

CITY OF BLOOMINGTON PUBLIC TREE INVENTORY - 2012

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BACKGROUND

The City of Bloomington has one of the oldest urban forestry programs in Indiana. This award-winning program is the oldest Indiana Tree City USA and is a state leader. The most recent complete inventory of street trees was conducted in 2007, and revealed that for every dollar spent on street trees, \$1.66 is received as benefits in the form of carbon storage, pollution removal and stormwater mitigation (Fischer et al. 2007). Additional benefits of urban trees not monetized in the 2007 analysis include aesthetic benefits and increased property values, improved human health and well-being, and reduction of energy costs and urban heat island effects.

Table 1. Explanation of select variables collected for 2012 City of Bloomington street and park tree inventory.

Variable	Explanation
<i>Species</i>	Species common and Latin name; verified tree in ground with City records
<i>Tree location</i>	Planting location (front yard or planting strip, including relationship of planting strip to addressed location)
<i>Address</i>	Full address of property adjacent to tree
<i>DBH</i>	Diameter at breast height (4.5 ft above ground level, measured in 2" classes)
<i>Overall condition</i>	Tree condition rating, according to visual assessment (good, fair, poor, dead/dying, or planting space available)
<i>Maintenance requirement</i>	See <i>Table 2</i>
<i>Wire conflict</i>	Any potential or existing conflict with overhead utility wires

Table 2. Category descriptions for Maintenance Requirements.

Maintenance category	Description
<i>None</i>	No maintenance is required.
<i>Routine SM</i>	Routine pruning is needed for a small tree (no bucket truck is required).
<i>Routine LG</i>	Routine pruning is needed for a large tree (a bucket truck required).
<i>Stake/Train</i>	Staking or training (structural pruning to improve tree form) is required for a newly planted tree.
<i>Removal</i>	Removal of this tree is recommended in the near future.

METHODS

In the summer of 2012, the City of Bloomington Urban Forestry Division contracted BUFRG to conduct a sample re-inventory of Bloomington public street and park trees. IUB graduates Nick Myers (MPA/ MSES '12) and Kaitlyn McClain (BSPA '12) surveyed a sample of Bloomington neighborhoods and parks (see page 3) using the same urban tree inventory protocol used for the complete street tree inventory in Bloomington in 2007 (Fischer et al. 2007).

Street trees in 7 neighborhoods, the Downtown Core, Miller-Showers Park and the B-Line Trail were surveyed, and the variables listed in Table 1 (above) were collected using Palm handheld electronic units (HP iPAQ hx2400 series) running iTree Streets software. Data were analyzed in Microsoft Excel.

CITATIONS

Fischer, Burnell C., Michael Steinhoff, Sarah Mincey, and Lance Dye. 2007. *The 2007 Bloomington Street Tree Report: An Analysis of Demographics and Ecosystem Services*. Bloomington Urban Forestry Report 01-07. 30 pp. Available at <http://bloomington.in.gov/media/media/application/pdf/2337.pdf>.

SUPPORT & FUNDING



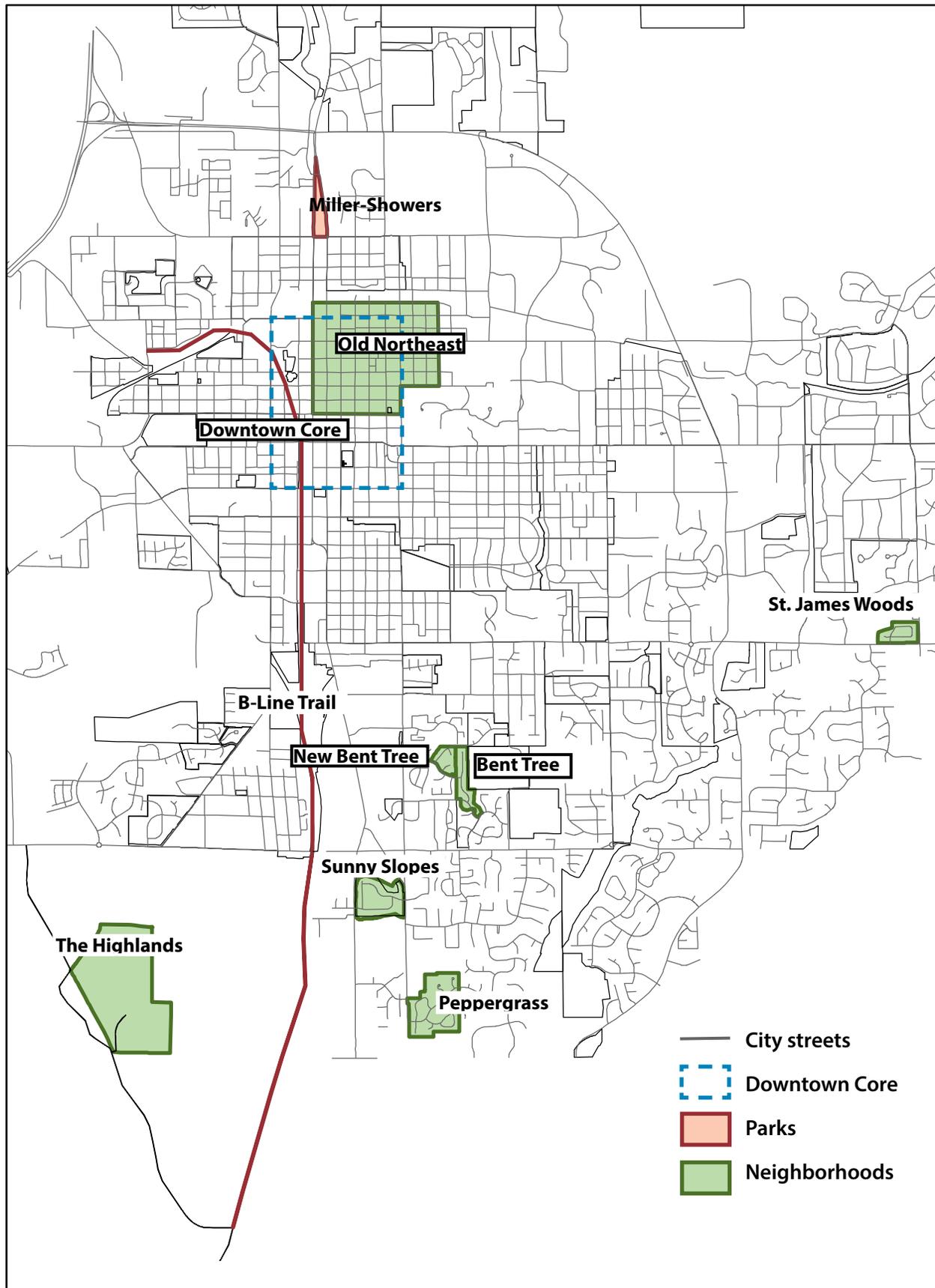
SCHOOL OF PUBLIC AND ENVIRONMENTAL AFFAIRS
INDIANA UNIVERSITY

Center for the study of Institutions,
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CITY OF BLOOMINGTON
parks and recreation

2012 SAMPLE INVENTORY AREAS



1. CITY-WIDE SAMPLE

SAMPLE STREET TREE INVENTORY RESULTS

We inventoried 2,978 trees in total. The sample tree population is characterized by a high number of red and sugar maples (*Fig. 1A*) and 51% of the mass is maple (*Table 1B*). Trees sampled are in good condition (*Fig. 1A, inset*), with a sustainable size distribution and many small trees less than 6" DBH (*Fig. 1C*).

Maintenance needs for the sample public tree population are moderate, with most trees requiring routine or no maintenance but 221 trees (7%) recommended for removal (*Fig. 1D*). 1,158 planting spaces exist (*Fig. 1E*), ~28% of possible tree spaces in the areas surveyed.

Table 1B. Top 10 species in basal area for the 2012 City sample compared to the 2007 complete inventory and a 2011 sample of private neighborhood trees. Basal area is computed as the area of a circle at the diameter at breast height.

Species	2012 City Sample (%)	2007 Complete Inventory (%)	2011 Private Tree Sample (%)*
Sugar maple	19.0	12.6	8.3
Silver maple	17.4	21.5	22.8
Red maple	14.6	11.4	4.8
Littleleaf linden	6.2	0.8	0.0
Callery pear	6.0	4.5	0.7
Green ash	5.1	2.6	5.2
Northern red oak	3.4	0.5	0.01
Sweetgum	3.2	2.1	0.6
Scarlet oak	2.4	0.02	0.0
Am. basswood	2.1	0.02	0.04

* Sarah Mincey, unpublished data, 2012

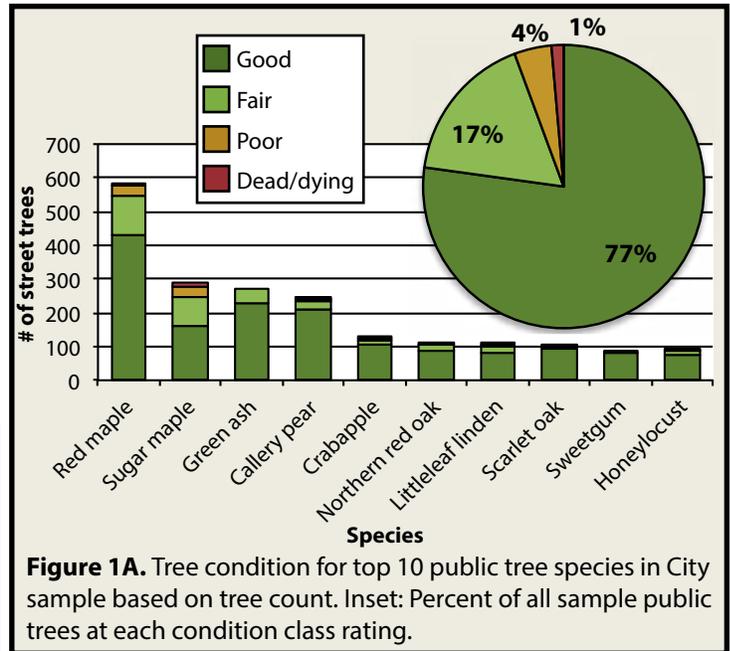


Figure 1A. Tree condition for top 10 public tree species in City sample based on tree count. Inset: Percent of all sample public trees at each condition class rating.

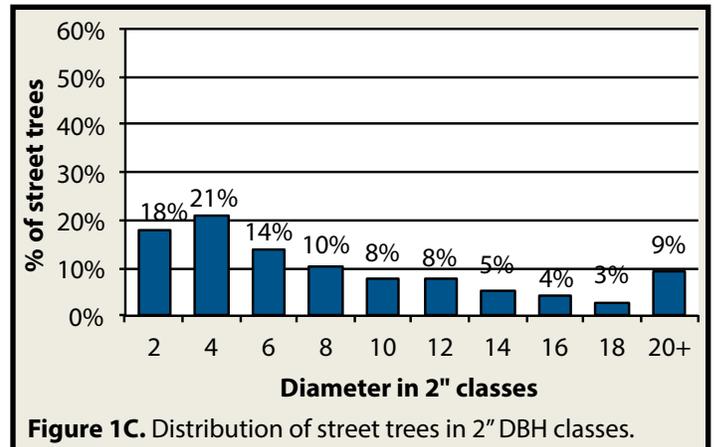


Figure 1C. Distribution of street trees in 2" DBH classes.

