worksheet Prepared by: Lisa Burban (USDA Forest Service), Jim Hermann (Minneapolis Park and Recreation Board), and Katie Himanga (Heartwood Forestry) – Updated May, 2006. Worksheet available on-line at: http://www.na.fs.fed.us/urban/inforesources - under "Urban Forest Management")

APPENDIX B
RECOMMENDATIONS FOR STORM PREPAREDNESS

TREE RISK
Remove or prune the 89 High Risk trees immediately to reduce risk and liability, improve public safety, and limit the chance of these trees failing during extreme weather events.
Assess the 2,601 Moderate Risk trees and decide the best way to manage these trees. Some may need to be removed, others pruned, and others may require interventions such as cabling and bracing to support weak branch unions in otherwise healthy trees. Proactively maintaining these trees will limit the chance of them failing during extreme weather events.
Conduct risk assessments for the 307 trees with a risk rating of N/A.
Conduct routine monitoring of the public tree population to identify trees with elevated levels of risk. Ideally, this should be done every year and/or after extreme weather events. Level 1 assessments via walk-by or drive-by surveys are an efficient and cost-effective method to keep track of the risk associated with public trees.

TREE AGE
Maintain an age structure close to the industry recommended "ideal" of 40% young, 30% established, 20% maturing, and 10% mature. Sustained planting efforts are needed to maintain this type of age structure.
Proactively train young and established trees to aid in the development of good form and strong structure. Common defects such as weak branch attachments, codominant stems/limbs, overly dense crowns, and overextended branches should be the target of a young tree training program. This type of maintenance when trees are young can significantly reduce tree susceptibility to storms and lower program costs by limiting emergency tree maintenance needs as trees mature.
Proactively prune maturing and mature trees on a regular basis to remove defective parts which may fail during storms.

TREE CONDITION
Remove all dead trees from public streets and from maintained areas of public parks.
Assess the condition of the 300 trees with a Condition of Wood status of N/A.
Remove or prune trees in Poor condition.
Proactively prune trees in Fair condition on a regular basis to remove defective parts which may fail during storms.

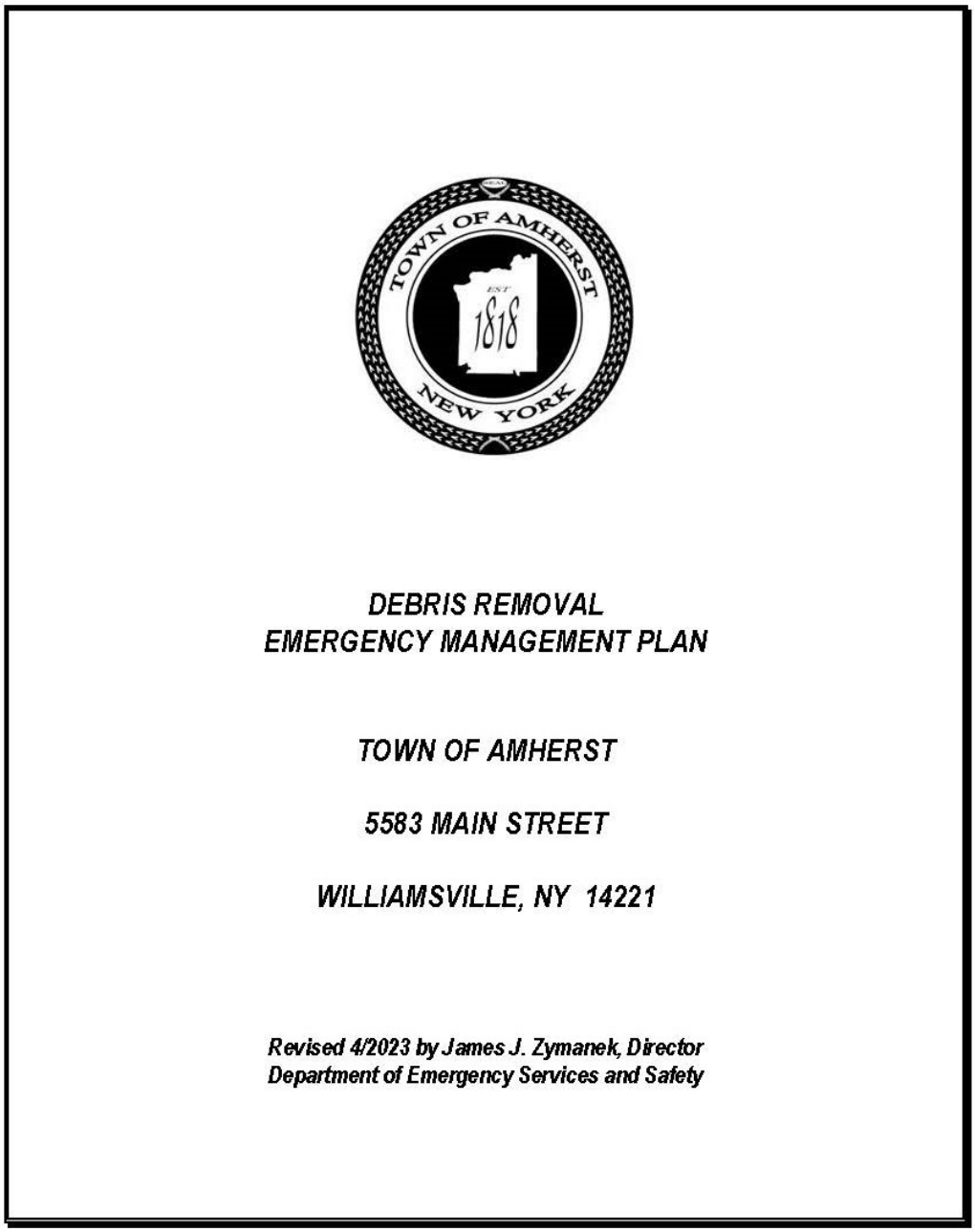
GROWING SPACE & LOCATION
Whenever possible, enlarge the growing space available for trees and provide adequate root space and soil volume to support a mature tree.
Enact tree protection measures during construction projects to keep heavy equipment and subsequent soil compaction outside the critical root zone.
Avoid cutting tree roots for hardscape replacement or installation projects and monitor contractors doing this work to ensure they follow contract stipulations. If tree roots must be disturbed, assess whether the root loss will compromise the root system and remove the tree if necessary.
Work with local utility owners to ensure that utility foresters, whether employed directly by the utility or contracted by the utility, are pruning trees using ANSI A300 pruning standards and associated best practices.
Select the right tree for the right place. Ensure that the tree selected will have sufficient root space and soil volume for its mature size, and avoid planting trees which will attain heights over 30 feet under or near overhead utility lines.

