

# Lancaster City Tree Inventory: Summary Report

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August 2011, revised November 2011



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## List of Abbreviations

ADA	Americans with Disabilities Act
ANSI	American National Standards Institute
DBH	Diameter at breast height (4.5 ft. above ground)
spp.	Species

## Acknowledgments

This tree inventory and municipal tree management plan was formulated by Brian Wolyniak and Bill Elmendorf. The 2011 tree inventory was performed by Matthew Puchalsky and Karl Quimby, graduates from the Pennsylvania State University School of Forest Resources. Brianna Hensel and Nanette Raczka, environmental studies students at Millersville University assisted with collecting field data. The inventory was conducted under the guidance of Dr. Bill Elmendorf, Associate Professor and Extension Specialist, Community and Urban Forestry, Penn State School of Forest Resources. Assistance with the inventory was also provided by Brian Wolyniak, a doctoral student at the Pennsylvania State University School of Forest Resources.

We would like to thank Dr. Carl Pike and all the members of the Lancaster Shade Tree Commission, along with Jim Bower, Lancaster City Arborist, and the Lancaster City Department of Public Works, Parks and Public Property Bureau. Thanks to Glenn Mohler, GIS Manager, and the Lancaster County IT/GIS department for providing GIS data for this inventory.

We would like to acknowledge Fritz Schroeder, Director of Programs, and the LIVE Green organization for their support of the inventory. Thanks also to James Street Housing and Franklin & Marshall College for assistance with housing for the duration of the inventory.

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## Scope of Study and Plan

Trees offer many benefits to communities but with these benefits there is also a certain degree of risk from breakage, failure, or other causes and conditions.

Recommendations that are made by our inventory crew and in the municipal tree management plan are intended to minimize or reduce hazardous conditions that may be associated with trees. However, there is and there can be no guarantee or certainty that efforts to identify and correct unsafe conditions will prevent breakage or failure of a tree. Our recommendations should reduce the risk of tree failure, but they cannot eliminate such risk, especially in the event of a storm or any Act of God. While an inventory should result in the detection of potentially risky trees, there can be no guarantee or certainty that all risk trees will be detected. Some hazardous conditions in landscapes are apparent, while others require detailed inspection and evaluation. This type of detailed inspection was not within the scope of the inventory or municipal tree management plan completed by the Penn State School of Forest Resources.

## Tree Benefits and Costs

Street and park trees provide a vast array of benefits and values to the City of Lancaster. Well-maintained trees in residential neighborhoods can significantly increase the value of homes and property by creating a sense of privacy and adding to the beauty of the landscape. Commercial areas benefit also, as studies have shown how tree lined storefronts increase the likelihood of shoppers, increase the length of time people shop, and increase the amount shoppers are willing to pay for goods. These economic values increase the amount of property and other taxes available to the City.

Cooling and heating costs can be reduced by strategically placing trees around buildings and roads. This shading and cooling provided by community trees helps to reduce energy needs and bills. Tree canopies reduce the amount and rate at which rain water strikes the ground, thereby reducing erosion and stormwater management costs.

Trees are known to provide many health benefits to people. They help filter particulates out of the air, absorb carbon dioxide, and emit oxygen. Street and park trees offer mental and emotional restorative properties to people by helping to mitigate noise, providing a contrast to hard concrete surfaces, by establishing a connection to the natural world, and importantly, by reducing stress. All these benefits not only make people healthier, but also reduce health care costs.

## Importance of Tree Inventory and Municipal Tree Plan

In order to formulate and implement an effective municipal tree plan, it is necessary to have a complete set of quality information. An accurate street tree inventory provides the foundation for which annual work plans and budgets are based. Knowledge of the community forest species composition, condition, and age helps to create a prioritized maintenance plan for annual tree pruning, removal, and planting.

Implementing and designing a community tree program requires a tree inventory, a municipal tree plan, a Shade Tree Commission, support from the City, and annual funding and work. This report will help move this work forward by discussing the responsibilities of the City and residents, providing tree removal guidelines, pruning and planting guidelines, and providing recommendations thoughts for the future.



## The City of Lancaster

Streets lined with large, majestic, green canopies conjure up images of beautiful communities and neighborhoods found throughout Pennsylvania. This is a vision that many people desire and work towards for their communities, including the City of Lancaster. Lancaster City is located in Lancaster County in southeastern Pennsylvania. It is home to approximately 60,000 people and encompasses 7.4 square miles.

Each of the landscapes found within the City's neighborhoods presents a unique set of challenges of how to best manage the public tree resource. This inventory, in conjunction with a municipal tree plan implemented by annual work and funding, will help Lancaster enjoy the many benefits of a safe and healthy community forest in the future.

## Community Tree Plan: Vision, Goals, and Objectives

Building on the information and recommendations provided in this inventory report, a more detailed municipal tree plan should be completed to accomplish the vision and goals for the community forest in Lancaster. Objectives should provide specific strategies and action items for achieving the broader vision and goals. This will help the community maximize return on investment in the City's public landscapes. Below are examples of common vision, goals, and objective statements which could be applied to Lancaster's community forest.

### Vision

To improve and maintain a healthy and sustainable community forest that provides ecosystem benefits for all Lancaster City residents and visitors.

### Goals

- Improve the aesthetic beauty and quality of life in the City.
- Make the City and its trees safer.
- Promote public awareness and involve people in civic environmental projects.
- Increase budgets through annual work and fundraising.
- Minimize hardscape damage and other tree problems.

### Objectives

- Provide effective administration.
- Manage tree risk for public safety.
- Provide qualified annual tree evaluation and removal.
- Promote aesthetically pleasing landscape design.
- Provide proper site analysis, site preparation, and tree selection.
- Increase canopy coverage and ecosystem services through proper annual tree planting.
- Provide proper tree maintenance.
- Increase public education, involvement, and support.

## 2011 Street Tree Inventory

### Overview

An inventory of Lancaster's public street trees was performed May through July 2011 by Matthew Puchalsky and Karl Quimby, graduates from the Pennsylvania State University School of Forest Resources. Brianna Hensel and Nanette Raczka, environmental studies students at Millersville University, also assisted with collecting field data. The inventory crew was under the guidance of Brian Wolyniak, Ph.D. candidate and Dr. Bill Elmendorf, Associate Professor and Extension Specialist, Community and Urban Forestry, Penn State School of Forest Resources.

The purpose of the inventory was to assess the condition (health and structure) of street trees in the City of Lancaster and indicate trees that may: 1) be potentially hazardous; 2) require removal; 3) be in need of maintenance, such as pruning. The inventory also indicates possible tree planting sites and information for immediate and future work. The Lancaster Shade Tree Commission should use this inventory information in conjunction with annual field evaluations to plan for the completion of tree removal and other work

The total number of trees inventoried was 5483. Also inventoried were 1276 potential planting sites.

### Methods

A walking inventory of trees and site characteristics was completed using portable field computers with GPS receivers and diameter tapes. Working in pairs, the field assistants measured and evaluated each tree or planting site and entered the information into a georeferenced database using customized data entry forms within ESRI ArcPad software. Tree and planting site locations were positioned using GPS in conjunction with an aerial photo of the City. In addition to GPS coordinates, tree and planting site locations were recorded by street, address number, and cell (see "Locating Trees and Planting Sites," pg. 11). Throughout the data collection process, data was downloaded from the handheld computers, corrected, and compiled, into a common georeferenced database using ESRI ArcMap and Microsoft Access software.

Data can be exported from the database for import into i-Tree Streets software. This free software from USDA Forest Service allows inventory data to be used to calculate ecosystem costs and benefits. Information about i-Tree can be found online at [www.itreetools.org](http://www.itreetools.org).

A number of attributes were recorded for each tree and planting site inventoried. In the case of planting sites, tree attributes were left empty and only site attributes were recorded. The following pages provide a list of the attributes included in this inventory.

## Site Attributes

**ID number** – An automatically generated unique number assigned to each tree or planting site.

**Inventory date** – The date the tree or planting site was recorded in the inventory.

**Address** – The numerical street address of the land parcel where sites are located.

**Unmarked Address** – When checked, the address was not present on-site and the address was estimated based on adjoining parcel addresses and city/county parcel data.

**Half Address** – When checked, the parcel has a half address. Add ½ to the numerical street address listed.

**Street** – The street name to which the land parcel containing the site is addressed.

**Cell** – The location of a tree or planting site within a particular address. See section below “Locating Trees and Planting Sites.”

**Sidewalk damage** – Cracks, breaks, or lifting of sidewalk to an extent which violates ADA standards. Damage is indicated to be either tree caused or non-tree caused.