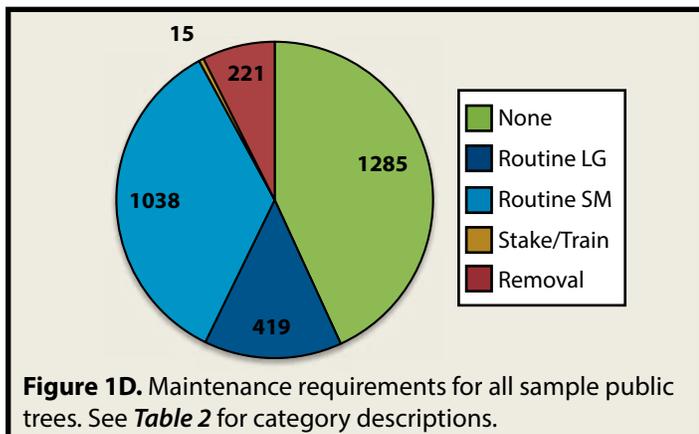


Figure 1D. Maintenance requirements for all sample public trees. See *Table 2* for category descriptions.

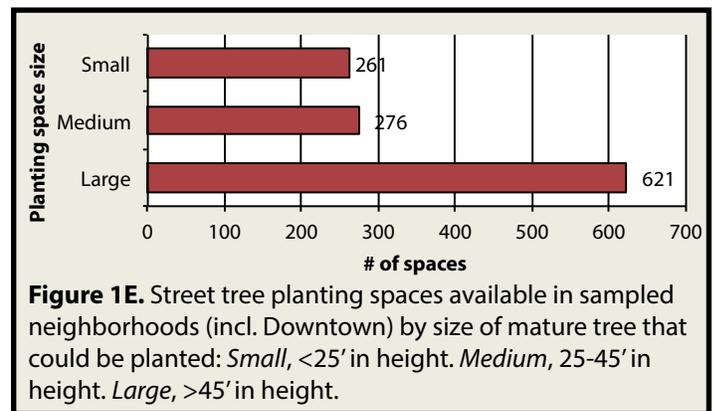


Figure 1E. Street tree planting spaces available in sampled neighborhoods (incl. Downtown) by size of mature tree that could be planted: *Small*, <25' in height. *Medium*, 25-45' in height. *Large*, >45' in height.

RECOMMENDATIONS

- Throughout the sections of this report, specific recommendations are given for each area surveyed.
- Recommendations for the City as a whole are given in the final section of this report.

2. DOWNTOWN CORE

STREET TREE INVENTORY RESULTS

The Downtown Core has 1,301 street trees. The sample tree population is characterized by a high percentage of red and sugar maple trees, both in number (*Fig. 2A*) and in mass (*Table 2B*). The trees as a whole are in good condition (*Fig. 2A, inset*), with an even size distribution (*Fig. 2C*).

Maintenance needs for the street tree population are moderate, with most trees requiring routine or no maintenance, but 96 trees (7%) are recommended for removal (*Fig. 2D*). There are 436 planting spaces available (25% of possible street tree sites), relatively evenly split across planting space size classes (*Fig. 2E*).

Table 2B. Top 10 species in tree basal area for the 2012 Downtown Core street tree inventory compared to the sample neighborhood street trees. Basal area is computed as the area of a circle at the diameter at breast height.

Species	Downtown Core (%)	2012 Neighb. Street Trees (%)
Sugar maple	23.7	18.5
Red maple	14.4	14.3
Silver maple	13.7	22.3
Littleleaf linden	7.9	4.1
Callery pear	6.0	4.3
Sweetgum	4.1	2.7
Northern red oak	3.6	3.8
Honeylocust	3.0	1.1
American basswood	2.7	2.1
Green ash	2.4	7.5

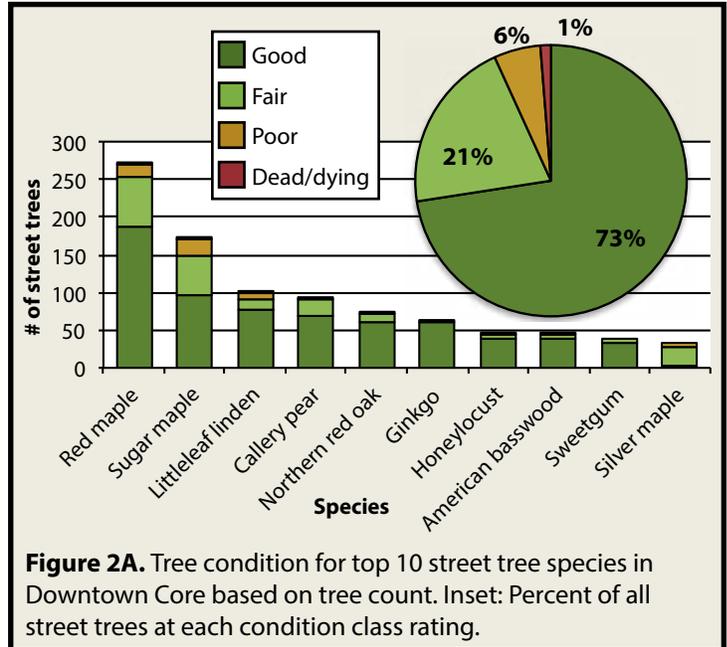


Figure 2A. Tree condition for top 10 street tree species in Downtown Core based on tree count. Inset: Percent of all street trees at each condition class rating.

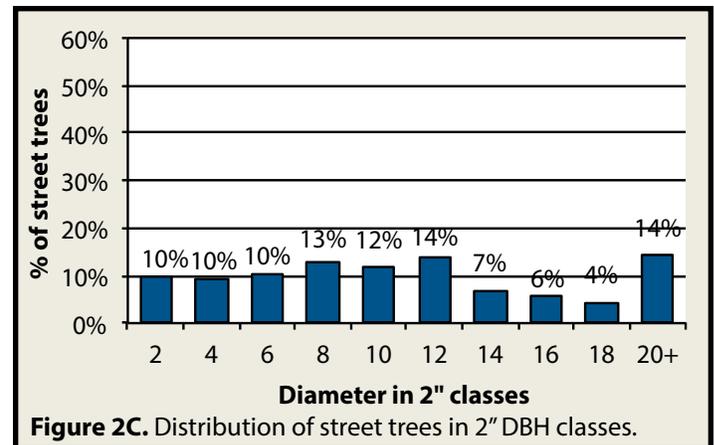


Figure 2C. Distribution of street trees in 2" DBH classes.

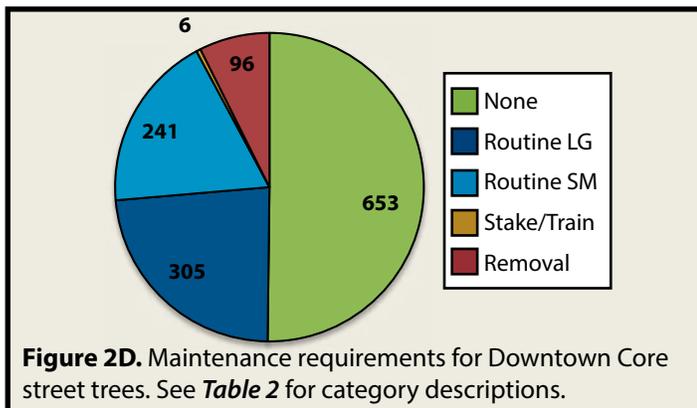


Figure 2D. Maintenance requirements for Downtown Core street trees. See *Table 2* for category descriptions.

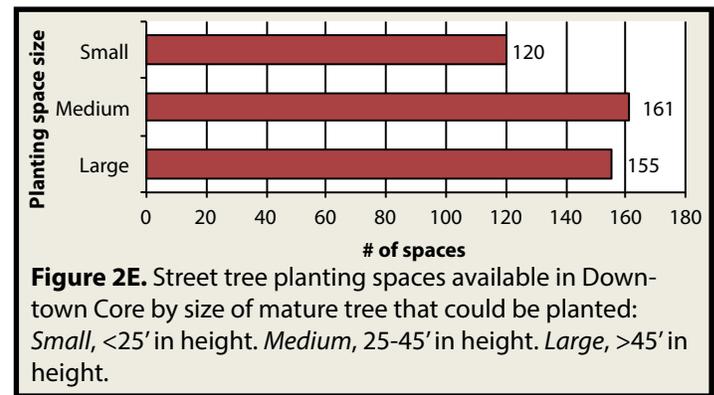


Figure 2E. Street tree planting spaces available in Downtown Core by size of mature tree that could be planted: *Small*, <25' in height. *Medium*, 25-45' in height. *Large*, >45' in height.

RECOMMENDATIONS

- 25% of possible tree sites are not occupied by trees. Planting efforts should concentrate on planting large and medium-sized trees of species other than maple in appropriate sites to improve the species diversity distribution.
- Continuous planting programs are important to increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size over time.

3. MILLER-SHOWERS PARK

PARK TREE INVENTORY RESULTS

Millers-Showers Park in Bloomington has 265 trees. The tree population is fairly diverse, with the top 3 most abundant species being green ash, eastern redbud and flowering dogwood (*Fig. 3A*). However, the mass of trees is 6 callery pear trees 10-18" DBH (*Table 3B*). The park trees are in very good condition (*Fig. 3A, inset*), and because the Miller-Showers was recently constructed, most trees are young and less than 6" DBH (*Fig. 3C*).

Maintenance (pruning and removal) needs for the present park tree population are moderate, with most trees requiring routine or no maintenance, but 20 dogwood trees and several other trees in poor condition are recommended for removal (*Fig. 3D*). Note that planting spaces were not counted during the Millers-Showers tree inventory because any green space in the park is plantable area.

Table 3B. Top 10¹ species in basal area for Miller-Showers Park compared to the sample neighborhood street trees. Basal area is computed as the area of a circle at the diameter at breast height.

