IUB Historical Neighborhood Street Tree Inventory and Analysis

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Introduction

The IU Bloomington Historic Neighborhood, also known as University Courts, is a famous neighborhood located adjacent to the IUB campus. The neighborhood is bounded by Woodlawn and Indiana in the east and west, and by 7th and 10th in the south and north, and comprises 15 street blocks. Much of the neighborhood was constructed in the 1920s and 30s, using the architectural styles of those periods (University Courts Historic District). As a result, the neighborhood was designated a Historic District by the city of Bloomington in 2014 (University Courts Historic District).

Most of the neighborhood is a mix of residential houses and fraternity houses (which are located primarily in the eastern part of the nieghborhood). Much of the neighborhood is now owned by IU, and many of the original buildings have been renovated to house various faculty and department offices. Due to its close proximity to the IU campus and its large amount of IU affiliated buildings, the neighborhood, and its trees, reflect IU pride. As a result, much of the neighborhood is filled with maples (specifically red maples), although there is some new diversity.

Street tree inventories of the University Courts Historic District were conducted in 2007 and 2014, but some planting and tree removal has occurred since the most recent inventory. In addition, the recent completion of the fraternity house on Woodlawn has resulted in some new planting, and has opened up new planting sites. It was, therefore, interesting to create a new inventory to quantify the new overall urban forest condition and trends in the neighborhood.

Methods

A map template was set up using the Esri ArcGIS software package; this involved specifying the attribute data to be collected, determining the type of data collected in each attribute field (i.e. text or numerical data; for this map service all fields used text data save for DBH and the lawn width), and defining the domains for certain fields (specifying what values were possible for the attribute; e.g. “Good”, “Fair”, “Poor”, “Dead”, or “Plant” for the condition field).

The map template was then published onto the ArcGIS Online service using an Indiana University account, and shared within a group. Using the Collector for ArcGIS app on mobile smartphones (linked to the web map service), the following data was then collected: Species, address, street name, diameter at breast height (DBH), condition, lawn width, maintenance needs, relevant comments, and the presence of any overhead utilities. The Collector app also recorded the geospatial coordinates upon entering data for each tree. A topographical map was included as a basemap for the area (depicting street names, nearby buildings, and other geographical features).

Upon completion of the data collection phase, the web map was opened in the desktop version of ArcGIS. The species diversity, condition, and size distribution of the trees across the neighborhood were symbolized in three separate maps, for which relevant legends and other map components were generated. Species diversity was symbolized according to color, condition rating was symbolized according to the colors specified during creation of the map template, and size distribution was symbolized by green circles of varying sizes.

The map data was downloaded into Excel format using the ArcGIS "Table to Excel" tool. An index was created of the different species of trees found in the inventory, and a tabulation was created of the number of trees of each species found within the inventory. This tabulation was used to calculate the percentage of each species in the total inventory. In addition, a more specific tabulation was created for the number of trees of each of three condition ratings ("Good", "Fair", or "Poor") for each species of tree in order to assess the overall health of the population of each tree species represented in the inventory. Finally, an average DBH was calculated for each tree species represented in the inventory in order to represent the approximate age of each species of tree within the inventory.

Monetary benefits provided by street trees were calculated by using Excel to find the average DBH for the three most numerous species. The average DBH for each of those species was entered into the National Tree Benefits Calculator. The calculated monetary value was multiplied by the number of trees in each species in order to estimate the total benefits provided by these species in the neighborhood.

Results and Discussion

The first, and arguably most important, observation of this tree inventory is the lack of diversity in the neighborhood. Figure 1, which shows the percentage of each type of tree species in the neighborhood, illustrates this lack of divserity. The neighborhood is dominated by only three types of trees: red maples, red oaks, and sugar maples. These three species alone make up almost 60% of the trees in the neighborhood, with red maples alone accounting for nealy 32%. Map A-1, presented in the appendix, further highlights this point, showing that multiple streets

are composed entirely, or almost entirely, of maples. This severe lack of diversity should be corrected in order to prevent a major loss of tree canopy and benefits in the event that a maple-specific pest arrives. The likelihood of correction of this lack of diversity is, however, unlikely due to the neighborhood's proximity to the IU campus and the popularity of the red maple.