**Utilities** – Presence of primary or secondary overhead utility lines above a site.

**Site type** – The category of site type into which a site falls. Site type categories:

**Tree pit** – A planting pit cut out of a sidewalk, or otherwise surrounded by impervious hardscape. These are generally small and hold only one tree.

**Tree lawn** – A continuous planting strip located between a street and sidewalk. Multiple trees can be planted along the length of a tree lawn.

**Trench** – A large tree pit (extending greater than 10 ft.) or continuous planting strip typically located within sidewalks. Pervious hardscape surface between trees allows water to infiltrate while maintaining sidewalk space.

**Median** – This site is similar to a tree lawn, but is used to describe tree sites located in an island median of a road.

**Yard** – Site is unbounded within 8 feet on at least 3 sides. This type is used when a sidewalk is not present, or a sidewalk is located immediately adjacent to a road, with trees (subject to city ownership/management) planted behind the sidewalk.

**Undefined** – Site is unbounded within 8 feet. This type is typically used for trees not adjacent to roads or sidewalks, such as in parks.

**Site size** – The width of a site as measured perpendicularly to the adjacent road.

**Site condition** – Rating of the suitability of a site as a planting site based on potential conflicts.

**Notes** – An open text field for any additional information deemed important about a site or a tree.



## Tree Attributes

**Species code** – Standard USDA Forest Service codes, usually derived as the first two letters of the genus and the first two letters of the species epithet.

**Scientific name** – Latin/botanical name.

### Common name

**DBH** – Diameter at breast height. Tree diameter measured at a height of 4.5 feet from the ground using a diameter tape.

**Light conflict** – Tree parts are growing in the way of a street light, blocking light dispersion.

**Sign conflict** – Tree parts are blocking visibility of nearby signage.

**Traffic conflict** – Tree parts extend into the space extending from the roadway to a height of 16 feet.

**Walkway conflict** – Tree parts are located within the space between a walkway and a height of eight feet above the walkway.

**Building conflict** – Tree parts are in conflict with a nearby building.

**Maintenance** – recommended maintenance based on evaluation of tree at time of inventory. See descriptions on next page.

**Defects** – Issues which contribute to determining tree condition rating and of importance for recommended and ongoing maintenance.

**Wound** – Tearing of bark, crushing of inner bark/cambium from physical contact by equipment, vandalism, or lightning.

**Decay** – Decomposition of wood by microorganisms.

**Cavity** – Void caused by complete decay of wood.

**Disease/Insects** – Signs/symptoms of disease pathogens or damaging insects.

**Codominant trunk** – Multiple upright stems of similar height and diameter.

**Deadwood** – Significant accumulation of dead branches.

**Large deadwood** – Presence of dead limbs greater than 4" in diameter.

**Decline** – Overall thinning of foliage and live branches due to stress.

**Object** – Any object physically attached or situated close to the trunk or branches and causing injury to the tree.

**Necrosis** – Death of foliage

**Chlorosis** – Yellowing of foliage

**Girdling roots** – Roots at the base of a tree, which grow across or encircle the root flare, restricting the flow of water and nutrients.

**Storm damage** – Tree exhibits broken limbs, wounds with ripped or torn bark, or other signs of storm damage. Any needed repairs are noted in the maintenance section.

**Condition rating** – Rating of tree condition based on the health and structure of the tree and its parts. Categorical ratings are excellent, good, fair, poor, and dead.

Ratings are assigned based on a visual assessment of tree condition, relative to ratings applied to other trees of the same and similar species found at similar sites. Ratings are also based on the training and experience of the personnel conducting the inventory. Visible defects and other tree attribute data provide detail for the assigned condition ratings. Structural and health factors that could not be seen could not be considered (e.g., root rot) in the context of this inventory. In general, the greater the number and extent of individual defects or problems within a tree, the lesser the condition rating assigned.

## Maintenance Descriptions

**Crown cleaning** – The selective removal of dead, dying, diseased, and broken branches from the tree crown.

**Crown raising** – Selective pruning to provide vertical clearance over roads and sidewalks.

**Crown restoration** – Pruning to improve the structure and form of trees which have been storm damaged or vandalized.

**Crown thinning** – The selective removal of live branches to allow light and air penetration or to lighten remaining branch weight.

**Horticultural train prune** – Pruning of young trees (less than 10 years old) to help establish good form and structure.

**Priority reinspect** – A more thorough inspection by an experienced/certified arborist should be conducted to investigate potential health and structural deficiencies.

**Removal** – Trees which should be removed because they are dead or in severe decline.

**Planting** – No tree is currently planted and the site is available to be planted with a new tree based on the site type, size, and condition. When listed as “Planting site – new” in the common name field, no tree had been previously planted in this location; removal of paving materials (e.g., concrete, bricks) to create a tree pit is likely.

**Stump removal** – An old stump is present and should be removed prior to replanting.

### Locating Trees and Planting Sites\*

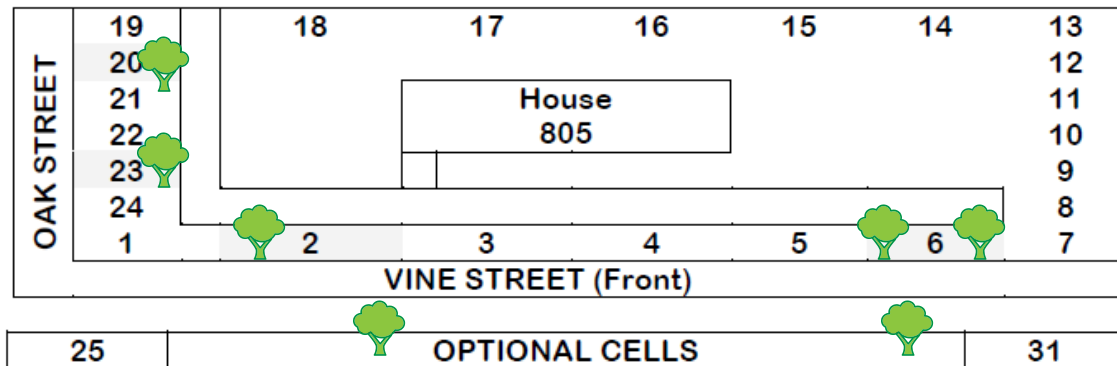
In addition to geographic coordinates, the location of a tree is recorded in reference to the address of the property to which the tree is adjacent. Thus, trees in the right of way which are located along streets to the side or rear of a property are given a location based on the address of that property, rather than a location based on the street along which the trees are physically located. To designate the relative location of a tree at a particular address, a cell number is assigned. Following from ACRT's cell number concept, an imaginary 7x7 cell grid is applied across a particular parcel. A number is assigned to each cell around the perimeter of the grid, starting with 1 in the front left corner and counting upward to 24, moving in a counterclockwise direction around the perimeter. Cell sizes vary with lot size and there may be zero, one, or more trees in each cell. The cell numbers are meant to be relative to the other trees and cell numbers.

Occasionally, trees may fall outside the normal perimeter location, such as trees planted in medians. For these locations, a set of optional cell numbers, ranging from 25 to 31, are used. A numerical street address is also assigned to these tree sites using the closest actual street address on either side of the road.

In the example here, there are four trees on the property perimeter and two trees in the median. The address for each tree is 805 Vine Street. Within the property, three cells (2, 20, and 23) contain one tree each. Two trees are located in cell 6, thus both trees are assigned 6 as the cell number. The median, here labeled "Optional Cells," contains two trees. Based on the tree locations, these trees would be assigned cell numbers of 27 and 30.

19	18	17	16	15	14	13
20						12
21						11
22						10
23						9
24						8
1	2	3	4	5	6	7

**FRONT OF PROPERTY**



\*Adapted from State College Borough, PA Municipal Tree Plan, and originally attributed to ACRT, Inc.