Species	Park Trees (%)	2012 Neighb. Street Trees (%)
Callery pear	24.1	4.3
Green ash	18.2	7.5
Eastern redbud	13.8	0.3
Baldcypress	13.5	0.1
Northern hackberry	4.6	0.2
American basswood	4.3	2.1
American sycamore	3.9	1.1
Sugar maple	3.8	18.5
Kentucky coffeetree	2.5	0.00
Black tupelo	1.7	0.04
Shingle oak	1.7	0.1

1 Black tupelo and shingle oak are tied for 10th greatest basal area; thus 11 species are listed in this table.

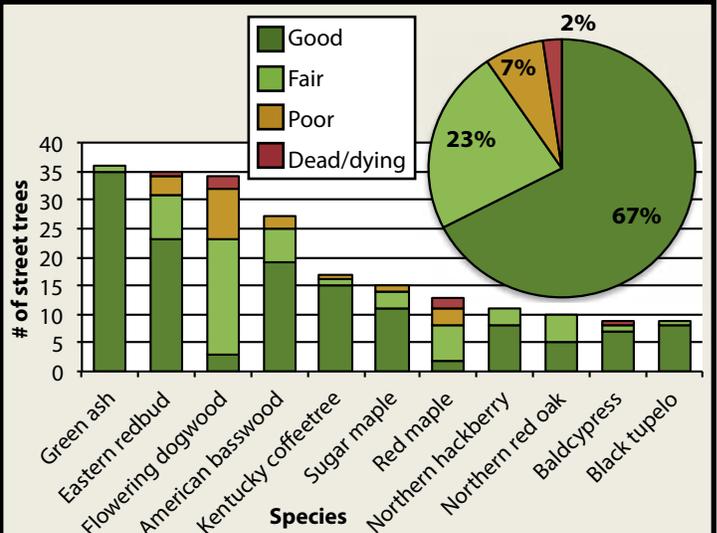


Figure 3A. Tree condition for top 10¹ park tree species in Miller-Showers based on tree count. Inset: Percent of all park trees at each condition class rating.

1 Baldcypress and black tupelo are tied for 10th most numerous; thus 11 species are shown in this chart.

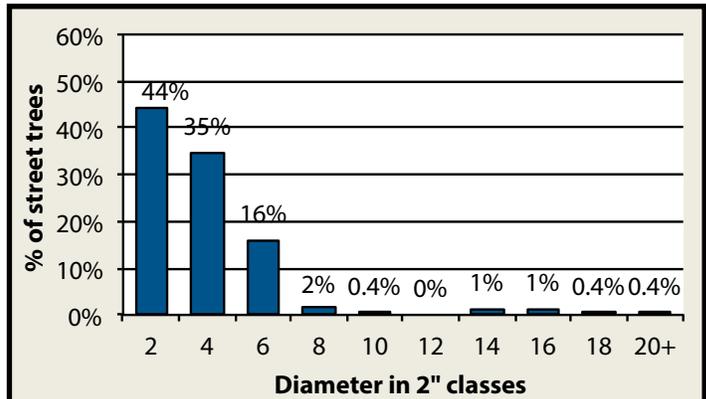


Figure 3C. Distribution of park trees trees in 2" DBH classes.

RECOMMENDATIONS

- Because the ash trees are small and in good condition, we recommend following the latest guidelines from Purdue Extension to protect these trees from emerald ash borer.
- Dogwood and red maple trees are in poor condition and at risk due to location and site conditions. If these trees die and are removed, they should be replaced with different species.
- Planting so far has resulted in a good size and species distribution. Keeping up with planting efforts will help ensure a sustainable park tree population into the future.

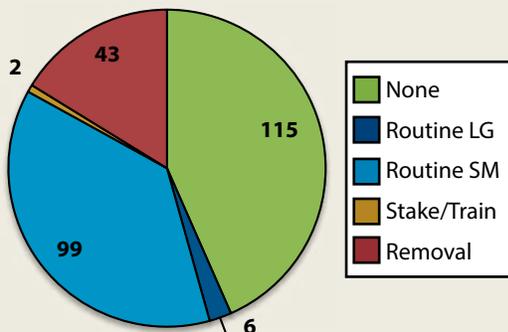


Figure 3D. Maintenance requirements for Miller-Showers park trees. See *Table 2* for category descriptions.

4. B-LINE TRAIL

TRAIL TREE INVENTORY RESULTS

The B-Line in Bloomington has a total of 296 trees. The tree population is characterized by a high number of crabapple and red maple trees (Fig. 4A) but the mass is mostly callery pear trees (Table 4B). The trail trees are in very good condition (Fig. 4A, inset), and because the B-Line was only recently constructed, all trees are young and less than 6" DBH (Fig. 4C).

Maintenance needs for the present trail tree population are very minimal, with 99% of trees requiring routine or no maintenance (Fig. 4D). Note that planting spaces were not counted during the inventory.

Table 4B. Top 10 species in tree basal area for the 2012 B-Line Trail tree inventory compared to the sample neighborhood street trees. Basal area is computed as the area of a circle at the diameter at breast height.

Species	B-Line Trail (%)	2012 Neighb. Street Trees (%)
Callery pear	26.3	4.3
Red maple	23.8	14.3
Crabapple	18.4	1.3
Honeylocust	14.0	1.1
American elm	6.0	0.8
Baldcypress	2.2	0.1
Eastern cottonwood	2.1	0.1
Eastern serviceberry	2.1	0.00
Bur oak	1.1	0.2
Northern white cedar	1.0	0.00

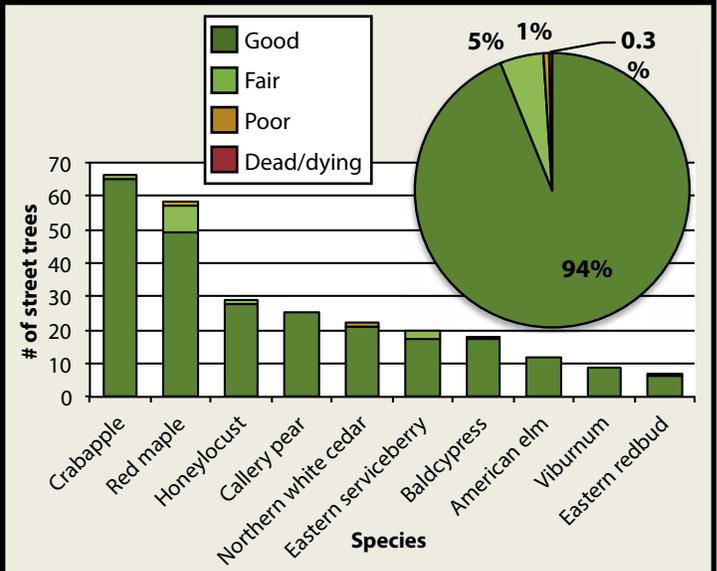


Figure 4A. Tree condition for top 10 trail tree species on B-Line Trail based on tree count. Inset: Percent of all trail trees at each condition class rating.

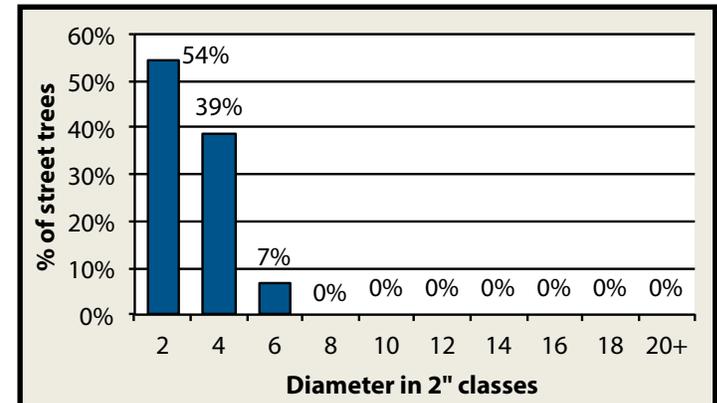


Figure 4C. Distribution of trail trees in 2" DBH classes.

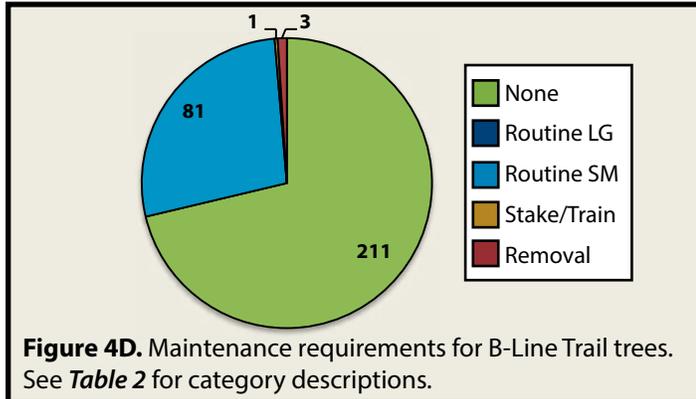


Figure 4D. Maintenance requirements for B-Line Trail trees. See Table 2 for category descriptions.

RECOMMENDATIONS

- The tree species composition along the B-Line Trail is much different from the species composition of other public places in Bloomington, and because of this, the future maintenance needs of this population may be different from the rest of the city. The introduction of uncommon trees may mean more frequent maintenance is required.

- The trees along the trail were planted as a single cohort. Because of this, we recommend vigilance in replacement when trees die. The continuous addition of trees to the small size classes will maintain a sustainable size distribution of trees along the Trail.
- Because the trees on the B-Line Trail (and in Miller-Showers Park) are young, they require regular watering to become well-established in the landscape. Frequent watering during dry summer months is crucial to protect the investment trees represent.

5. ALL SAMPLE NEIGHBORHOODS

NEIGHBORHOOD TREE INVENTORY RESULTS

We inventoried 1,713 trees in 7 neighborhoods. The neighborhoods tree populations are characterized by a high number of red maple and green ash trees (*Fig. 5A*) while 55% of the mass is maple (*Table 5B*). The trees are in good condition (*Fig. 5A, inset*), with a sustainable size distribution and many trees less than 6" DBH (*Fig. 5C*).

Maintenance needs for the sample neighborhood street trees are moderate, with most trees requiring routine maintenance, but 126 (7%) trees are recommended for removal (*Fig. 5D*). There are 721 planting spaces available (30% of possible street tree sites), most of which are suitable for large trees. (*Fig. 5E*).

Table 5B. Top 10 species in tree basal area for the 2012 sample neighborhoods street tree inventory compared to 2007 complete inventory and 2011 private neighborhood trees sample. Basal area is computed as the area of a circle at the diameter at breast height.

Species	City Street Trees (%)		2011 Private Tree Sample (%)*
	2012 Neighb.	2007 Complete Inventory	
Silver maple	22.3	21.5	22.8
Sugar maple	18.5	12.6	8.3
Red maple	14.2	11.4	4.8
Green ash	7.5	2.6	5.2
Callery pear	4.3	4.5	0.7
Littleleaf linden	4.1	0.8	0.0
Northern red oak	3.8	0.5	0.01
Scarlet oak	3.0	0.02	0.00
Sweetgum	2.7	2.1	0.6
Am. basswood	2.1	0.02	0.04

* Sarah Mincey, unpublished data, 2012

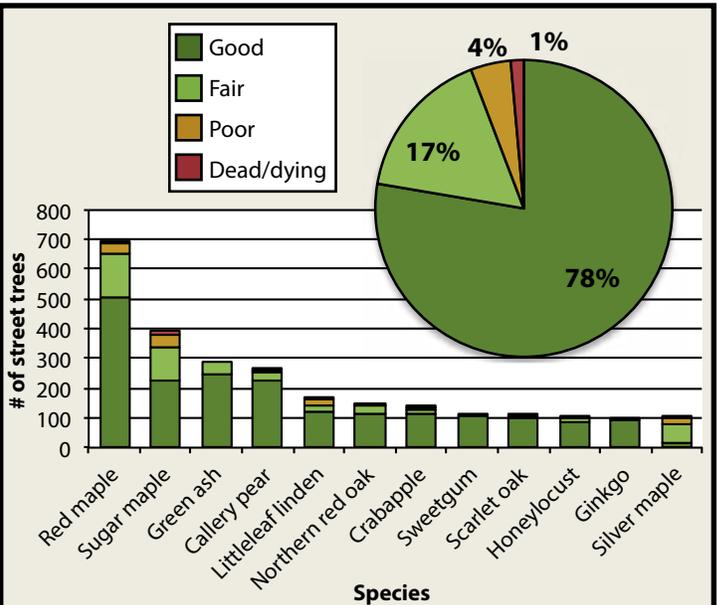


Figure 5A. Tree condition for top 10 street tree species in neighborhood based on tree count. Inset: Percent of all street trees at each condition class rating.