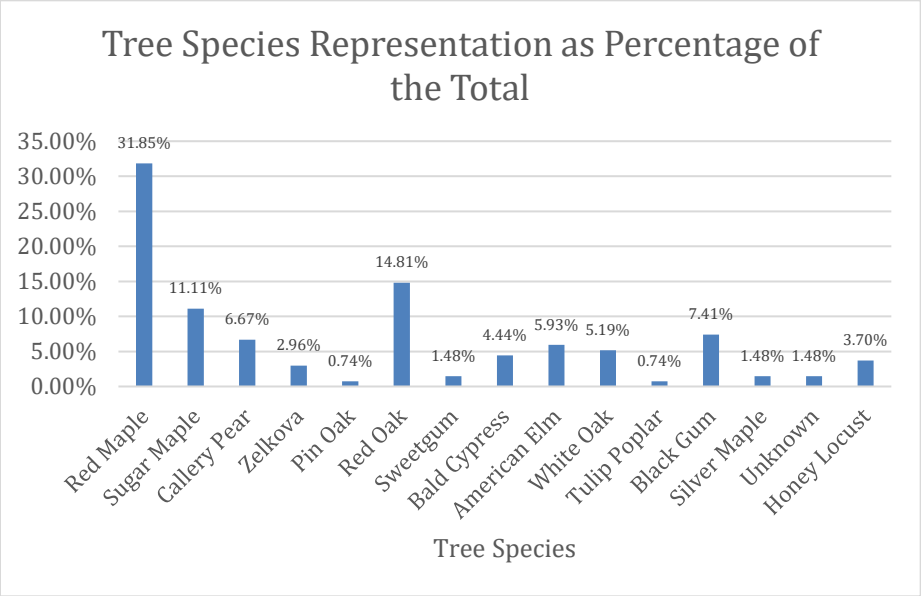


Figure 1-Tree Species as a percentage of all trees in the neighborhood

Another important observation is in regards to the sustainability of the neighborhood's urban forest. Figure 2 presents the average DBH for each species in the neighborhood. While there are many large, mature trees in the neighborhood, there has also been a major drive to plant new trees. This is evidenced by the presence of many small trees spread