## Results with Recommendations

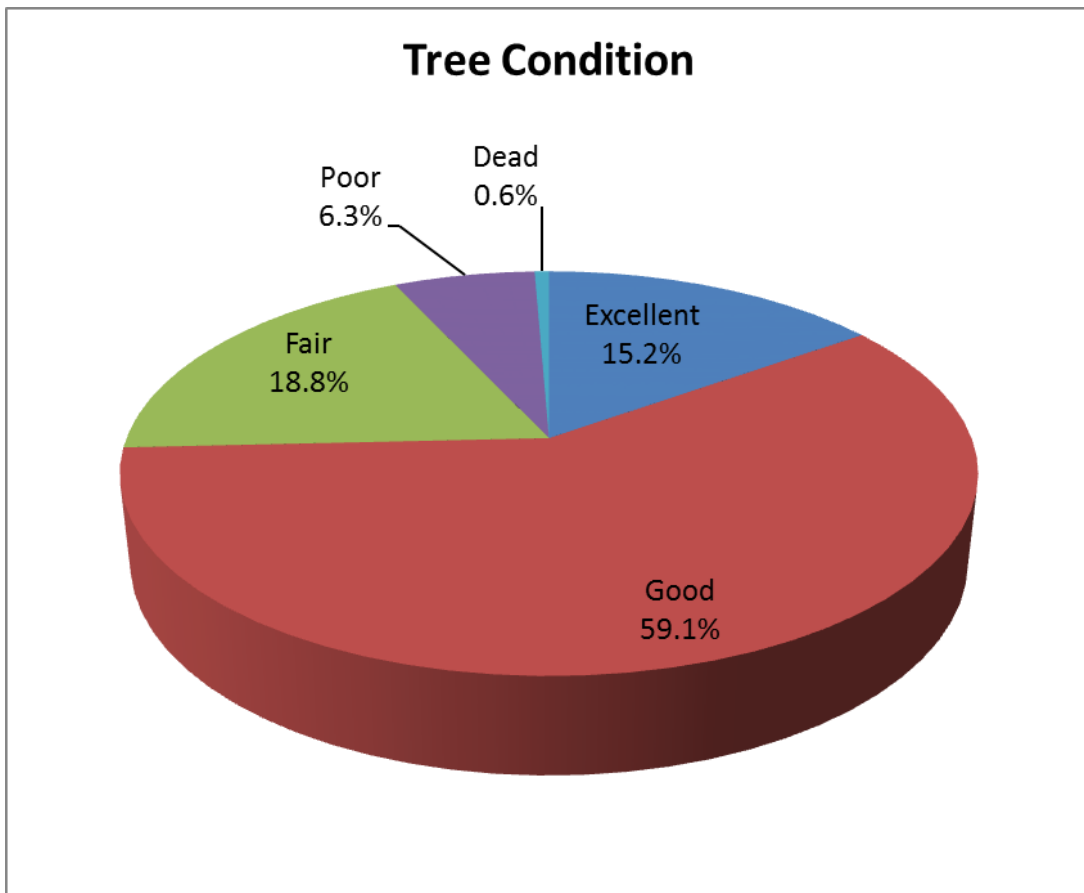
Results of the street tree inventory presented below provide an overview of all City street trees. The total number of trees inventoried was 5483. Also inventoried were 1276 potential planting sites.

### Street Tree Condition

- 832 – Excellent
- 3239 – Good
- 1032 – Fair
- 345 – Poor
- 35 – Dead

**Recommendation.** Dead trees and trees in poor condition should be prioritized and considered for immediate removal. Trees in fair condition will most likely continue to deteriorate in condition over time. These trees should be reviewed more frequently as they will have increasing need for maintenance or removal.

**Recommendation:** Using the information in this report, the Lancaster Shade Tree Commission should complete annual evaluations of all street trees; especially those in fair or poor conditions. This evaluation can be done by car, but a walking evaluation is more accurate. The objectives of this annual evaluation are to: 1) identify trees that are in need of removal and maintenance that year; 2) update the inventory completed in 2011; 3) identify areas where trees should be planted that year; and 4) develop an annual work plan and budget for the next year.



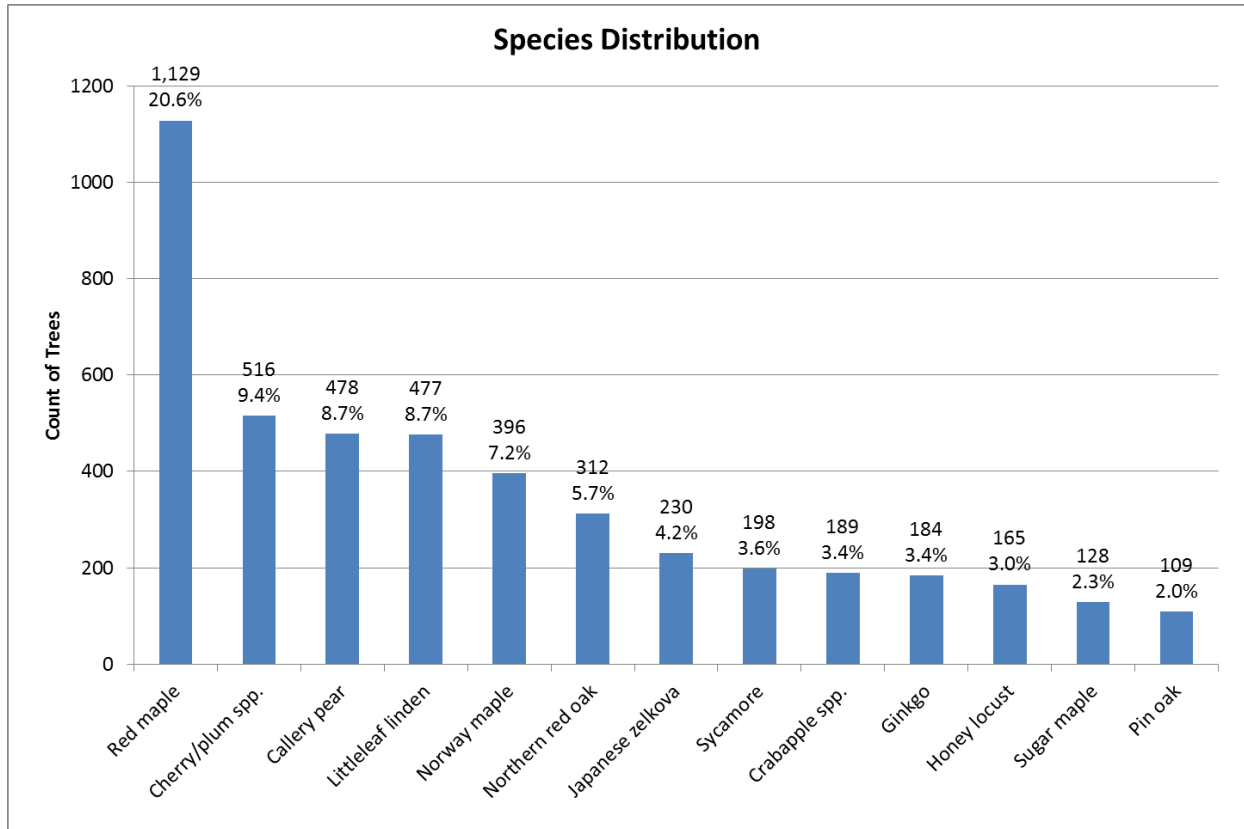
## Tree Species and Age Distribution

Of the trees inventoried, 33% were maple species. Of these, almost two thirds were red maple (1129 trees, 21% of total population), making this the most common species. Other maple species were less prevalent. Norway maple was the fifth most common species (396 trees, 7% of total population), while sugar maple ranked a distant twelfth (128 trees, 2% of total population). Ranking between red and Norway maples, cherry, Callery pear, and littleleaf linden were the second, third, and fourth most common species, respectively.

Oak species made up 8% of the inventory, with the majority being northern red oak (312 trees, 5.7% of total population), ranking sixth most common overall. Pin oak was the only other frequently occurring oak species, ranking thirteenth overall (109 trees, 2% of total population).