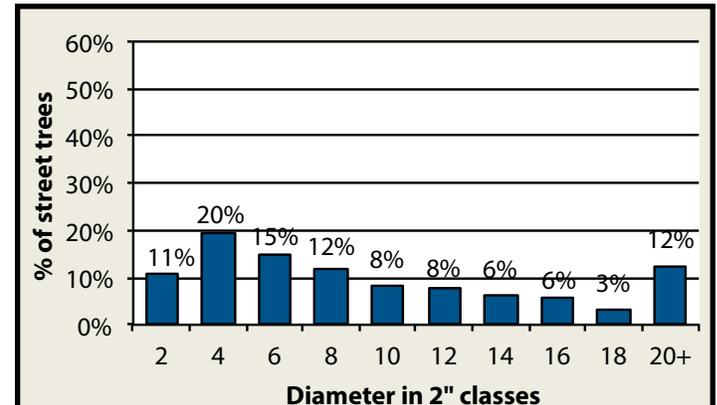


Figure 5C. Distribution of street trees in 2" DBH classes.

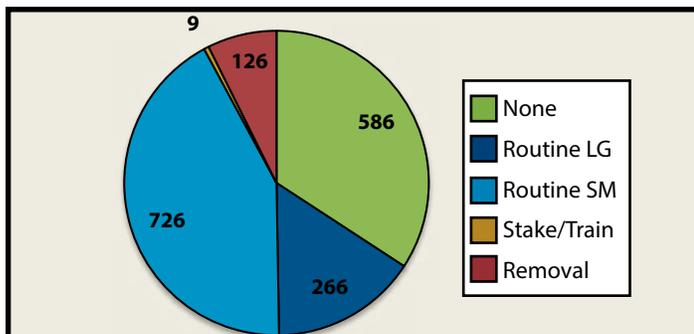


Figure 5D. Maintenance requirements for neighborhood street trees. See *Table 2* for category descriptions.

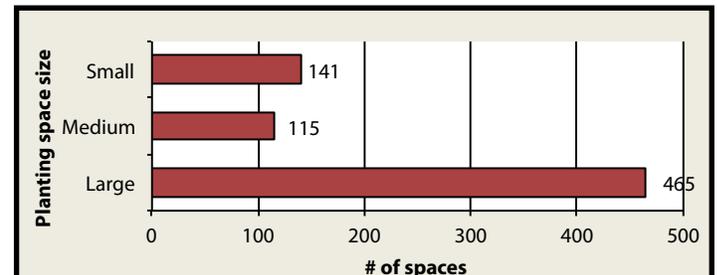


Figure 5E. Street tree planting spaces available in neighborhood by size of mature tree that could be planted: *Small*, <25' in height. *Medium*, 25-45' in height. *Large*, >45' in height.

RECOMMENDATIONS

- See subsequent pages for unique recommendations for each of the 7 neighborhoods.

6. BENT TREE NEIGHBORHOOD

STREET TREE INVENTORY RESULTS

Bent Tree is a small neighborhood with 51 street trees. The population is characterized by only two species, pin oak and Norway spruce, all in good condition (Fig. 6A). These are not common species either by numbers or by mass in either a sample of private trees in Bent Tree neighborhood or the entire 2012 neighborhood sample (Table 6B). Although the tree population is in good condition, the size distribution is unsustainable, with very few small trees less than 6" DBH (Fig. 6C).

Maintenance needs for the present street tree population are minimal, with all trees requiring routine or no maintenance (Fig. 6D). However, there are 84 planting spaces (62% of possible street tree sites) in Bent Tree neighborhood, almost half of which are suitable for planting trees that grow to a mature size of more than 45 feet in height (Fig. 6E).

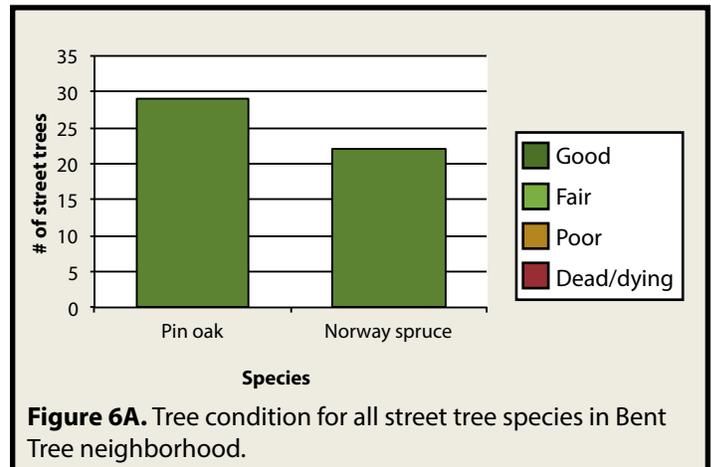


Figure 6A. Tree condition for all street tree species in Bent Tree neighborhood.

Table 6B. Basal area by species for Bent Tree neighborhood street trees and a sample of private trees compared to the entire 2012 neighborhoods sample. Basal area is computed as the area of a circle at the diameter at breast height.

Species	Bent Tree (%)		2012 Neighb. Street Trees (%)
	All Street Trees	Private Sample*	
Pin oak	69.2	3.1	3.8
Norway spruce	30.8	0.0	1.6

* Sarah Mincey, unpublished data, 2012

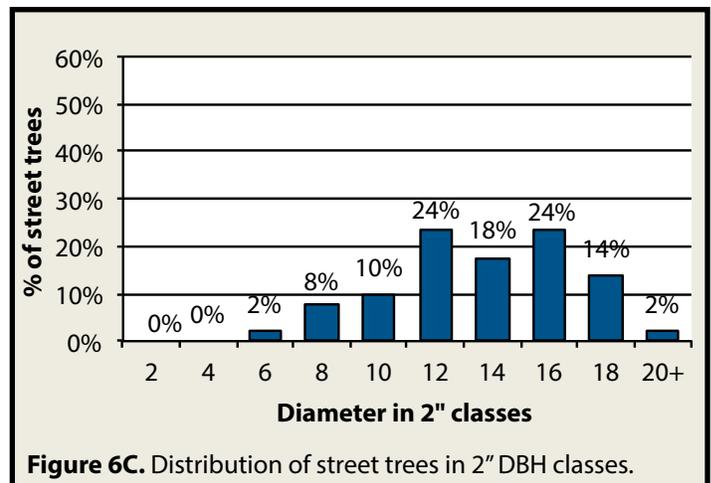


Figure 6C. Distribution of street trees in 2" DBH classes.

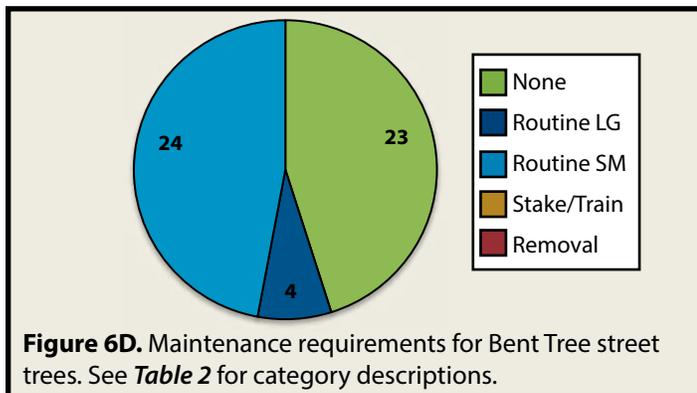


Figure 6D. Maintenance requirements for Bent Tree street trees. See Table 2 for category descriptions.

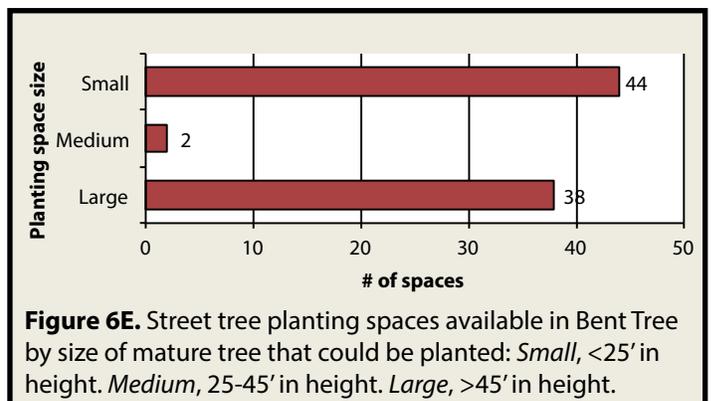


Figure 6E. Street tree planting spaces available in Bent Tree by size of mature tree that could be planted: Small, <25' in height. Medium, 25-45' in height. Large, >45' in height.

RECOMMENDATIONS

- Almost one-third of the possible street tree sites in the Bent Tree neighborhood are available for planting. The species and size distribution of the street tree population could be improved immediately by planting a variety of tree species in available planting spaces.
- Continuous planting programs are important to increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size over time.

7. NEW BENT TREE NEIGHBORHOOD

STREET TREE INVENTORY RESULTS

New Bent Tree is small neighborhood with only 6 street trees. The population is evenly distributed among species (*Fig. 7A*), although a single large slippery elm accounts for nearly half the tree mass in the neighborhood (*Table 7B*). The street trees as a whole are in fairly good condition (*Fig. 7A, inset*), and the population shows a sustainable age distribution, with many young trees less than 6" DBH (*Fig. 7C*).

One of the 6 street trees is recommended for removal, while all others require only routine or no maintenance (*Fig. 7D*). However, there are 19 planting spaces available (76% of possible street tree sites) in New Bent Tree, over half of which are suitable for planting trees that grow to a mature size of more than 45 feet in height (*Fig. 7E*).