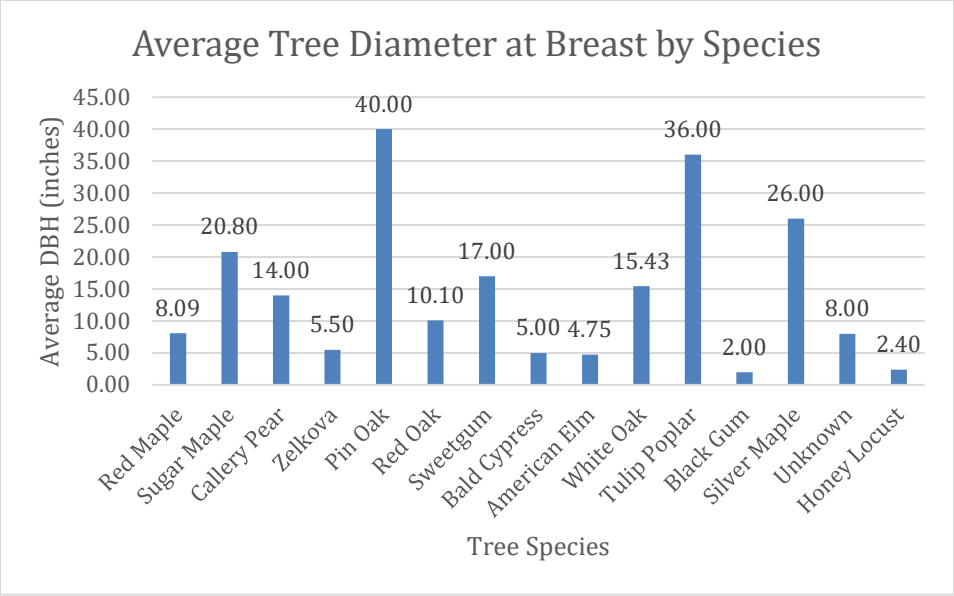


Figure 2-Average DBH for each species in the neighborhood

throughout the neighborhood. In fact, the average DBH of trees in the neighborhood is only 14.34 in. When the major outliers (a 40 in. pin oak and a 36 in. tulip poplar) are excluded, the average DBH drops to only 10.70 inches. Map A-2 in the appendix helps demonstrate the location and extent of the planting efforts. The amounts of small trees indicate that effort is being taken to ensure the sustainability and future of the neighborhood's urban forest. Despite the effort to plant more trees, however, the tree planting is set to reinforce some of the currently existing problems in the neighborhood. Of the new trees planted many were red maple, which will do little to fix the diversity problem mentioned in the previous paragraph. However, some of the new trees are different species, like American Elm and Bald Cypress, so there is still some improvement in diversity. To ensure a truly sustainable urban forest simply planting new trees is not enough; diversity must be factored in so that one pest does not devastate an entire neighborhood's tree population.

Finally, the last major observation is about the tree condition, as it ties in with both of the previous points. Figure 3 depicts the various conditions of every type of tree species in the neighborhood. While the overall condition does appear to good, there are some notable issues. Many of the red maples are in fair condition, and some