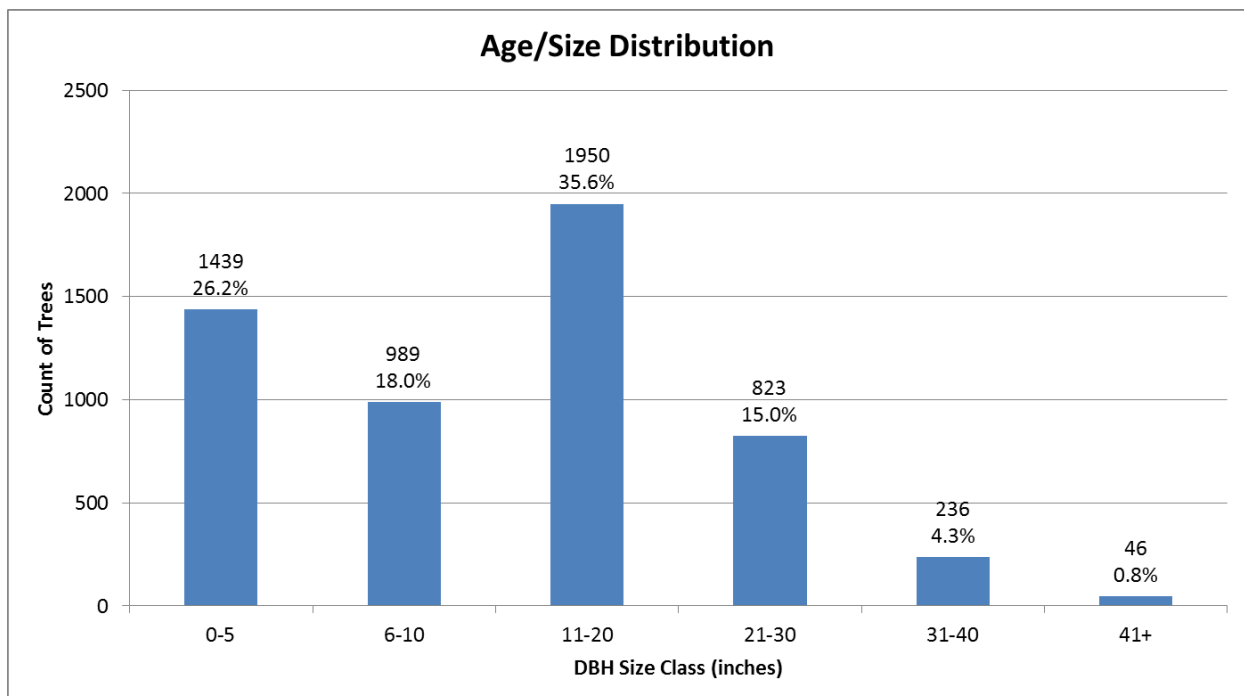
Japanese zelkova, sycamore, crabapple, ginkgo, and honey locust were found somewhat frequently, while a variety of other species were found less commonly. A total of 77 different tree species were identified.

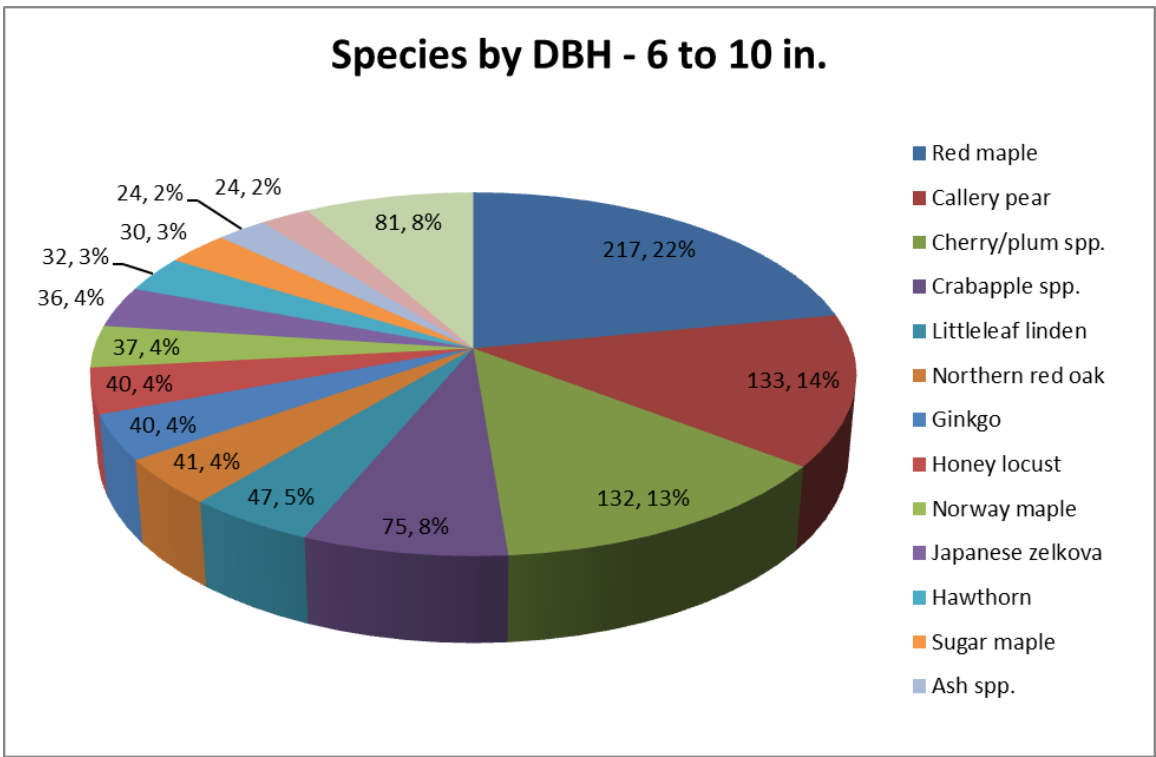
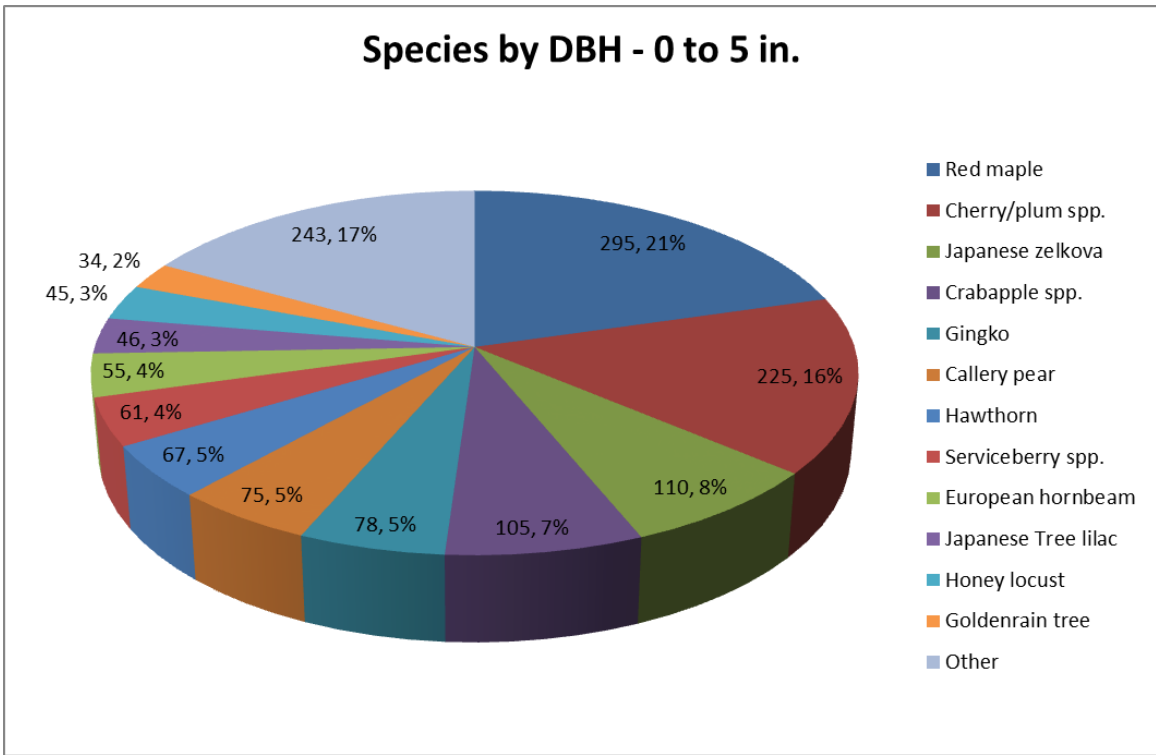
Species	Count	Rank	Species	Count	Rank	Species	Count	Rank
Red maple	1129	1	Elm spp.	22	26	English walnut	2	53
Cherry/plum spp.	516	2	Tatarian maple	18	28	Black maple	2	53
Callery pear	478	3	American basswood	17	29	Eastern hophornbeam	2	53
Littleleaf linden	477	4	Parrotia (Persian Ironwood)	15	30	Chestnut oak	2	53
Norway maple	396	5	Horse chestnut	14	31	Juniper spp.	2	53
Northern red oak	312	6	Sycamore maple	13	32	Kentucky coffeetree	2	53
Japanese zelkova	230	7	Willow oak	13	32	White oak	2	53
Sycamore	198	8	Pear spp.	13	32	Leyland cypress	2	53
Crabapple spp.	189	9	White ash	9	35	Norway spruce	2	53
Ginkgo	184	10	Tulip poplar	8	36	Katsura tree	2	53
Honey locust	165	11	Bigleaf linden	8	36	Sawtooth oak	2	53
Sugar maple	128	12	Eastern redbud	8	36	Persimmon	1	64
Pin oak	109	13	Catalpa tree	7	39	American beech	1	64
Ash spp.	102	14	Kousa dogwood	7	39	Tree of heaven	1	64
Hawthorn	101	15	Hedge maple	6	41	Sumac	1	64
Serviceberry spp.	67	16	American yellowwood	5	42	Sourwood	1	64
Japanese pagoda tree	64	17	Amur maple	5	42	Silver linden	1	64
European hornbeam	62	18	Unknown	5	42	Privet	1	64
Silver maple	59	19	Shingle oak	4	45	Green ash	1	64
Flowering dogwood	50	20	Japanese maple	3	46	Northern white cedar	1	64
Japanese Tree lilac	50	20	Paper birch	3	46	Magnolia spp.	1	64
Golden raintree	43	22	Apple spp.	3	46	Yew spp.	1	64
Sweetgum	42	23	Birch spp.	3	46	Crape myrtle	1	64
London planetree	30	24	American hornbeam	3	46	Dawn redwood	1	64
Paperbark maple	26	25	European beech	3	46	Rose of Sharon	1	64
Blackgum	22	26	Boxwood spp.	3	46			