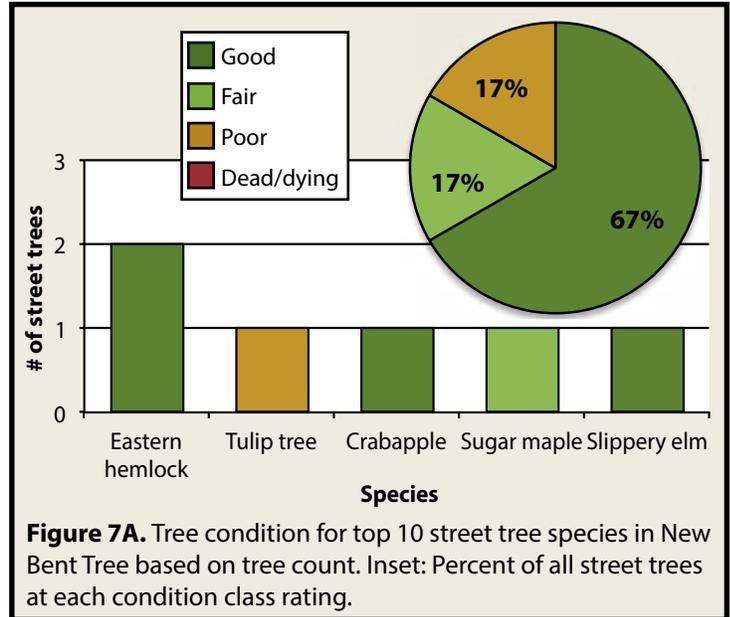


Figure 7A. Tree condition for top 10 street tree species in New Bent Tree based on tree count. Inset: Percent of all street trees at each condition class rating.

Table 7B. Basal area by species for New Bent Tree neighborhood street trees and a sample of private trees compared to the entire 2012 neighborhoods sample. Basal area is computed as the area of a circle at the diameter at breast height.

Species	New Bent Tree (%)		2012 Neighb. Street Trees (%)
	All Street Trees	Private Sample	
Slippery elm	48.1	0.0	0.2
Tulip tree	17.3	16.1	1.8
Sugar maple	14.6	15.8	18.5
Crabapple	14.0	0.8	1.3
Eastern hemlock	6.0	0.1	0.02

* Sarah Mincey, unpublished data, 2012

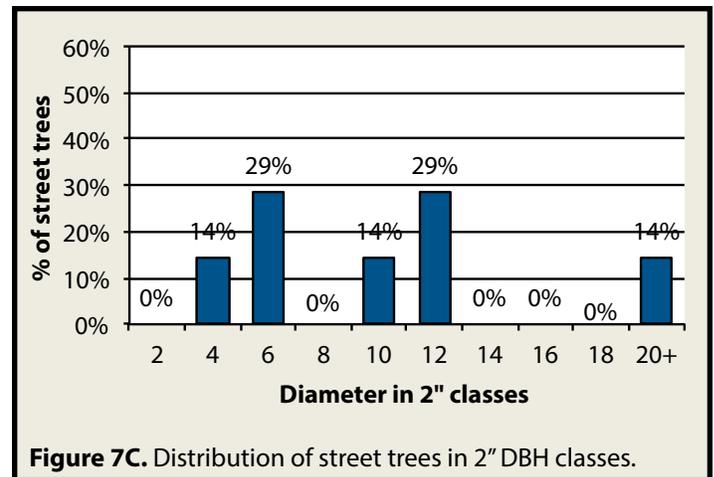


Figure 7C. Distribution of street trees in 2" DBH classes.

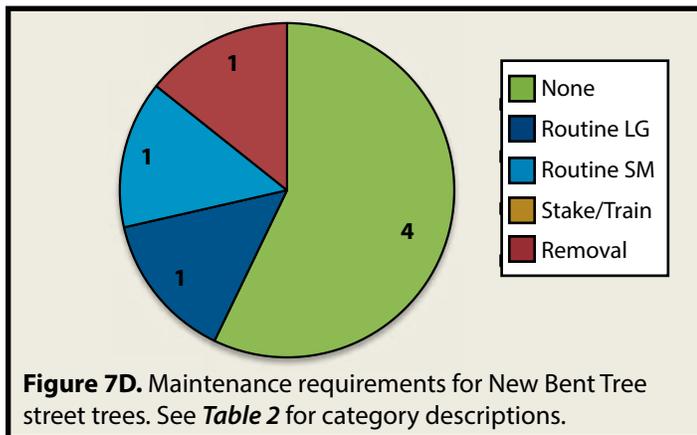


Figure 7D. Maintenance requirements for New Bent Tree street trees. See *Table 2* for category descriptions.

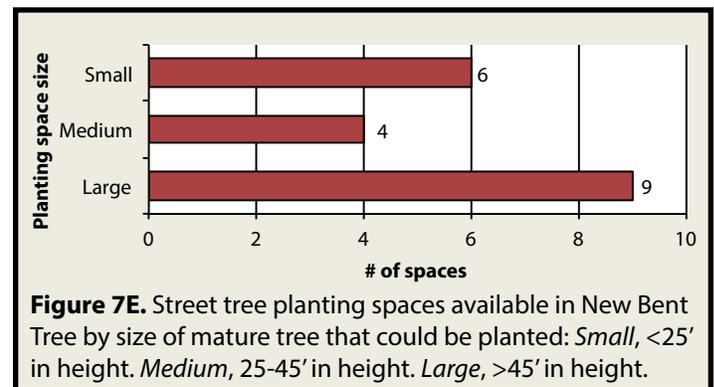


Figure 7E. Street tree planting spaces available in New Bent Tree by size of mature tree that could be planted: *Small*, <25' in height. *Medium*, 25-45' in height. *Large*, >45' in height.

RECOMMENDATIONS

- Three-quarters of the possible tree sites in New Bent Tree neighborhood are available for planting and thus the neighborhood has lots of opportunity to plant additional street trees.
- We recommend continued planting a variety of species to keep a diverse species distribution and sustainable age distribution.

8. OLD NORTHEAST NEIGHBORHOOD

STREET TREE INVENTORY RESULTS

Old Northeast has 826 street trees. The population is characterized by a high percentage of maple trees, both in numbers (*Fig. 8A*) and in mass (*Table 8B*). Although the street trees as a whole are in fairly good condition (*Fig. 8A, inset*), the size distribution is unsustainable, with over 22% of all street trees greater than 20 inches in diameter (*Fig. 8C*).

Maintenance needs for the present street tree population are minimal, with almost 90% of trees requiring routine or no maintenance (*Fig. 8D*). However, there are 326 planting spaces available (28% of possible tree sites) in the Old Northeast neighborhood, 141 of which are suitable for planting trees that grow to a mature size of more than 45 feet in height (*Fig. 8E*).

Table 8B. Top 10 species in tree basal area for Old Northeast neighborhood street trees compared to the entire 2012 neighborhoods sample. Basal area is computed as the area of a circle at the diameter at breast height.

Species	Old Northeast Street Trees (%)	2012 Neighb. Street Trees (%)
Sugar maple	23.6	18.5
Silver maple	21.2	22.3
Red maple	17.0	14.3
Littleleaf linden	5.4	4.1
Northern red oak	5.0	3.8
Callery pear	3.4	4.3
American basswood	2.7	2.1
Sweetgum	2.6	2.7
Green ash	2.3	7.5
Tulip tree	2.2	1.8

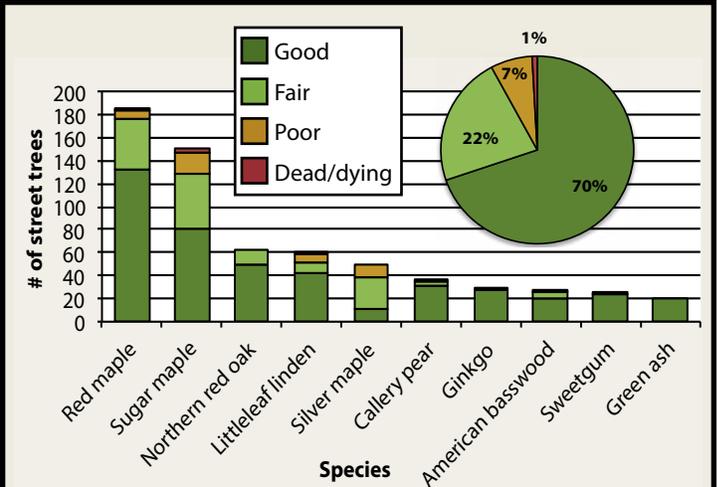


Figure 8A. Tree condition for top 10 street tree species in Old Northeast based on tree count. Inset: Percent of all street trees at each condition class rating.

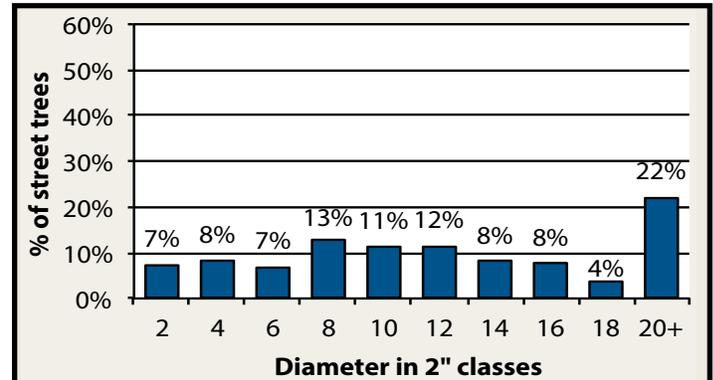


Figure 8C. Distribution of street trees in 2" DBH classes.

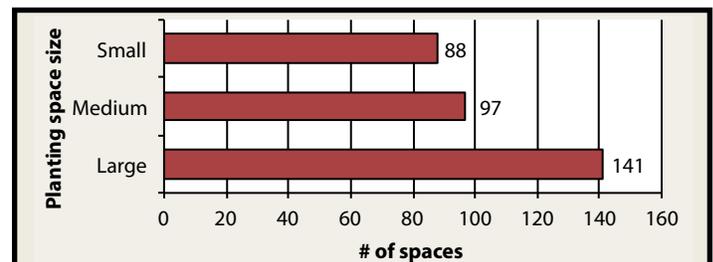


Figure 8E. Street tree planting spaces available in Old Northeast by size of mature tree that could be planted: *Small*, <25' in height. *Medium*, 25-45' in height. *Large*, >45' in height.

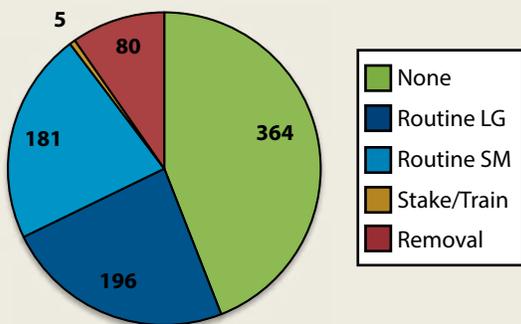


Figure 8D. Maintenance requirements for Old Northeast street trees. See *Table 2* for category descriptions.

RECOMMENDATIONS

- The unsustainable size distribution and presently limited diversity can be addressed through planting non-maple trees in available planting spaces.
- Continuous planting programs are important to increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size over time.
- Vacant planting spaces are relatively large spaces, so plant trees that will grow to a large size in maturity.

9. PEPPERGRASS NEIGHBORHOOD

STREET TREE INVENTORY RESULTS

Peppergrass has 107 street trees. The population is characterized by a high percentage of green ash, both in numbers (Fig. 9A) and in mass (Table 9B). The street trees are in very good condition (Fig. 9A, inset). However, the population shows an unsustainable size distribution, with mostly mid-sized trees and few small trees less than 6" DBH (Fig. 9C).