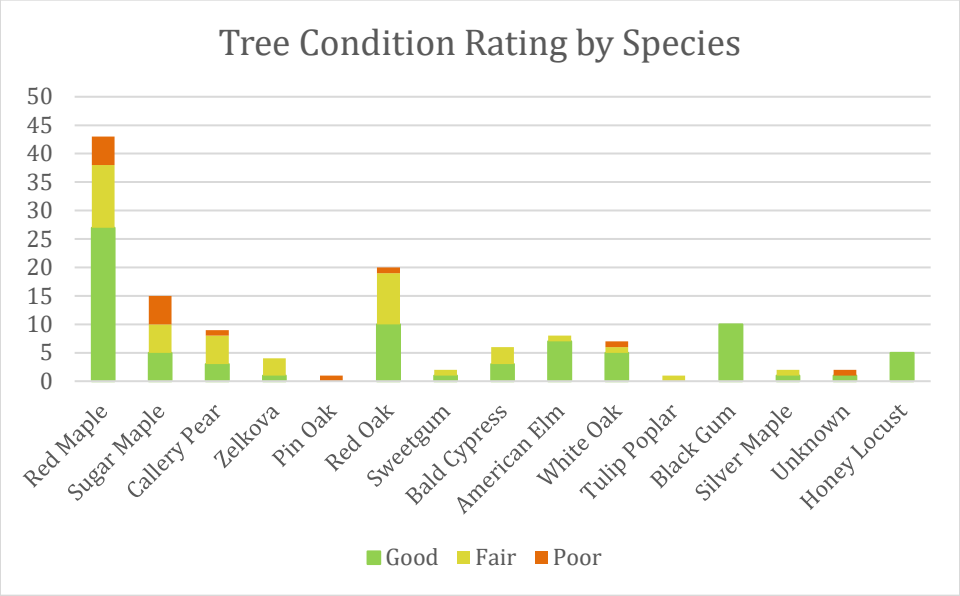


Figure 3-Tree condition by species

are even in poor condition. Since this is one of the most common newly planted trees, more care should be taken to improve their condition and ensure that they are able to survive to adulthood. Red oaks, though typically more mature than the red maples, exhibited the same problem, and to a larger extent than the red maples. In addition, there were multiple instances of encircling roots, which should be examined and treated in order to prevent tree death. There were also many trees with ivy growth on the trunk and in the canopy. While this is not as damaging as some other problems, the ivy can negatively impact the tree, so affected trees should have ivy growth pruned to prevent any damage. Finally, as map A-3 (in the appendix) illustrates, many of the fair condition trees are located on Fess Ave. in the center of the neighborhood, indicating that perhaps that area has been overlooked in regards to tree care. More maintenance (and maintenance that is equal across all locations of the neighborhood) is needed in order to ensure that the trees are healthy, able to reach maturity, and to promote a sustainable population.