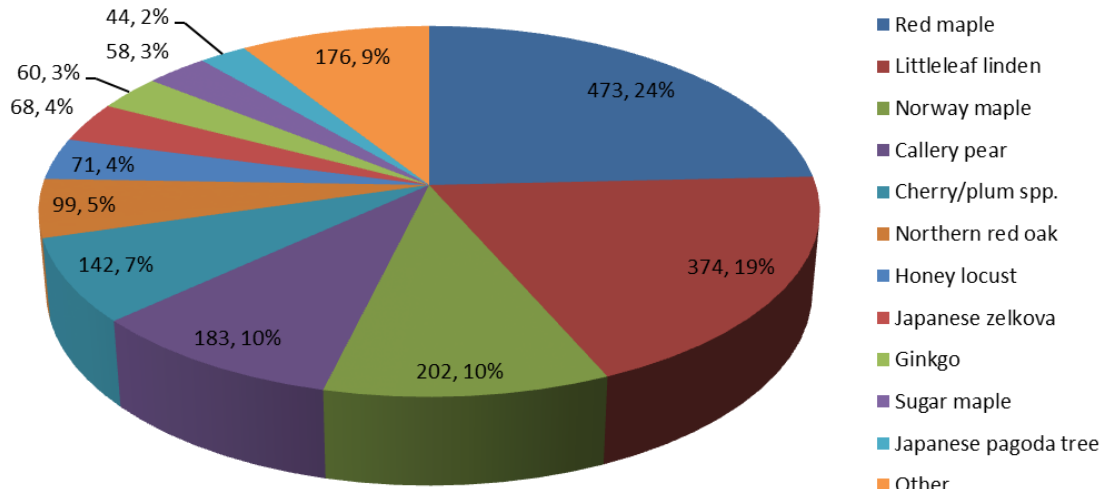
Trees with a DBH of 10 inches or less made up 44% of the total population, with another third having a DBH of 11-20 inches. The overall age/size distribution of trees was

indicative of the patterns of attrition with age typically seen in urban forests. This distribution also reflects regular, ongoing planting to replace trees which are removed.

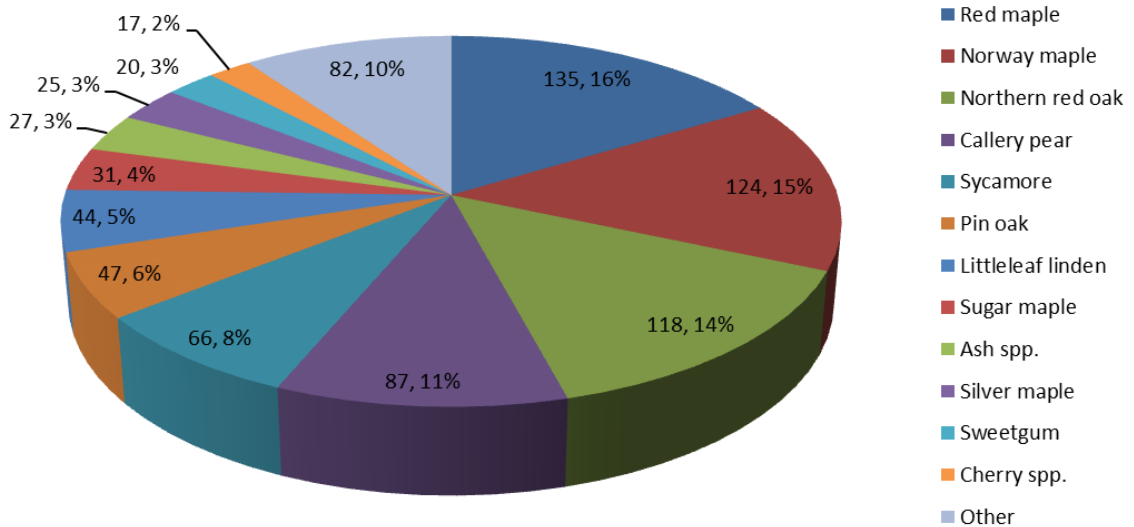




### Species by DBH - 11 to 20 in.

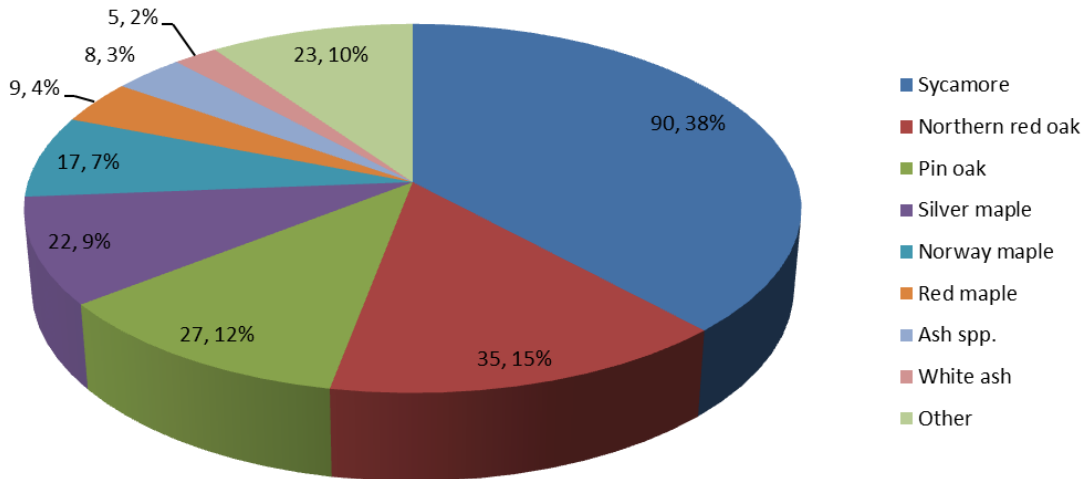


### Species by DBH - 21 to 30 in.

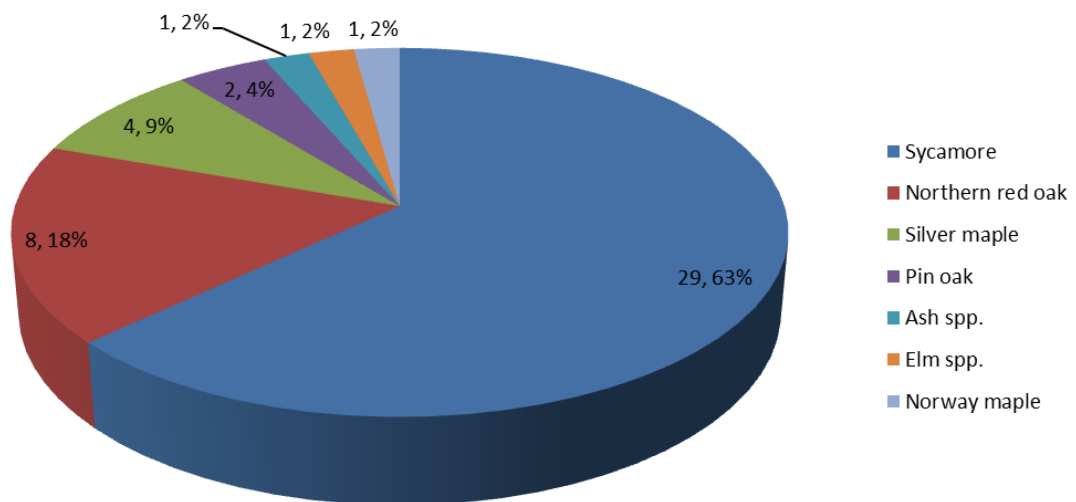




**Species by DBH - 31 to 40 in.**



**Species by DBH - 41+ in.**



## Tree Species and Age Distribution (continued)

**Recommendation:** There is an overabundance of maple trees, and red maples in particular. Tree species diversity is a key to health and stability. Do not plant more than 15% of any tree species within the community forest as a whole. Have a minimum of three tree species on any street and in any tree planting project. Also try to diversify at the genus and family level, but avoid disease or pest prone species. As a result (1) do not plant Norway maple or sugar maple on any street; (2) do not plant ash as a street tree; (3) do not plant little leaf linden in areas where heat or drought are factors (4) reduce the planting of Callery pear and red maple. In place of these species, consider planting more London planetree/sycamore, honey locust, and ginkgo, as well as any of the less common species that are acceptable, such as basswood and tulip poplar. Reserve crabapple, cherry, and plum trees for planting at sites where a small stature tree is necessary. Because of concerns with Dutch elm disease and elm yellows, consider planting small numbers of the disease-resistant elm cultivars Triumph, Native Charm, and Accolade.