TREE SPECIES
Strive towards the industry recommended standard of the urban forest's tree population consisting of no more than 10% of one species, 20% of one genus, or 30% of one family.
Systematically remove and replace tree species susceptible to storm damage with more resistant species. Proactively remove and replace ash trees, which are susceptible to both storm damage and emerald ash borer.
Select tree species with reported resistance to storm damage whenever possible for new plantings.

MANAGEMENT
Be sure all staff are signed up for the New York Emergency Alert System through (alert.ny.gov/).
Establish communication protocol for storm events. Both during and after a storm emergency, the Town of Amherst may be relying on and working with multiple departments and levels of government. Effective communication is key to effective and expedient action. An effective plan ensures that all potentially involved or relevant departments understand their roles in the storm response effort.
Routinely update the tree inventory as maintenance activities occur or as otherwise warranted. The most effective storm preparedness and management plans rely on current data to prioritize work and ultimately reduce future storm damage.
Annually review the Storm Preparedness and Response Plan and update as necessary.

MANAGEMENT (Continued)
Utilize the Homeland Security office to provide quick notification to the NYS DEMHS and FEMA if reimbursement from disaster funds is anticipated. Understand in advance the FEMA system for reimbursement and develop a clear system of record keeping in order to streamline and expedite reimbursement.
Provide staff training, particularly on tree risk and working in environments with potential electrical hazards.
Commit to providing the citizens timely messaging about Amherst's response and recovery activities and about tree damage and correction topics. Prepare public relations materials ahead of time so that they are easily accessible when storms strike.
Review FEMA Debris Monitoring Guide (March 2021) for further guidance.

APPENDIX C
DEBRIS REMOVAL EMERGENCY MANAGEMENT PLAN



DEBRIS REMOVAL PLAN

PURPOSE

The Debris Removal Plan is designed to be used as a guide establishing an operating procedure to follow for each event. While all contingencies cannot be accounted for, the following procedure will be implemented based upon each incident.

CHAIN OF COMMAND

The disaster chain of command for debris removal will follow the Incident Command System guidelines. For Tree removals and debris associated with downed trees the Town Forester and Highway Superintendent shall play a lead role in command.