While the tree inventory provides insight into the overall population, it is also interesting to look at the benefits of individual trees. A red maple (the most common tree species in the neighborhood) with a DBH of 8.09 provides $60 in benefits annually, as shown in Figure 4. There are 43 red maples in the IUB historic neighborhood, resulting in benefits totaling to $2,580.

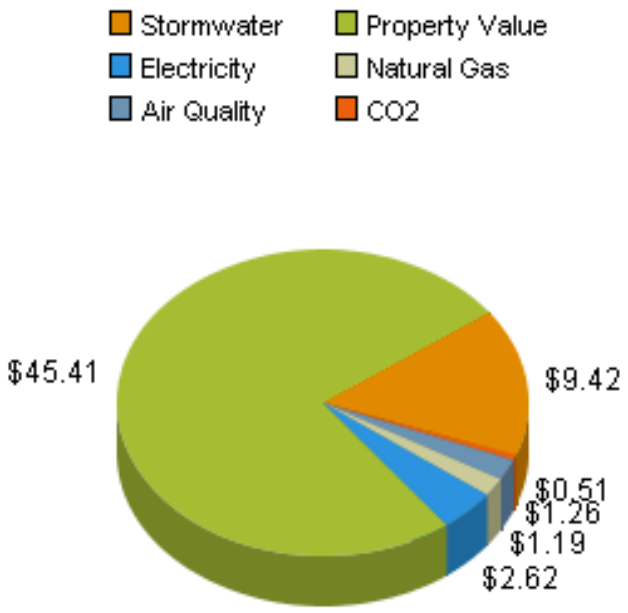


Figure 4-Annual benefits of a red maple with DBH of 8.09

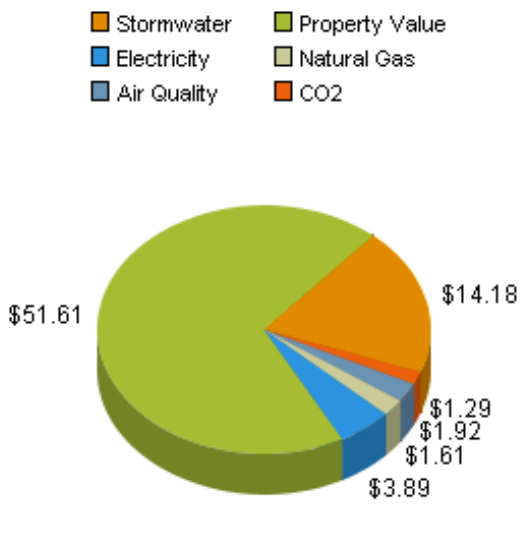


Figure 5-Annual benefits of a sugar maple with DBH of 20.8

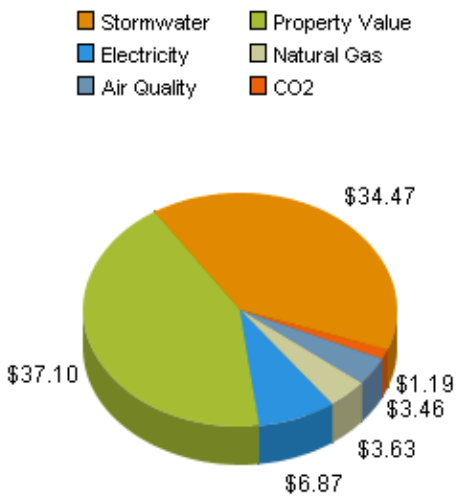


Figure 6-Annual benefits of a red oak with DBH of 10.1

The average DBH for red oaks (the second most common tree species) in the neighborhood was 10.10 inches. The annual benefits provided by a red oak of this size are $74, as shown in Figure 5. There are 20 red oaks in the neighborhood, so in total they provide $1,480 in annual benefits.