**Recommendation:** Tree age diversity is a key to forest health and stability. The current tree inventory indicates a healthy age distribution and reflects ongoing planting of new trees. With time and continued planting and maintenance, the number of larger, older trees will be normalized to create an even healthier age distribution. To maintain and improve age diversity, the Lancaster Shade Tree Commission should work to prioritize and remove all risk trees annually. They should also work to remove trees that are not a risk, but are of poor health, having served their useful life. A certain number of trees should be removed each year, a certain number planted, and a certain number maintained. This removal and planting strategy will help keep the community forest safe and provide a diversity of age and species for the public forest. Age and species diversity will help provide a more sustainable mixed-age and

mixed-species tree population and canopy. An uneven aged forest structure will improve landscape beauty while regulating storm damage, tree removal, and maintenance efforts and costs in the long run. Uneven age structure also provides for canopy replacement as larger trees are removed. As an example, if two percent of the total street tree population is removed each year a 50 year separation in age classes would be developed over time on the city streets. This coupled with species diversity is the best strategy for a healthy and well-structured landscape.

**Recommendation:** The Lancaster Shade Tree Commission should work to develop and use a tree planting selection list based on the size of tree planting areas (e.g., large, medium, small, and sidewalk cutout). This list should provide the best quality species and cultivars of trees that can be planted in the variety of landscapes found in Lancaster.

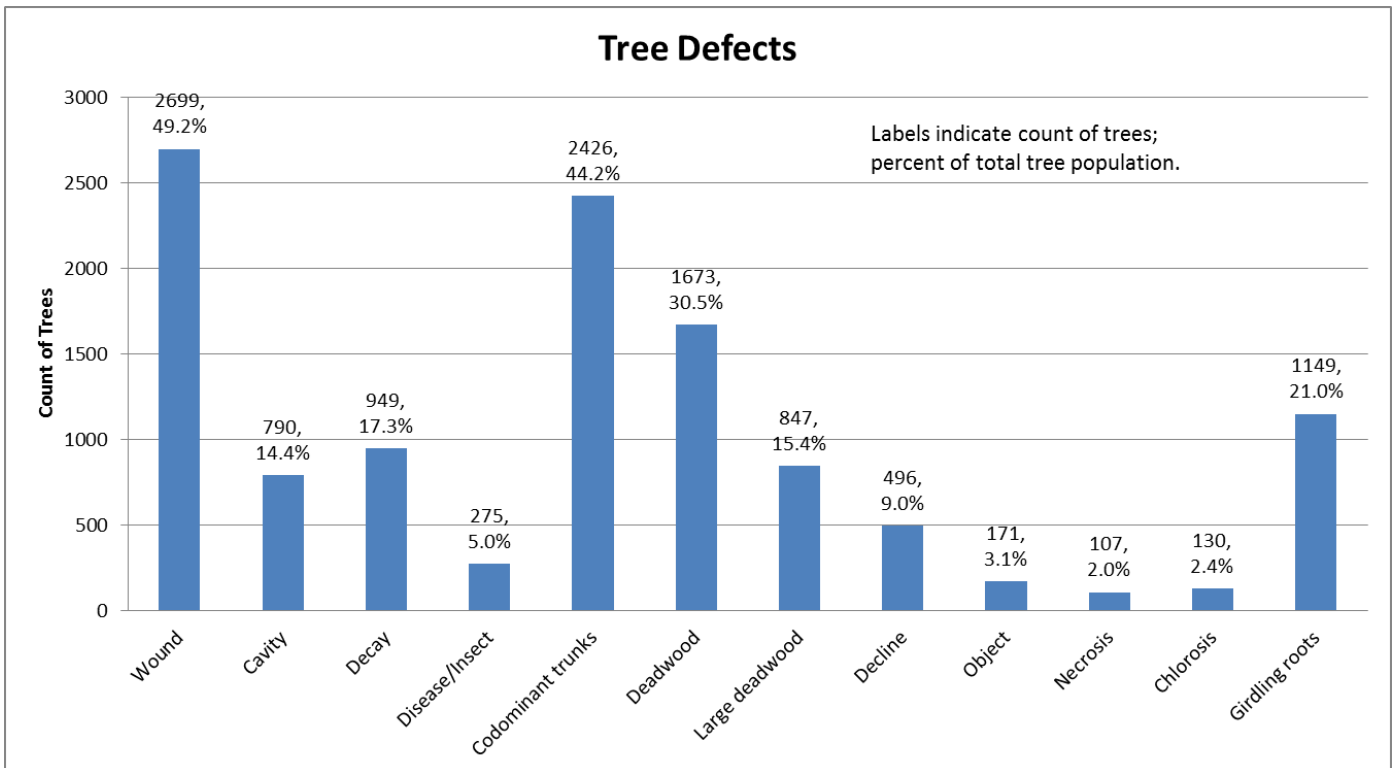
## Tree Defects

- Wound – **2699** trees
- Cavity – **790** trees
- Decay – **949** trees
- Disease/Insect – **275** trees
- Codominant trunk – **2426** trees
- Deadwood – **1673** trees
- Large deadwood – **847** trees
- Decline – **496** trees
- Object – **171** trees
- Necrosis – **107** trees
- Chlorosis – **130** trees
- Girdling roots – **1149** trees

Of the trees inventoried, almost half were marked as having wounds. Codominant trunks were also common, being found among 44% of trees. Deadwood (smaller than 4 in. diameter) was found in 30% of trees. Girdling roots were observed in just over one-fifth of the population. Various other defects were observed in smaller numbers across the population.

**Recommendation:** Tree defects should be noted and reinspected when considering maintenance and assessing tree risk. This inventory only notes presence of defects; it does not provide any rating of defect severity. Further, the extent of the impact of defects on a tree will vary based on tree species, planting site, and other environmental factors.

**Recommendation:** The occurrence of some defects can be reduced by following best practices for planting of new trees and pruning of young trees. Selecting good nursery stock, proper planting, and occasional pruning and assessment of young trees can help reduce the development of codominant trunks, girdling roots, and other future defects.



## Maintenance and Planting

- Crown Cleaning – **481** trees
- Crown Raising – **795** trees
- Crown Restoration – **10** trees
- Crown Thinning – **2** trees
- Horticultural Train Prune – **70** trees
- Priority Reinspect – **22** trees
- Removal – **268** trees

