An Updated Tree Inventory: Elm Heights

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Introduction

Located just south of the Indiana University campus, the Elm Heights neighborhood is a historic area with both permanent and short-term residents (i.e., homeowners and renters). According to the Elm Heights Neighborhood Association, homes in the western section of the neighborhood were built in the early 1900s, while the majority of the homes were built in the 1920s. In 2012, the Bloomington City Council approved the creation of the Elm Heights Historic District within the neighborhood (Elm Heights 2016).

The Elm Heights Neighborhood Association has self-identified a need for a succession plan for large, aging street trees predicted to be removed in the next 5-10 years. Older trees will eventually succumb and become hazardous for residents and their children; therefore, in order to prepare for their removal, the Neighborhood Association seeks to develop a plan to ensure the continuing sustainability of their street trees. In order to do this, data must be obtained which will accurately define the current status of the neighborhood's street trees and help to develop recommendations for the succession plan. Additionally, the Neighborhood Association is pursuing grant funding for tree planting, and hopes to utilize this data and analysis in applications.

Therefore, our project goals are twofold: (1) information gathering, and (2) community development, for the purpose of fund development and the creation of a

neighborhood street tree succession plan.

Methods A significant aspect of this project involved the re-inventory of a portion of the Elm Heights neighborhood. On two separate days our group split into two teams to inventory a

4 block by 3 block segment of Elm Heights, bordered by 2nd street to 1st street and from Henderson to Walnut (Figure 1). We used information from the 2007 Elm Heights tree inventory (the most recent inventory data available) to identify existing trees as well as to note where trees had been removed. New trees planted since 2007 were added to the data collected. Figure 1. The red subset represents the sampled portion of the Elm Heights neighborhood.

Data collected includes: tree species, diameter at breast height (DBH), location, condition of the tree, presence of overhead power lines, and suggested maintenance. DBH was determined using a biltmore stick. We used five variables to categorize the condition of each tree: removed, dead, poor, fair, and good. Suggested maintenance included variables of: no maintenance required, routine large, routine small, training, removal, priority 1 pruning, and priority 2 pruning. Only trees within the public right-of-way were inventoried. Yard trees were not considered in this analysis.

Results We ultimately collected data on 122 trees and found 24 different species of trees from our survey (Table 1).

Table1. Species and quantity of tree.

Species	No. of trees	Species	No. of trees
Littleleaf Linden	51	American Elm	3
Red Maple	37	American Sycamore	3
Gingko	35	Black Locust	3
Sugar Maple	29	Green Ash	3
Callery Pear	20	Catalpa	2
Tulip Poplar	12	White Oak	2
Elm	10	Sweetgum	2
Silver Maple	9	Crataegus Species	1
White ash	5	Japanese Maple	1
Black Walnut	5	Honey Locust	1
Crabapple	4	Norway Maple	1
American Basswood	4	Unknown	1

Out of the 24 species found in our inventory, the most frequent tree species were Littleleaf linden (*Tilia cordata*) at 21% followed by Red maple (*Acer rubrum*) at 15% and

Gingko (*Ginkgo biloba*) at 14% (Figure 2).

Figure 2. Species composition of Elm heights street trees.

About 3⁄4 of the trees inventoried in Elm Heights were in either good or fair condition; however, nearly 30% of the trees were poor or dead (Figure 3). Compared to the 2007 inventory report 5.19% of trees were removed and not replanted in 2016, indicating possible sites for replanting. We also found ten trees requiring a priority 1 prune, indicating the most significant need for management. These ten trees are located at: 721 1st St. E. (tree ID= 4531), 720 University St. E (tree ID= 4394), 815 University St. E. (tree

ID= 4417), 611 University St. E. (tree ID= 4590), 630 University St. E (tree ID= 4565) 449 Henderson St. S. (tree ID= 4617), 701 Fess Ave. (tree ID= 4569), 608 2nd St. E (tree ID= 4621), 716 2nd St. E. (tree ID= 4306) and 730 Woodlawn Ave. S. (no tree ID available).

Figure 3. Condition of Elm Heights street trees.

When comparing the 2007 street tree inventory with ours collected here, the 2007 street inventory shows a higher number of large trees (DBH of 18" and up) overall, with 47 large street trees compared to the 43 large street trees documented in the 2016 inventory (Figure 4, Figure 5). Mid-sized trees (8-16") make up a significant portion of the inventory

as well, with 49 in total. The highest percentage of the street tree inventory consists of small trees (DBH of 2”-8”) in the 2007 report- with a total of 65 small trees. The 2007 DBH distribution graph has a left-skewed distribution.

Figure 4. Size distribution in 2007 area street trees. Distribution is skewed towards the left, meaning there are many more smaller trees than larger trees.

We also found that the distribution of the 2016 street tree inventory is more normally distributed compared to the 2007 inventory (Figure 5). There is a large proportion of mid-size trees, with 53 in total. The 2016 inventory shows 43 large trees and the lowest concentration of small trees at 19 in total. The largest trees in the 2016 inventory are smaller than the largest trees in the 2007 inventory- the largest street trees in 2007 are between 36 and 52 inches DBH (Figure 4), while the largest street trees in 2016 are between 28 and 36 inches DBH (Figure 5).

Figure 5. Size distribution in 2016 area street trees. Distribution is closer to a normal distribution, meaning there is a relatively large amount of mid-size trees.