Maintenance needs for the present street tree population are minimal, with 98% of trees requiring routine or no maintenance (Fig. 9D). However, there are 37 planting spaces available (26% of possible street tree sites) in Peppergrass, all of which are suitable for planting trees that grow to a mature size of more than 45 feet in height (Fig. 9E).

Table 9B. Top 10 species in tree basal area for Peppergrass neighborhood street trees and a sample of private trees compared to the entire 2012 neighborhoods sample. Basal area is computed as the area of a circle at the diameter at breast height.

Species	Peppergrass (%)		2012 Neighb. Street Trees (%)
	All Street Trees	Private Sample*	
Green ash	68.3	0.0	7.5
Crabapple	9.7	0.0	1.3
Norway spruce	7.4	0.0	1.6
Sugar maple	5.3	4.5	18.5
Red maple	4.0	18.5	14.3
Sweetgum	2.2	0.0	2.7
Callery pear	1.4	0.0	4.3
Tulip tree	0.9	0.0	1.8
Norway maple	0.8	0.0	0.5

* Sarah Mincey, unpublished data, 2012

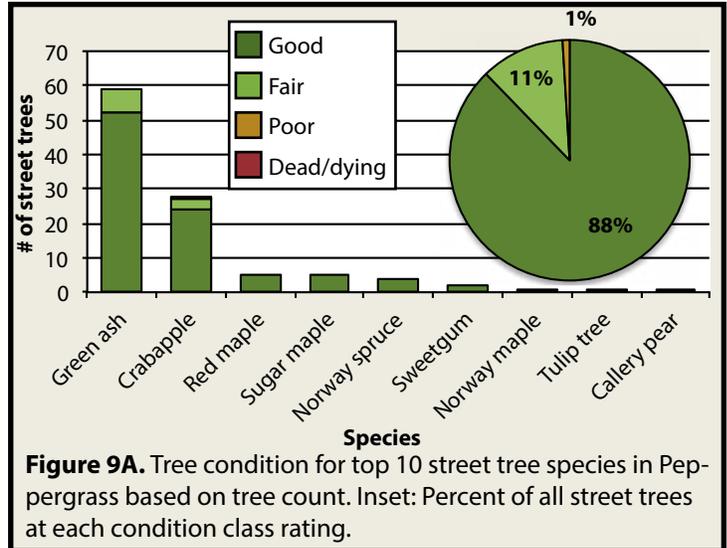


Figure 9A. Tree condition for top 10 street tree species in Peppergrass based on tree count. Inset: Percent of all street trees at each condition class rating.

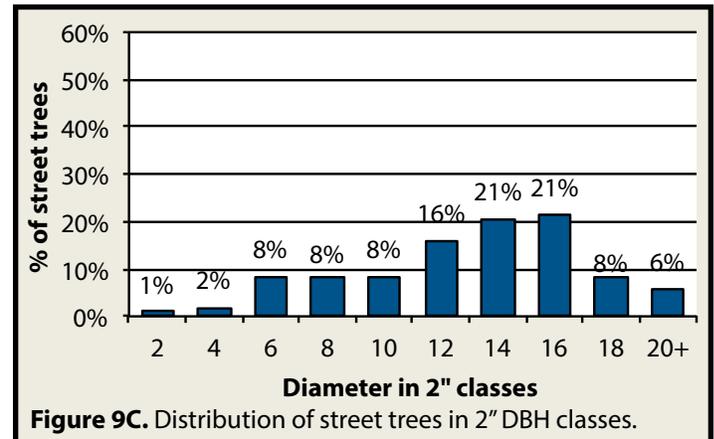


Figure 9C. Distribution of street trees in 2" DBH classes.

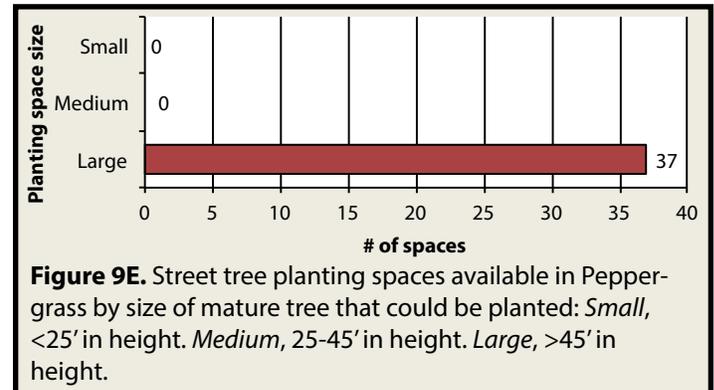


Figure 9E. Street tree planting spaces available in Peppergrass by size of mature tree that could be planted: *Small*, <25' in height. *Medium*, 25-45' in height. *Large*, >45' in height.

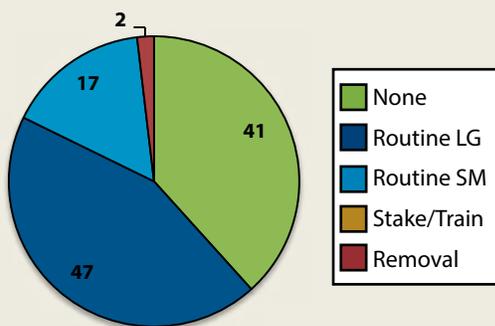


Figure 9D. Maintenance requirements for Peppergrass street trees. See Table 2 for category descriptions.

RECOMMENDATIONS

- Because the ash trees are numerous and in good condition, we recommend following the latest guidelines from Purdue Extension to protect these trees from emerald ash borer.
- Continuous planting programs are important to

increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size over time and provide.

10. ST. JAMES WOODS NEIGHBORHOOD

STREET TREE INVENTORY RESULTS

St. James Woods has 84 street trees. The population is characterized by a very high percentage of red maple, both in numbers (Fig. 10A) and in mass (Table 10B). The street trees as a whole are in good condition (Fig. 10A, inset), and the population show a sustainable size distribution, with many trees less than 6" DBH. (Fig. 10C).

Maintenance needs for the present street tree population are minimal, with only 1 tree recommended for removal and all others requiring routine or no maintenance (Fig. 10D). There are 10 planting spaces available (10% of possible street tree sites), suitable for planting small to medium sized trees that grow to less than 45 ft in height (Fig. 10E).

Table 10B. Basal area by species for St. James Woods street trees and a sample of private trees compared to the entire 2012 neighborhoods sample. Basal area is computed as the area of a circle at the diameter at breast height.

Species	St. James Woods (%)		2012 Neighb. Street Trees (%)
	All Street Trees	Private Sample*	
Red maple	70.4	11.7	14.3
Sweetgum	14.2	0.0	2.7
Callery pear	7.1	9.6	4.3
Maple sp. ¹	4.9	--	0.01
Silver maple	1.4	0.0	22.3
Japanese maple	0.6	0.0	0.01
Blue spruce	0.5	0.0	0.1
Norway maple	0.5	0.0	0.5
Crabapple	0.2	11.6	1.3
Magnolia	0.1	0.0	0.0

* Sarah Mincey, unpublished data, 2012

1 Refers to an unidentified species of maple tree.

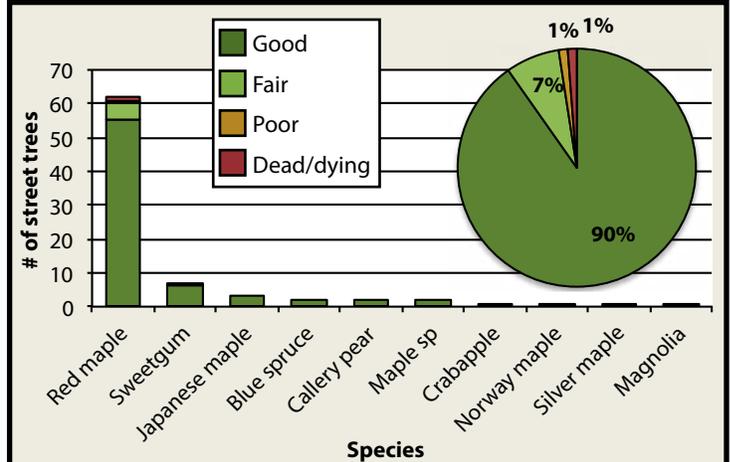


Figure 10A. Tree condition for top 10 street tree species in St. James Woods based on tree count. Inset: Percent of all street trees at each condition class rating.

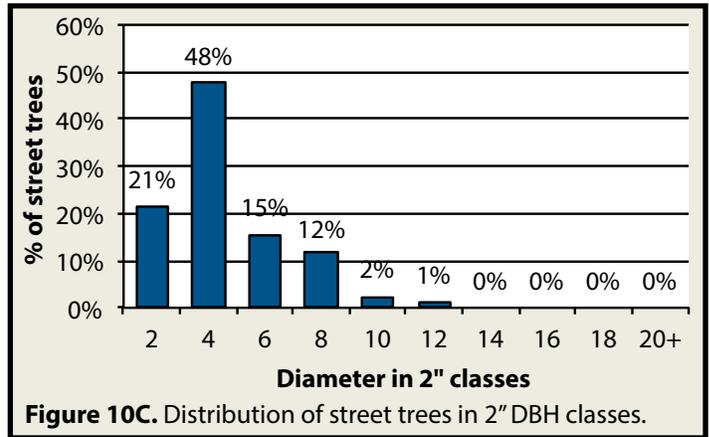


Figure 10C. Distribution of street trees in 2" DBH classes.

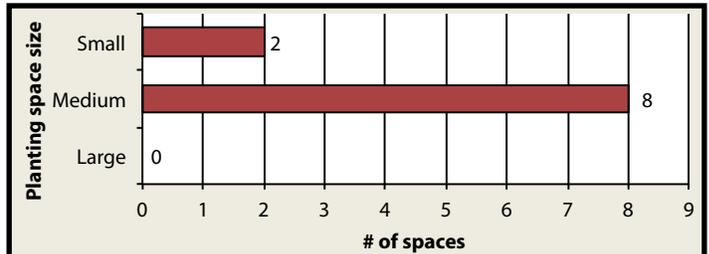


Figure 10E. Street tree planting spaces available in St. James Woods by size of mature tree that could be planted: Small, <25' in height. Medium, 25-45' in height. Large, >45' in height.

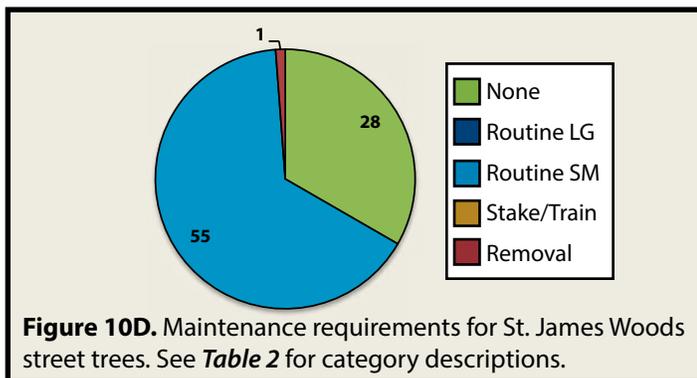


Figure 10D. Maintenance requirements for St. James Woods street trees. See Table 2 for category descriptions.