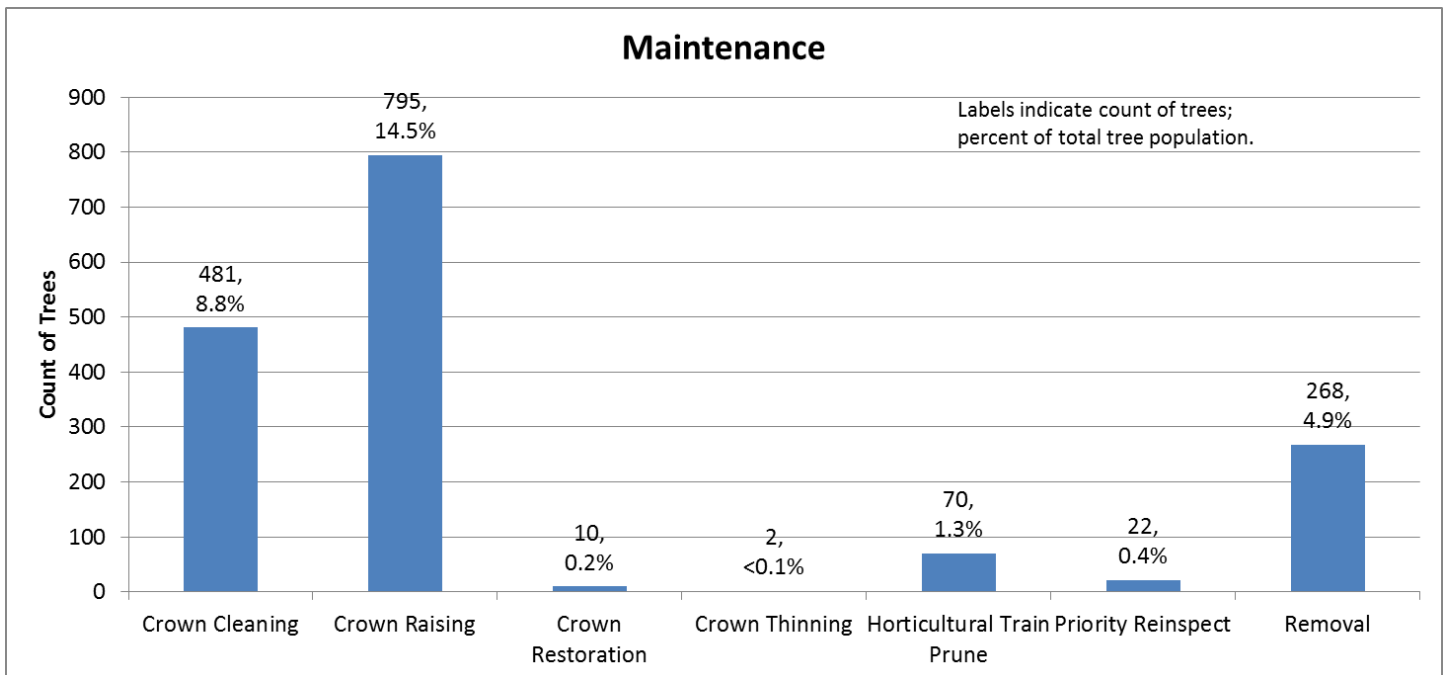
Of the trees inventoried, 30% (1648 trees) were marked for maintenance. Almost half of this maintenance is crown raising, which reflects conflicts between tree branches and vehicular and pedestrian traffic identified in this inventory.

- Planting – **1126** trees
- Stump Removal/Planting – **150** trees

This inventory identified a total of 1276 planting sites. Of these potential planting sites, 150 contain a stump from an old tree. Another 85 sites were marked as “Planting site – new” (indicated in the common name field). These “new” sites are not planting-ready, but require the creation of a tree pit or trench within a sidewalk or otherwise paved area.

**Recommendation:** All tree work identified in this section should be evaluated in the field by the City Arborist and members of the Lancaster Shade Tree Commission, prioritized, and completed in a timely fashion. If the City is not responsible for removal or maintenance of a tree impacting public safety, or the public right-of-way, then letters should be sent to those responsible advising them of the condition of their tree and the work which must be completed on that tree. At the very minimum, tree removals, re-inspection, and pruning of branches over 4 inches in diameter (large deadwood or limbs with structural problems) should be completed.

**Recommendation:** All trees listed for priority re-inspection should be identified in the field by the City Arborist and Lancaster Shade Tree Commission. These trees should be evaluated by a Certified Arborist to determine if removal, monitoring, or maintenance is appropriate. Trees marked for priority re-inspection, but not immediately receiving maintenance, should be inspected by the City Arborist, the Commission or their delegate twice a year to determine maintenance. It is very likely that these trees will require removal or maintenance within the next few years.



## Hardscape Damage

Hardscape damage was observed primarily among sidewalk panels. An inventory of damaged sidewalks adjacent to inventoried trees was conducted concurrently with the tree inventory. Locations of tree-adjacent and planting site-adjacent sidewalk damage were recorded along with an indication if the damage was tree related. Observations revealed the majority of trees and planting sites inventoried (4602), did not show sidewalk damage. Sidewalk damage was noted at the remaining 2157 sites, of which all but 41 were likely the result of tree roots.

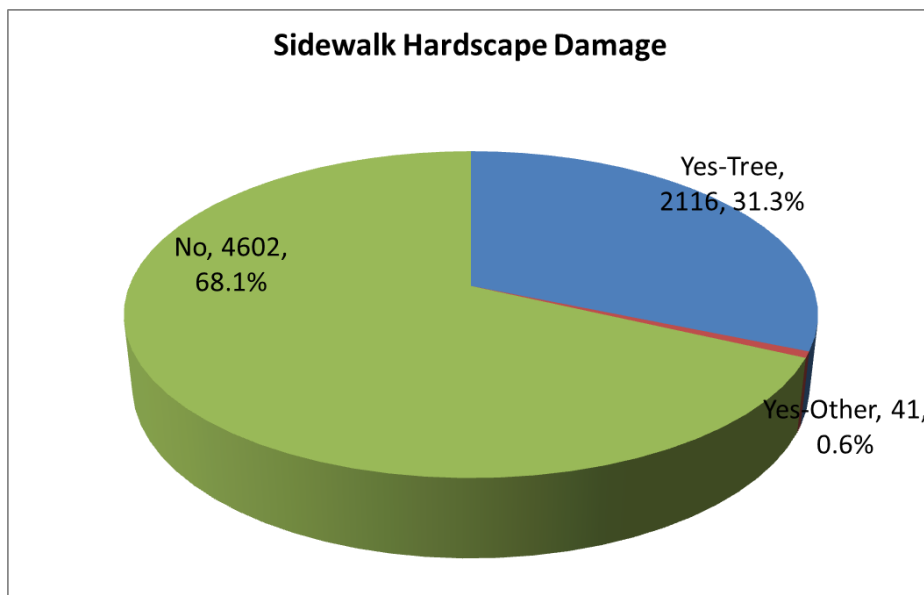
- **2116** (31.3%) – Sidewalk damaged by trees
- **41** (0.6%) – Sidewalk damaged for other reasons
- **4602** (68.1%) – No sidewalk damage

**Recommendation:** All sites identified as having damage to sidewalks should be evaluated by the Lancaster Shade Tree Commission, the City Arborist, and/or other appropriate municipal staff. Hardscapes posing a threat to safety should be repaired following the standards and procedures of Lancaster City for this type of repair.

**Recommendation:** Besides replacement, alternatives to repairing minor sidewalk damage should be used by the City. These alternatives could include correct grinding of lifted portions of sidewalks and the use of asphalt or concrete to provide interim ramps for lifted sidewalk portions.

**Recommendation:** Alternative materials should be considered along with concrete when replacing sidewalks. Materials such as asphalt, brick, and rubber may provide suitable alternatives to concrete. Potential damage by tree roots to these alternative materials appears to occur over a smaller area of the sidewalk surface, potentially reducing future repair or replacement costs.

**Recommendation:** When sidewalks are replaced, trees and the size of their planting site should be considered. Where space allows, rerouting of sidewalks around street trees to provide a larger planting pit or tree lawn may help reduce future lifting and damage to sidewalk panels by tree roots. If sidewalks are not damaged, existing tree pits should be enlarged as much as space allows. A minimum pit size of 5 ft. by 5 ft., with a depth of 3 ft. with careful species selection is recommended. Plastic root barriers installed between sidewalks and newly planted trees will help reduce future hardscape damage. When working in downtown or other areas where planting pit size is limited, the use of structural or other engineered soils should be considered.



## Lancaster City Municipal Tree Program: General Recommendations and Policies

### Administration and Management

Annual work plans and budgets are tools that should be included in a tree program. Annual work plans will enable the Shade Tree Commission to become proactive rather than reactionary. Communication between residents and the Shade Tree Commission regarding tree removal and planting, and setting clear and fair management guidelines will help make it easier for the residents and businesses to buy into the tree program.

**Recommendation:** Lancaster should maintain and build upon the tree inventory which was completed in 2011. Tree planting, pruning, removal, and risk information should be added to the inventory as it becomes available.

**Recommendation:** Lancaster should consider the use of management compartments for the maintenance of City trees. These areas are created given distinct landscape conditions and requirements (e.g., downtown, park, residential) in conjunction with neighborhood and geographic considerations. They are used to help organize and schedule maintenance to maximize efficiency of time and money spent.

**Recommendation:** Tree protection standards shall be provided in all construction contracts/plans that impact existing public trees.

**Recommendation:** All utility pruning should be completed with the notification of the Shade Tree Commission. All utility pruning should be done under the supervision of a Certified Arborist using directional pruning and reduction and thinning pruning cuts. Where appropriate, larger inferior trees will be removed from beneath utility lines and replaced with appropriate smaller growing trees.

**Recommendation:** As required, a Certified Arborist shall be consulted for periodic review and advice.

**Recommendation:** The City should consider using both non-traffic summary offense and restitution in the enforcement of street tree and park ordinances.