Benefits of Elm Heights Trees

To calculate the benefits of the Elm Heights street trees, we relied on the National Tree Benefits Calculator. This online service allows users to input the tree species and DBH to determine annual benefits. The National Tree Benefits Calculator considers the following when determining annual benefits: storm water reductions, carbon dioxide reductions, air quality improvements, lowered energy consumption, decreased natural gas use, and

increased property values. To determine the annual benefits of the street trees, we determined which tree species were most common in the Elm Heights neighborhood and calculated the average DBH of those trees. We then input the three most common tree species, which follow: littleleaf linden, red maple, and ginkgo. We found that the littleleaf linden, with an average DBH of 15 inches, offered average annual benefits of $52 per year

per tree. The red maple, with an average DBH of 11 inches, provided an average of $72 worth of benefits per tree per year. Finally, the ginkgo tree, with an average DBH of 10 inches, contributed about $64 worth of benefits per tree per year (Figures 6-8).

Figure 6. Annual benefits of average Elm Heights Littleleaf linden.

Figure 7. Annual benefits of average Elm Heights Red maple.

Figure 8. Annual benefits of average Elm Heights Ginkgo.

Analysis

Our inventory of Elm Heights street trees and our comparison to the 2007 inventory produced a number of important results. We found that the current species composition of the street trees is relatively diverse, although a few species (Littleleaf, Red Maple, and Ginkgo) occur more often than ideal (see Recommendations). When comparing size distribution of the 2007 street tree inventory and this 2016 inventory we found that although the Neighborhood Association is correct in assessing that there are a number of larger street trees which may require removal in the next 5-10 years, the current size distribution of the street trees is actually much narrower than in 2007 (i.e., the largest trees in 2016 are much smaller than the largest trees in 2007). This is consistent with our findings that 5% of the street trees in the area have been removed since 2007.

However, a sustainable tree population has the largest percentage of trees in the size category of a DBH of less than six inches and the smallest percentage of trees in the size category of a DBH of 18 inches or more (Richards 1983). Therefore, when compared to this ideal sustainable tree population (Figure 9), it's clear that the street trees in 2007

represented a much more sustainable tree population than the current (2016) distribution.

Figure 9. An ideal, sustainable urban tree population (McPherson et al. 2005)

Therefore, our major finding is that Elm Heights' street trees are not currently at a large risk for removal due to size and age; instead, we have found that the neighborhood is in need of a succession plan to combat removals and tree failure due to lack of maintenance, particularly early in life. Our data indicate that nearly 30% of the trees in our sample area are classified as "Poor [condition]" or "Dead." Tree maintenance issues that we observed, which contributed most significantly to these poor conditions, include:

1. Girdling roots
2. Broken/dangling branches
3. Lack of care early in life- central leader stem never chosen, leaning or crooked trees, lack of early pruning/training leading to unstable branches over streets and sidewalks

We also identified a trend of under-utilization of available tree planting sites. There were a number of such areas in the portion of the neighborhood we surveyed (either empty spaces along the right of way, or sites of former tree removals), including:

a. 700 & 800 block of 2nd St E

b. 700 block of Henderson St S

c. 500-700 block of Fess Ave S

d. 600 & 700 block of Park Ave S

Finally, during our inventory we found that Elm Heights has clear existing community investment: we were stopped by residents multiple times each day we surveyed, in order to discuss our project and the data we had collected, as well as current management strategies residents are employing and recommended tree care. This created

an additional theme in our project- community development (see Recommendations). Ultimately, we found that residents are enthusiastic and interested in learning how to improve neighborhood tree maintenance; however guidance is needed in order to employ well-informed and successful strategies. This brings us to our final recommendations for the Neighborhood Association.

Recommendations

The Elm Heights Neighborhood Association should include these 4 major priorities when applying for funding for further street tree planting:

1. Tree care and maintenance education should be included in all street tree plantings. Volunteer training should stress the importance of tree care in all life stages. Proper pruning should also be emphasized so that a clear leader is defined early in life. The ten trees indicated as a Priority 1 prune in the 2016 inventory should be addressed as soon as possible.
2. The City (and the Neighborhood Association) should continue to plant diverse street tree species. Ideally, the number of Littleleaf linden (*Tilia cordata*) and Red maple (*Acer rubrum)* trees planted will be reduced so that species diversity will thrive in the neighborhood. A sustainable urban forest includes no more than 10 percent of the same species, no more than 20 percent of the same genus, and no more than 30 percent of the same family (Santamour 1990).

3. The pruning of branches that hang over highly-trafficked streets and sidewalks should also be a priority in the neighborhood association's plan and grant proposal.
4. To create a successful street tree succession plan the existing spaces mentioned above should be utilized, as they are prime locations for trees (see list above).

We also recommend meeting with Bloomington Urban Forestry officials to propose that these priorities be included in the management strategy for Elm Heights street trees. An additional recommendation for the Elm Heights Neighborhood Association is to explore the possibility of community pruning training & classes, including those offered through:

1. City of Bloomington
2. Hilltop Campus Gardens
3. Bloomington Community Orchard

Such training and classes would enhance Elm Heights' community development as well as their commitment to assisting the city of Bloomington with street tree care.

Conclusions

This re-inventory of Elm Heights street trees found that the majority of the trees are in good shape, although we highlighted particular trees and procedures which should be

undertaken in future management. Large, healthy trees provide numerous benefits to the neighborhood. The three most common trees in Elm Heights produce on average of $14,684 of benefits per year within the subset of the neighborhood which we inventoried.

Future, active management of Elm Heights street trees can ensure that benefits will continue and increase in the coming years.

Works Cited

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