CONDITION

Disaster relief will be incident driven. The incident may take the form of an ice or snow emergency, wind storm, flood, or a man-made incident effecting the town or part of the town. Anytime a State of Emergency is declared and there is disruption of normal town activities, certain portions of the Debris Removal Plan may need to be activated.

TASK

Removal of debris and trash will be completed as soon as possible after the initial declaration has been lifted. Prior to removal of the declaration, a complete assessment will be conducted to determine the extent of the damage and the volume of the material to be removed. Efforts must be made to remove contaminated material and to dispose of it as soon as possible. This will prevent the spreading of disease and control the rodent situation. Special attention will be given to the condition of the roadways to insure that emergency services can be provided. This will require certain events based upon the size of the incident and how much of the town is affected.

1. *Localized flooding of neighborhoods. This can be accomplished through normal collection cycles. The Office of Refuse will monitor the volume of material and to the extent of the area affected to determine the amount of equipment need to remove the material as soon as possible.*

2. *Large area flooding covering large portions of the town. This will require a coordinated effort between the private contractor and the town to insure that this material is removed as soon as possible. Large volume collection may require use of all town packers, dump trailers, front end loaders and additional equipment from the private contractor to remove and dispose of the material as soon as possible.*

3. *All contaminated material will be removed and disposed at American Ref-Fuel. In addition, the Temporary Transfer Area at the Highway Department may be used to unload packers to get the trucks back on the road collecting material. The town will reload this material on*

rental transfer trailers for disposal at American Ref-Fuel. At no time will any contaminated material remain at the Highway Department for longer than 24 hours before removal and disposal.

4. *Alternate BFI transfer station on Broadway Ave. in Cheektowaga can be utilized and opened if necessary to handle excessive volumes of material.*

5. *Wind/ice storm tree debris removal. Based upon the volume of the damage, and the affected area will determine what course of action will be followed. Initial assessment will require removal of tree debris to open roadways for emergency access. Large amounts of trees and brush may require the use of certain areas of the town for temporary storage. This will establish initial opening of the town. Consultation with the Krantz Compost Facility personnel is extremely important during the assessment phase to determine storage capacity of the facility.*

6. *All loads of debris will need to be evaluated and documented as to their load size. Photos shall be taken of all loads and documentation shall be needed as to where the debris was picked up. This information and documentation is important for FEMA reimbursements.*

7. *The following areas have been designated as temporary storage areas in the town:*

    a. *Amherst Compost Facility, 560 Smith Road*
    b. *Amherst Highway Department, 1042 N. Forest Road*
    c. *Harlem Road Community Center parking lot*
    d. *Margaret Louise Park, Hopkins Road*
    e. *Royal Park off West Royal Parkway*
    f. *Amherst Museum parking lot on New Road*
    g. *Dellwood playground, Dellwood Road*

    Town owned properties will be utilized first. If needed additional parking lots may be used depending on the volume and extent of the damage.

8. *A complete inventory will be kept of all available equipment. This includes all Highway and Engineering Department equipment.*

9. *The Compost Facility will be notified as far in advance to prepare for large volumes of material. Adequate spare parts should be on hand at all times to limit down time for repairs.*

10. *Removal of processed material from the Compost Facility must occur as expeditiously as possible. The Compost Facility personnel must have an active role in directing the removal of finished material. Private contractors may be authorized by emergency approval of the Town Board. Preferred options of material removal include (in order of preference):*

    a. *Amherst Highway and Engineering Department*

b. *Neighboring municipalities*
c. *Private hauling contractors*

11. *In order to move material from the Compost Facility, outlets and/or storage locations for finished material must be found. A list of preferred outlets includes, but is not limited to:*

a. *Nature view Park (for trail maintenance)*
b. *New Road dump site*
c. *Former Nike Base (launch area), 4355 Millersport Highway*
d. *Erie County Department of Public Works*
e. *City of Lockport Wastewater Treatment Plant Sludge Compost Facility*
f. *NYSDOT*
g. *Private contractors*

11. *In all situations, the Compost Facility personnel will attempt to receive established finished material prices for any emergency debris cleanup processed material. However, the situation may arise where receiving such prices is not possible. In such circumstances, the Compost Facility personnel with Town Board approval may negotiate any pricing structure to expedite the removal of finished material from the site. Documentation and clear recordkeeping must be maintained for any vegetative compost that is sold as it will affect any reimbursements.*

STANDARD

The intent is to return the Town to a state of normal operation as soon as possible. This will be accomplished with respect to the health, welfare and safety of the resident and the individuals involved in returning the Town to a normal status. Extreme care must be observed to limit damage, maintain law and order and prevent the spreading of disease.