RECOMMENDATIONS

- Because 90% of the possible street tree spaces are filled, encouraging homeowners to plant species other than red maple & sweetgum on their property may help diversify the neighborhood trees.

- Insect & disease monitoring is critical due to the single-species dominance of the street trees. One way to protect the tree population could be a neighborhood fund for tree care or treatment in case of pest/disease infestation.

11. SUNNY SLOPES NEIGHBORHOOD

STREET TREE INVENTORY RESULTS

Sunny Slopes has a total of 48 street trees. The population is characterized by a high percentage of silver maple in numbers (*Fig. 11A*) and especially in mass (*Table 11B*). The street trees are in fair condition (*Fig. 11A, inset*). Yet, the oldest and largest trees (silver maples) are not in good condition (*Fig. 11A*), and over 40% of neighborhood street trees are >20" DBH (*Fig. 11C*).

Maintenance needs for the present street tree population are substantial, with 42% of trees recommended for removal in the near future (*Fig. 11D*). However, there are 42 planting spaces (47% of possible street tree sites) suitable for planting trees that grow to a mature size of more than 45 feet in height (*Fig. 11E*).

Table 11B. Top 10 species in tree basal area for Sunny Slopes street trees and a sample of private trees compared to the entire 2012 neighborhoods sample. Basal area is computed as the area of a circle at the diameter at breast height.

Species	Sunny Slopes (%)		2012 Neighb. Street Trees (%)
	All Street Trees	Private Sample*	
Silver maple	79.9	27.0	22.3
Eastern white pine	9.7	15.5	0.8
American elm	2.8	4.4	0.8
Scotch pine	2.8	0.0	0.2
Sugar maple	2.3	7.6	18.5
Boxelder	0.9	0.1	0.8
Black cherry	0.7	1.1	0.1
Eastern red cedar	0.6	0.1	0.1
Mulberry	0.2	0.1	0.02
Eastern redbud	0.1	0.9	0.3

* Sarah Mincey, unpublished data, 2012

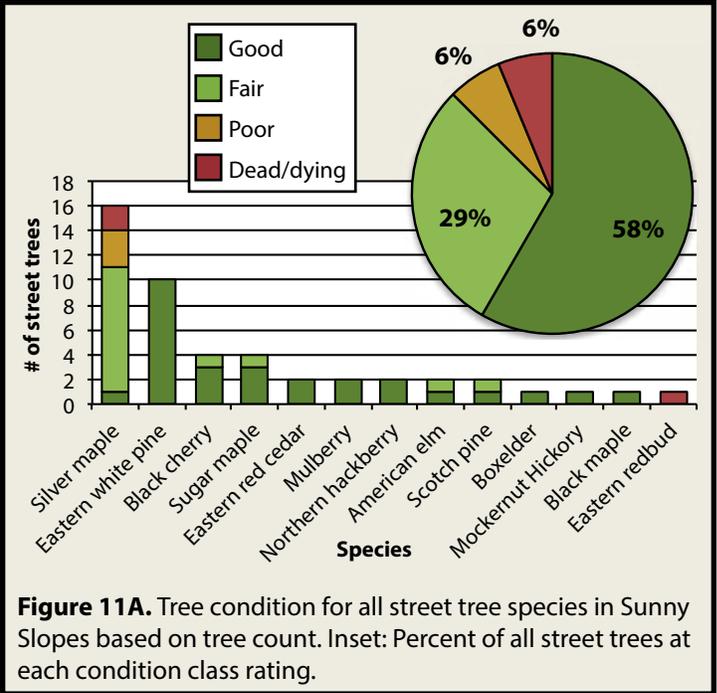


Figure 11A. Tree condition for all street tree species in Sunny Slopes based on tree count. Inset: Percent of all street trees at each condition class rating.

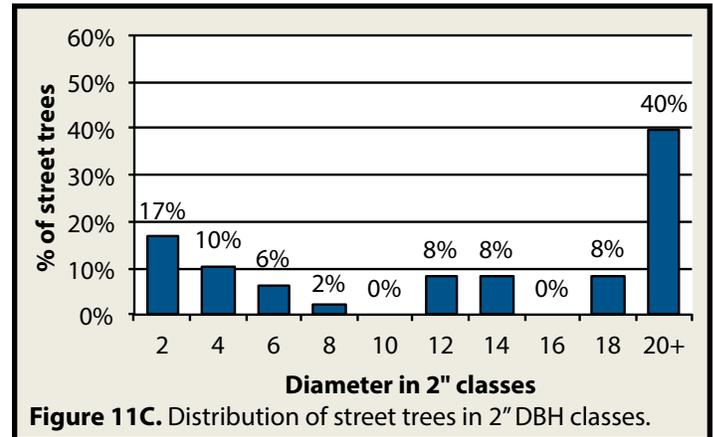


Figure 11C. Distribution of street trees in 2" DBH classes.

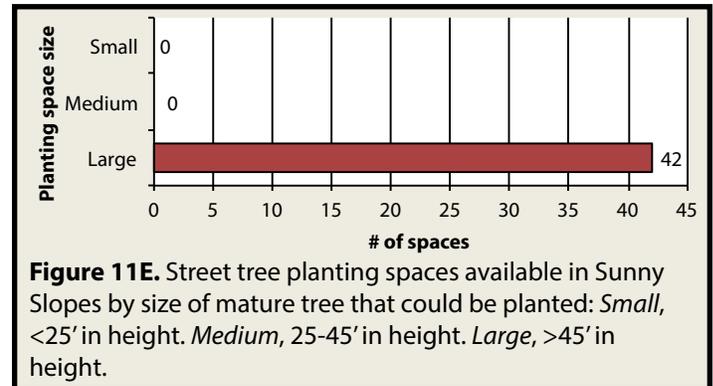


Figure 11D. Maintenance requirements for Sunny Slopes street trees. See *Table 2* for category descriptions.

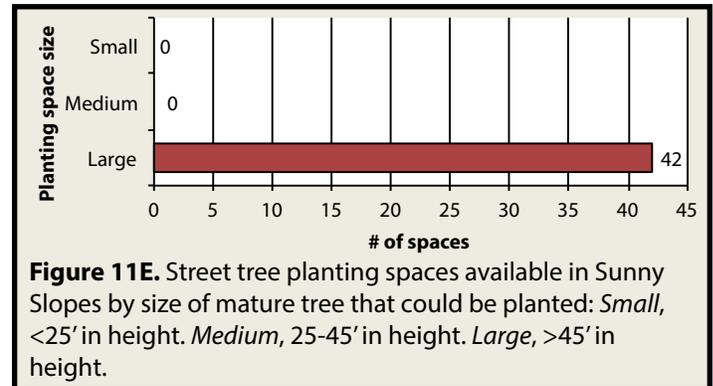


Figure 11E. Street tree planting spaces available in Sunny Slopes by size of mature tree that could be planted: *Small*, <25' in height. *Medium*, 25-45' in height. *Large*, >45' in height.

RECOMMENDATIONS

- Sunny Slopes has lots of large planting spaces which could be planted with non-maple species to improve size and species distributions immediately. Continuous planting programs are important to increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size.

12. THE HIGHLANDS NEIGHBORHOOD

STREET TREE INVENTORY RESULTS

The Highlands has 590 street trees. The population is characterized by a high percentage of green ash, red maple and callery pear trees in numbers (*Fig. 12A*) and mass (*Table 12B*). The street trees are in good condition (*Fig. 12A, inset*), with a sustainable size distribution with more small than large trees (*Fig. 12C*).

Maintenance needs for the present street tree population are minimal, with 96% of trees requiring routine or no maintenance (*Fig. 12D*). There are 203 planting spaces available (26% of possible street tree sites), most of which are suitable for planting trees that grow to a mature size of more than 45 feet in height (*Fig. 12E*).

Table 12B. Top 10 species in tree basal area for The Highlands street trees and a sample of private trees compared to the entire 2012 neighborhoods sample. Basal area is computed as the area of a circle at the diameter at breast height.

Species	The Highlands (%)		2012 Neighb. Street Trees (%)
	All Street Trees	Private Sample*	
Callery pear	29.0	7.7	4.3
Green ash	19.0	0.0	7.5
Red maple	13.4	0.5	14.3
Sweetgum	8.8	0.0	2.7
Scarlet oak	6.0	0.1	3.0
Sugar maple	4.6	3.9	18.5
White ash	4.5	0.5	1.7
Bur oak	3.3	0.0	0.2
Honeylocust	2.2	0.0	1.1
Shingle oak	2.2	0.0	0.1

* Sarah Mincey, unpublished data, 2012

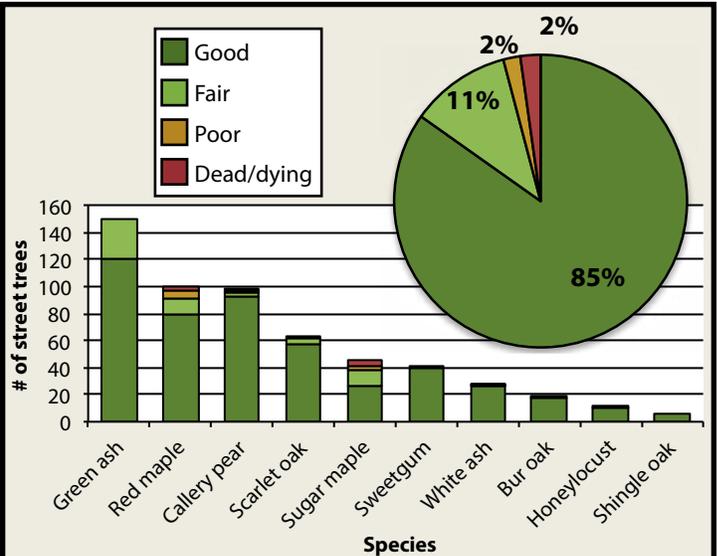


Figure 12A. Tree condition for top 10 street tree species in The Highlands based on tree count. Inset: Percent of all street trees at each condition class rating.

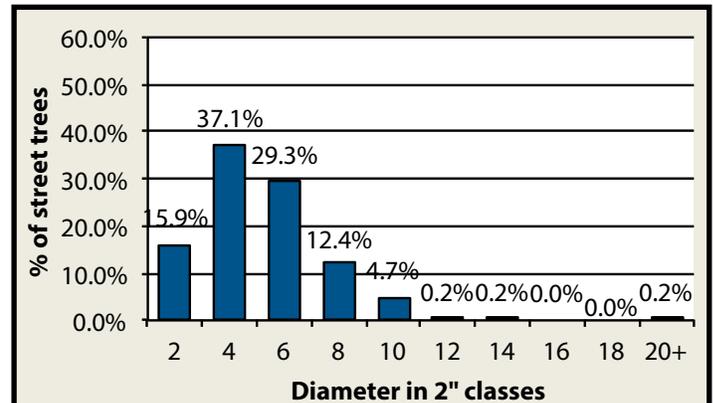


Figure 12C. Distribution of street trees in 2" DBH classes.