## Liability Issues

Trees can present a serious safety concern, especially large, old ones. In Pennsylvania, municipalities assume responsibility for a safe public right-of-way. Any negligence for the care of trees impacting the safety of the right-of-way may fall on the municipality. However, by implementing a comprehensive tree risk management program, the City can take steps to limit their liability and keep a safe public forest.

**Recommendation:** An annual evaluation of street and park tree health and structure shall be completed by the City Arborist and Shade Tree Commission. Consideration should be given to trees marked fair or poor in the inventory.

**Recommendation:** All tree inventories and maintenance records shall be recorded and kept on file. The tree inventory will be updated on a yearly basis.

**Recommendation:** Tree maintenance and removals will be prioritized by risk and be carried out in a timely fashion.

**Recommendation:** Inspections and maintenance will be performed by a Certified Arborist.

**Recommendation:** The City should consider notifying property owners of tree nuisances that may impact the safety of the public right-of-way (e.g., branches blocking traffic signs, trees on private property that could fall into the street) and the health of other private and public trees in the City (e.g., oak wilt, Dutch elm disease).

## Landscape Design

Trees provide numerous benefits to people and the places they live including positive contributions to property value, shade and weather protection, aesthetics, a connection to nature, and better human health. The design and incorporation of street and park trees into Lancaster City provides many such benefits.

**Recommendation:** Neighborhood distinctions can be maintained and achieved by repeating a particular planting design.

**Recommendation:** Trees properly planted in the business districts will provide patrons relief from summer heat, beautify store fronts, and increase the number of shoppers. Shoppers have been found to spend more time and money when shopping on tree-lined streets. As part of a more comprehensive tree species selection list, a small list of trees that are successful in downtown sidewalk plantings should be developed (e.g., honey locust, ginkgo, hardy rubber tree).

**Recommendation:** Parking lots will be made more attractive and less hot by correctly incorporating trees into their design and landscaping. Through the use of porous pavement, engineered soils, grading, and bioretention basins, trees can also be incorporated into stormwater management strategies.

**Recommendation:** The location and type of trees planted should take into consideration their contribution to energy conservation, views, noise reduction, and screening of undesirable objects.

**Recommendation:** Major entry ways to the City should be beautified by using distinct and proper tree plantings.

**Recommendation:** If not already done, the City should consider adding a landscape design section to their subdivision and land development ordinance.

## Tree Evaluation and Removal

Evaluating trees on an annual basis will increase safety, lower maintenance costs in the long run, and prolong the life of the trees. It will also help to predict future health and structure problems, and indicate potential risk to property or pedestrians.

**Recommendation:** An annual review of City trees will be conducted by a Certified Arborist. Tree condition and the degree of risk will be identified and recorded.

**Recommendation:** An annual work plan for tree removal and pruning will be developed based on the annual tree condition and risk review. This work will be prioritized based on the degree of tree risk and completed in a timely fashion. Critical risk trees will be treated as soon as possible.

**Recommendation:** Property and business owners impacted by tree removal should be notified of that tree removal by the Shade Tree Commission. The Shade Tree Commission should consider holding a public hearing to provide public testimony on tree removals and plantings.

## Site Analysis and Species Selection

It is very important to match the proper tree species to each particular planting site. Taking this into consideration will help minimize future hardscape damage and maintenance problems and costs. This will ensure that the size and look of the tree fits into its surroundings.

**Recommendation:** Proper site analysis, species selection, and site modification will take place for every tree planting site. The proper tree will be planted in the proper site in a correct fashion.

**Recommendation:** Design/engineering solutions shall be used to increase soil volume and tree growing area and to minimize potential concrete and other damage from trees planted in confined areas. Adequate space and site conditions for healthy tree growth will be provided for all tree plantings.

**Recommendation:** Trees planted in the City will be chosen from an approved tree planting list.

**Recommendation:** Trees native to Pennsylvania shall be used for planting when their use provides the best choice for the particular project and site being considered.



## Tree Planting

Tree planting guidelines and standards should be established and adhered to in order to ensure a healthy and beautiful community forest.

**Recommendation:** Every tree removed will be considered for replacement with an appropriate new tree not likely to cause any problems for which the original tree was removed.

**Recommendation:** Correct tree planting standards and young tree maintenance standards will be provided in all tree plantings. These standards must be followed by landscape architects, contractors, and others performing tree plantings.

**Recommendation:** PA-One-Call will be used before all tree plantings.

**Recommendation:** Both tree age and species diversity will be promoted through annual tree planting and removal. A variety of species will be planted within each tree planting area within the City as a whole.

**Recommendation:** The Lancaster Shade Tree Commission should work to develop and use a tree planting selection list based on management compartments and the size of tree planting areas.

**Recommendation.** For sidewalk plantings, a minimum pit size of 5 ft. by 5 ft., with a depth of 3 ft. should be used along with careful species selection.

**Recommendation.** Plastic root barriers installed between sidewalks and newly planted trees will help reduce future hardscape damage.

**Recommendation.** When working in downtown or other areas where planting pit size is limited, the use of structural or other engineered soils should be considered.

## Tree Maintenance

It is critical that a comprehensive tree program use proper standards and guidelines for arboriculture work including those for young, mature, and declining trees. Newly planted trees should be provided with irrigation and proper pruning to ensure proper establishment and form. Routine maintenance decreases the risk of branch and tree failure due to inclement weather and increases the beauty and life of the tree.

**Recommendation:** All City street and park trees will be pruned by qualified arborists using safety and pruning standards found within the ANSI A300: Standards for Tree Care Operations – Tree, Shrub, and Other Woody Plant Maintenance Standard Practices, the ANSI Z133.1: Safety Requirements for Tree Care Operations, and the International Society of Arboriculture Tree Pruning and Maintenance Best Management Standards.

**Recommendation:** Only thinning and reduction pruning cuts will be used to prune street and park trees. No heading or stub cuts will be used on live trees remaining in the landscape.

**Recommendation:** All tree pruning shall be approved and administered by the Shade Tree Commission and City Arborist.

**Recommendation:** The Shade Tree Commission will consider implementing management compartments and a pruning cycle for each management compartment. A pruning cycle can help normalize yearly budgets by planning and scheduling pruning work to be completed each year. A number of aspects of each management compartment will need to be considered in order to plan for pruning cycles. These aspects include number of trees, number of landscapes or management compartments, age of trees, condition of trees, species, and amount of funding available.

## Public Education and Support

The understanding and support of residents and business owners for a community tree program is important. It is helpful to involve the public in planting projects, as well as decision making. These opportunities for involvement will go a long way in garnering the public's support, helping to raise funds, and reducing conflicts.

**Recommendation:** Offer Arbor Day and Earth Day activities where the public can participate.

**Recommendation:** Provide educational materials about community trees and forests to schools and the public.

**Recommendation:** Utilize the media to promote tree activities and programs at least once a year.

**Recommendation:** Promote memorial and dedication tree programs and trees.

**Recommendation:** Provide the residents with an approved list of trees to choose from to plant in front of their homes.

**Recommendation:** Provide for public notice and hearing in tree removal and planting decisions.

## Conclusions and Summary of Recommendations

### Conclusions

- Maple species, red and Norway in particular, are overabundant. The City should increase both tree species and age diversity by limiting the planting of these tree species.
- While there is an overabundance of some species, there is good overall diversity of species. New plantings should focus on including a variety of species, especially those occurring less commonly in the current inventory.
- The overall age/size distribution of trees was indicative of the patterns of attrition with age typically seen in healthy urban forests and reflects ongoing replacement of street trees.
- A majority (74%) of the trees are in excellent or good condition. Of these, the majority are in good condition (59% of total population).
- 7% of the trees are in poor or dead condition and should be removed.
- About one-third of evaluated sidewalks showed damage, mostly thought to be caused by trees.
- The southeastern section of the City is particularly under-stocked. Consider directing extra resources and attention to this area.
- Many residents encountered during the inventory were unaware of who is responsible for maintenance of the City street trees.

### Recommendations

- Inspect all trees and update the tree inventory annually.
- Address risk trees through removal or pruning in a timely manner.
- Choose the proper species for each planting location.
- Develop a cycle of annual tree removals and plantings to achieve and maintain species and age diversity.
- Monitor mature trees in decline, especially those in fair or poor condition.
- Use structural soils, plastic root barriers, and other tools along with proper tree selection and planting to reduce hardscape damage.
- Consider developing tree planting standards for sidewalk and parking lot plantings.
- Through the use of porous concrete, curb cuts, grading, engineered soils, and bioretention basins, tie tree plantings into stormwater management.
- Increase public education and participation through tree-planting and other related activities.
- Consider adding a landscape design section to the existing subdivision and land development ordinances and “Rules of Arbor Work” to the street and park tree ordinance.