The average DBH of a sugar maple (the third most common tree species) in the neighborhood was 20.8 inches, which provides $87 in benefits annually, as shown in Figure 6. The fifteen sugar maples present in the neighborhood provide $1,305 in benefits annually. For all three of these species, the bulk of the benefits come from increased property values, with stormwater benefits accounting for the next largest benefit type.

Conclusion and Recommendations

The IUB historic neighborhood has many street trees in good condition overall. There are quite a few trees, however, that require maintenance and some trees that may need to be

removed. The age distribution of the street trees is well dispersed, but maintenance of the young trees is needed for the canopy to be sustained.

In order to maintain the street tree canopy, we recommend that the city forester utilize the ample planting sites in the neighborhood in order to increase species diversity. The sites are mostly small, with a few medium sized planting sites scattered throughout the neighborhood. The City of Bloomington Tree Care Manual provides examples of trees that are a good fit for the city and would help increase diversity in the neighborhood. Some of the possible options for small trees include the Allegheny Serviceberry or Washington Hawthorn. Options for medium sized trees include American Hophornbeam and Yellowwood. Whatever the choice, the most important part is that diversity in the neighborhood increases.

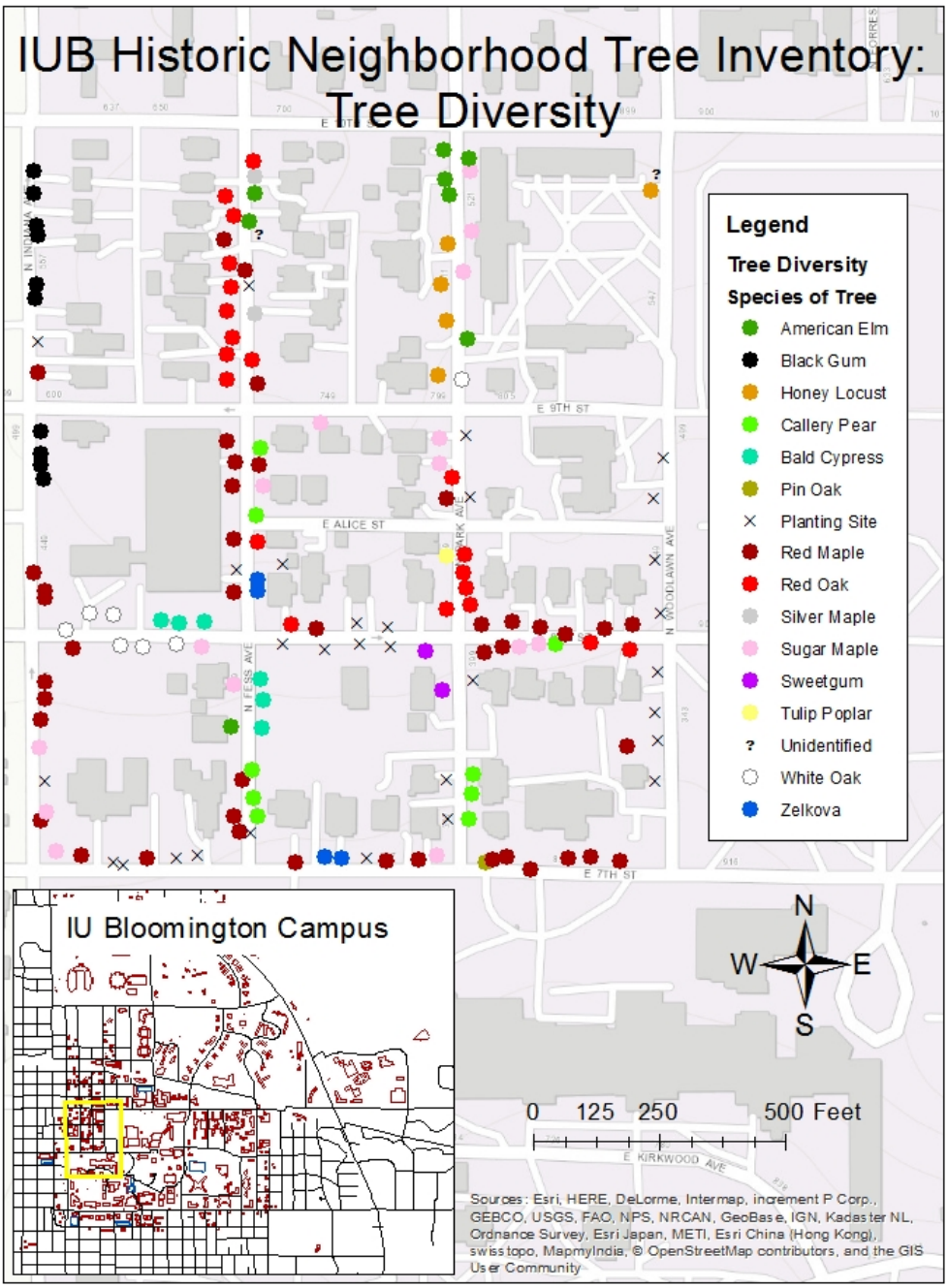
It is also recommended that a professional arborist examine the trees for maintenance needs, as many trees had encircling roots and pruning needs. Proper care of the neighborhood trees will help to ensure the sustainability of its canopy. Furthermore, there are some trees that should be removed, including a large pin oak on Fess Avenue and a large white oak on 8th Street. Both trees have many large, dead branches and could be a liability if they break. There are also some small red maples off of 8th Street and sugar maples on 7th Street that are nearly dead. Because of their size, they are not, however, an immediate priority for removal.