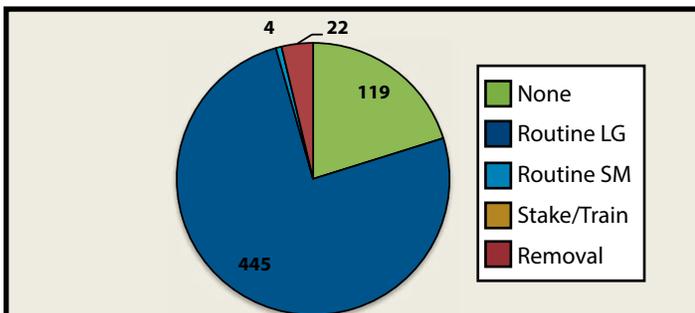


Figure 12D. Maintenance requirements for The Highlands street trees. See *Table 2* for category descriptions.

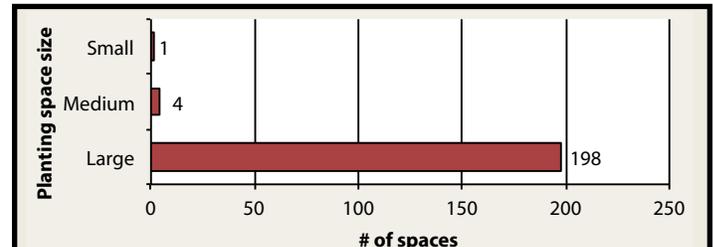


Figure 12E. Street tree planting spaces available in The Highlands by size of mature tree that could be planted: *Small*, <25' in height. *Medium*, 25-45' in height. *Large*, >45' in height.

RECOMMENDATIONS

- Because the ash trees are numerous and in good condition, we recommend following the latest guidelines from Purdue Extension to protect these trees from emerald ash borer.
- Planting trees now in available spaces will help ensure provision of tree benefits through time as short-lived callery pear trees and ash trees threatened by EAB die, and to maintain the sustainable size distribution.

SUMMARY OF RECOMMENDATIONS

DOWNTOWN CORE

- 25% of possible tree sites are not occupied by trees. Planting efforts should concentrate on planting large and medium-sized trees of species other than maple in appropriate sites to improve the species diversity distribution.
- Continuous planting programs are important to increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size over time.

MILLER-SHOWERS PARK

- Because the ash trees are small and in good condition, we recommend following the latest guidelines from Purdue Extension to protect these trees from emerald ash borer.
- Dogwood and red maple trees are in poor condition and at risk due to location and site conditions. If these trees die and are removed, they should be replaced with different species.
- Planting so far has resulted in a good size and species distribution. Keeping up with planting efforts will help ensure a sustainable park tree population into the future.

B-LINE TRAIL

- The tree species composition along the B-Line Trail is much different from the species composition of other public places in Bloomington, and because of this, the future maintenance needs of this population may be different from the rest of the city. The introduction of uncommon trees may mean more frequent maintenance is required.
- The trees along the trail were planted as a single cohort. Because of this, we recommend vigilance in replacement when trees die. The continuous addition of trees to the small size classes will maintain a sustainable size distribution of trees along the Trail
- Because the trees on the B-Line Trail (and in Miller-Showers Park) are young, they require regular watering to become well-established in the landscape. Frequent watering during dry summer months is crucial to protect the investment trees represent.

NEIGHBORHOOD STREET TREES

Bent Tree

- Almost one-third of the possible street tree sites in the Bent Tree neighborhood are available for planting. The species and size distribution of the street tree population could be improved immediately by planting a variety of tree species in available planting spaces.
- Continuous planting programs are important to increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size over time.

New Bent Tree

- Three-quarters of the possible tree sites in New Bent Tree neighborhood are available for planting and thus the neighborhood has lots of opportunity to plant additional street trees.
- We recommend continued planting a variety of species to keep a diverse species distribution and sustainable age distribution.

Old Northeast

- The unsustainable size distribution and presently limited diversity can be addressed through planting non-maple trees in available planting spaces.
- Continuous planting programs are important to increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size over time.

Peppergrass

- Because the ash trees are numerous and in good condition, we recommend following the latest guidelines from Purdue Extension to protect these trees from emerald ash borer.
- Continuous planting programs are important to increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size over time.

St. James Woods

- Because 90% of the possible street tree spaces are filled, encouraging homeowners to plant species other than red maple & sweetgum on their property may help diversify the neighborhood trees.
- Insect & disease monitoring is critical due to the

RECOMMENDATIONS (continued)

single-species dominance of the street trees. One way to protect the tree population could be a neighborhood fund for tree care or treatment in case of pest/disease invasion.

Sunny Slopes

- Sunny Slopes has lots of large planting spaces which could be planted with non-maple species to improve size and species distributions immediately.
- Continuous planting programs are important to increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size.

The Highlands

- Because the ash trees are numerous and in good condition, we recommend following the latest guidelines from Purdue Extension to protect these trees from emerald ash borer.
- Planting trees now in available spaces will help ensure provision of tree benefits through time as short-lived trees such as callery pear die, and maintain the sustainable size distribution.

RECOMMENDATIONS FOR THE CITY AS A WHOLE

Diversity

For the 7 neighborhoods, Downtown Core, B-Line Trail and Miller-Showers Park, the top 4 most numerous public tree species were red maple, sugar maple, green ash, and callery pear (*Fig. 1A*). The 2007 inventory also counted these four species in the top 6 most numerous species. Maple species are very common street tree species in Bloomington, and in order to avoid having an overabundance of maples (making the street tree population vulnerable to maple-specific pests and diseases), we recommend minimizing the number of maples planted overall. Planting non-maple species is particularly important in areas where a very large percentage of the population is already maples (e.g., Old Northeast, St. James Woods, Sunny Slopes).

Ash species are vulnerable to emerald ash borer (EAB), which we now know to be in Monroe County. Where there are ash trees that are young or in good condition, we recommend following the latest guidelines from Purdue Extension to protect these trees from succumbing to EAB. Protecting ash from EAB should be a priority in areas where ash trees are a large percentage of the local population (e.g., Peppercorn, Miller-Showers Park), because these areas have few trees of other species to “pick up the slack” in provision of benefits if ash were to die from EAB.

Callery pear trees are numerous, but because they are not only a short-lived species but also an invasive species, we recommend that when these trees die and are removed they are replaced with larger, longer-lived species where possible (e.g., basswood or oak species). This is consistent with the City’s invasive species policies and the City of Bloomington Tree Care Manual, where callery pear (also known as flowering pear) is listed as an “undesirable tree species.”

Size distribution

In the areas inventoried, the size of public trees was relatively evenly distributed across 2” DBH classes (*Fig. 1C*). An ideal, sustainable size distribution has more small trees than large trees, because we assume that some planted trees will die before they reach a large size and can provide large amounts of bene-

...FOR THE CITY AS A WHOLE (continued)

fits. Continuous planting programs are important to increase the number of small trees relative to large trees, which increases the chances that more trees grow to a large size over time and are able to provide a high amount of benefits to city residents.

Planting spaces

Approximately 28% of possible street tree planting sites remain available in the neighborhood and downtown areas surveyed (planting spaces were not counted for trail and park inventories). Most of these planting spaces are large and suitable for planting trees that grow to a mature size of greater than 45' tall. Planting trees in available spaces can begin to remedy any current problems with unsustainable species and size distributions in the areas inventoried as indicated in specific recommendations above. (Note that the 2012 summer inventory planting space assessment did not consider the location of underground sewer or electrical utilities and, as always, this information should influence street tree planting decisions.)

Maintenance

Recommended maintenance tasks on inventoried trees are relatively minimal, with only 7% of inventoried trees recommended for removal at some point in the future and most other trees requiring only routine or no maintenance. However, as the neighborhood summaries indicate, removal needs (based on current condition of trees) vary widely from neighborhood to neighborhood, with 42% of the trees (primarily old silver maples) in Sunny Slopes recommended for removal but only 1 tree of 84 recommended for removal in St. James Woods.

Although not an explicit maintenance task included in the inventory, watering street trees is an important tree maintenance task to help recently planted trees become established in the landscape and to protect the investment represented by all street trees. Areas inventoried with high proportions of small trees include Miller-Showers Park, the B-Line Trail, St. James Woods and The Highlands. For park and trail trees, the City should budget and formally plan for routine watering of all recently planted trees, particularly during dry summer periods. For neighborhood trees, an outreach effort by the City to convey the importance of watering street trees could encourage adjacent homeowners (perhaps through neighborhood associations) to water street trees to help ensure they survive to provide benefits into the future.

Inventory technology

Both the 2007 complete inventory and the 2012 inventory were conducted using the same technology: hand-held PC's running iTree Streets software. These units are not integrated with global positioning system (GPS) capabilities and because of this street tree location is given using a combination of the street address adjacent to the planted tree, side of the building on which the tree resides, and a 1, 2, 3, numbering system representing the order of the trees in front of the house, where the increasing tree numbers correspond to the direction of increasing street address numbers. This is a convoluted and difficult method of tracking tree location year after year and we do not currently feel confident that the accuracy of this system allows us to match individual trees between inventory years to calculate growth or mortality rates. (Park and trail tree location is even more hazy than street tree locations.)

For these reasons, we strongly recommend that the City of Bloomington move to an electronic, live-updating inventory system that uses GPS to locate trees in a more precise and accurate manner. This type of geolocating is standard practice for many other types of city infrastructure (roads, sewers, etc.) and trees, as green infrastructure, should be no different. Accurate tracking of individual trees will become even more crucial as monitoring for and treating EAB or other pests increases the monetary investment the City makes in its street and park trees. App-based smartphone systems for tree inventories are an alternative system that BUFRG has had great success using to track trees in Indianapolis and would also be a good op-

...For the City as a Whole (continued)

tion for Bloomington. This kind of technology requires an investment from the City, but will also improve calculations of the return on investment through monitoring tree survival and growth.

Future public tree inventories

This 2012 inventory of public trees is the first re-inventory since the 2007 complete street tree inventory. We re-inventoried 4,136 (25%) of the city's 16,252 possible street tree sites in the 7 neighborhoods and Downtown Core included in 2012 inventory. In the future, we recommend that 20-25% of the City's public trees be inventoried every year. An annual partial inventory is more easily budgeted by the City than a complete inventory that occurs infrequently. Annual inventories of selected street tree sites and additional park trees as warranted will keep the City abreast of trends and possible emerging problems, as well as allow for targeted inventories in specific city areas of concern.

How to access an electronic version of this report:

The Bloomington Urban Forestry Research Group (BUFRG) is developing a website that will be live in early 2013. The project page for City of Bloomington Tree Inventories, where this report can be downloaded as a PDF, will be: https://www.indiana.edu/~cipec/research/bufrgproj_inventories.php.

The City of Bloomington Street Trees and Landscaping webpage will also have a PDF available for download at: <http://bloomington.in.gov/treecare>.

Questions?

Contact Burney Fischer: bufische@indiana.edu.

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