Works Cited

"University Courts Historic District." *The City of Bloomington*. City of Bloomington, Indiana, 19 Mar. 2014. <https://bloomington.in.gov/historic-districts/university-courts>.

Appendix

A-1


IUB Historic Neighborhood Tree Inventory: Tree Diversity
Legend
Tree Diversity
Species of Tree
American Elm
Black Gum
Honey Locust
Callery Pear
Bald Cypress
Pin Oak
Planting Site
Red Maple
Red Oak
Silver Maple
Sugar Maple
Sweetgum
Tulip Poplar
Unidentified
White Oak
Zelkova
E 9TH ST
E ALICE ST
E 7TH ST
E KIRKWOOD AVE
N FESS AVE
N WOODLAWN AVE
IU Bloomington Campus
N
W
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0 125 250 500 Feet
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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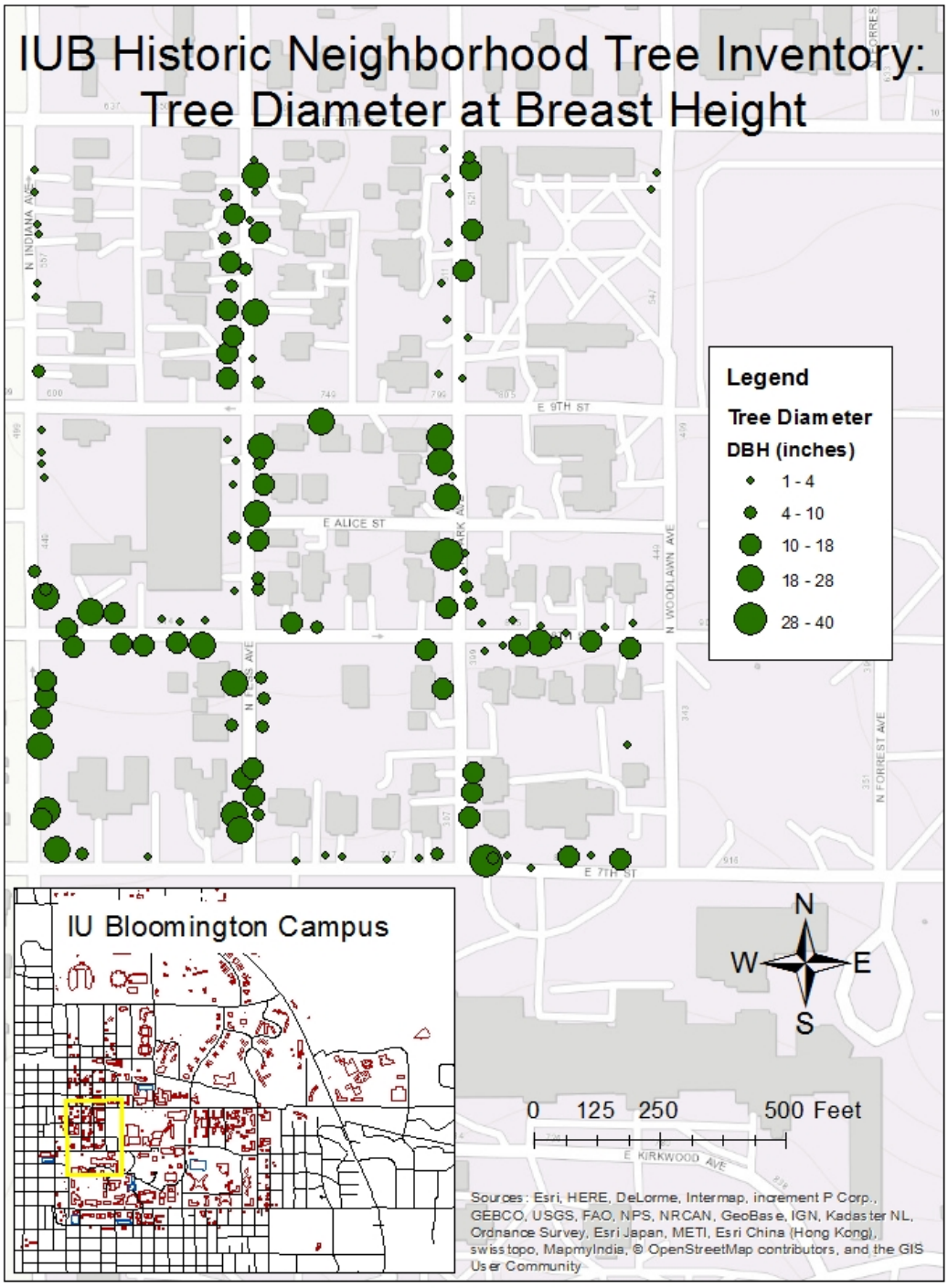
IUB Historic Neighborhood Tree Inventory:
Tree Diameter at Breast Height
Legend
Tree Diameter
DBH (inches)
1 - 4
4 - 10
10 - 18
18 - 28
28 - 40
E 9TH ST
E ALICE ST
E 7TH ST
N INDIANA AVE
N WOODLAWN AVE
N FORREST AVE
IU Bloomington Campus
N
W
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S
0 125 250 500 Feet
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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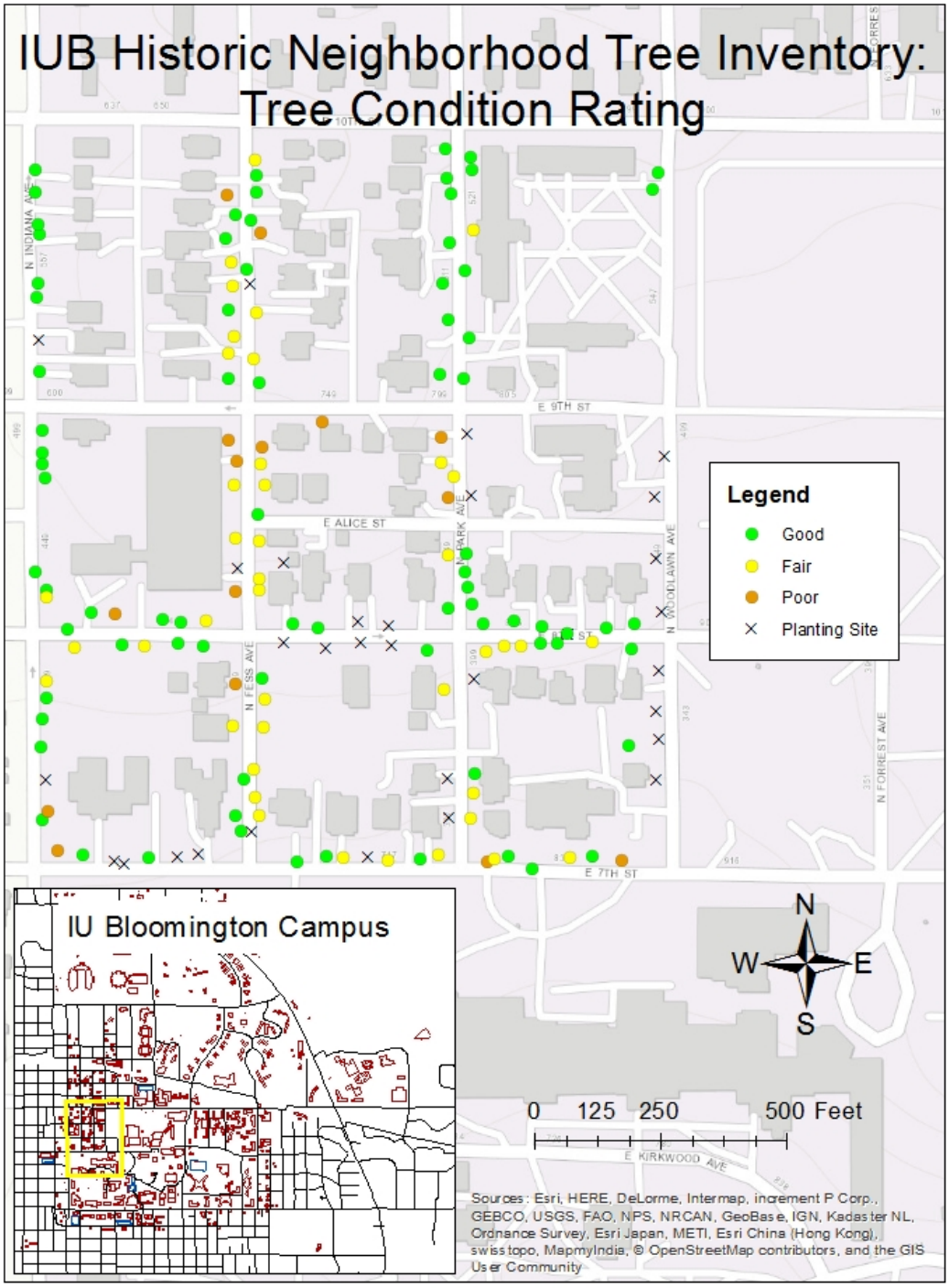
IUB Historic Neighborhood Tree Inventory:
Tree Condition Rating
Legend
Good
Fair
Poor
Planting Site
E 9TH ST
E ALICE ST
E 7TH ST
N INDIANA AVE
N FESS AVE
N WOODLAWN AVE
N FORREST AVE
E KIRKWOOD AVE
IU Bloomington Campus
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0 125 250 500 Feet
Sources: Esri, HERE, DeLorme, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community