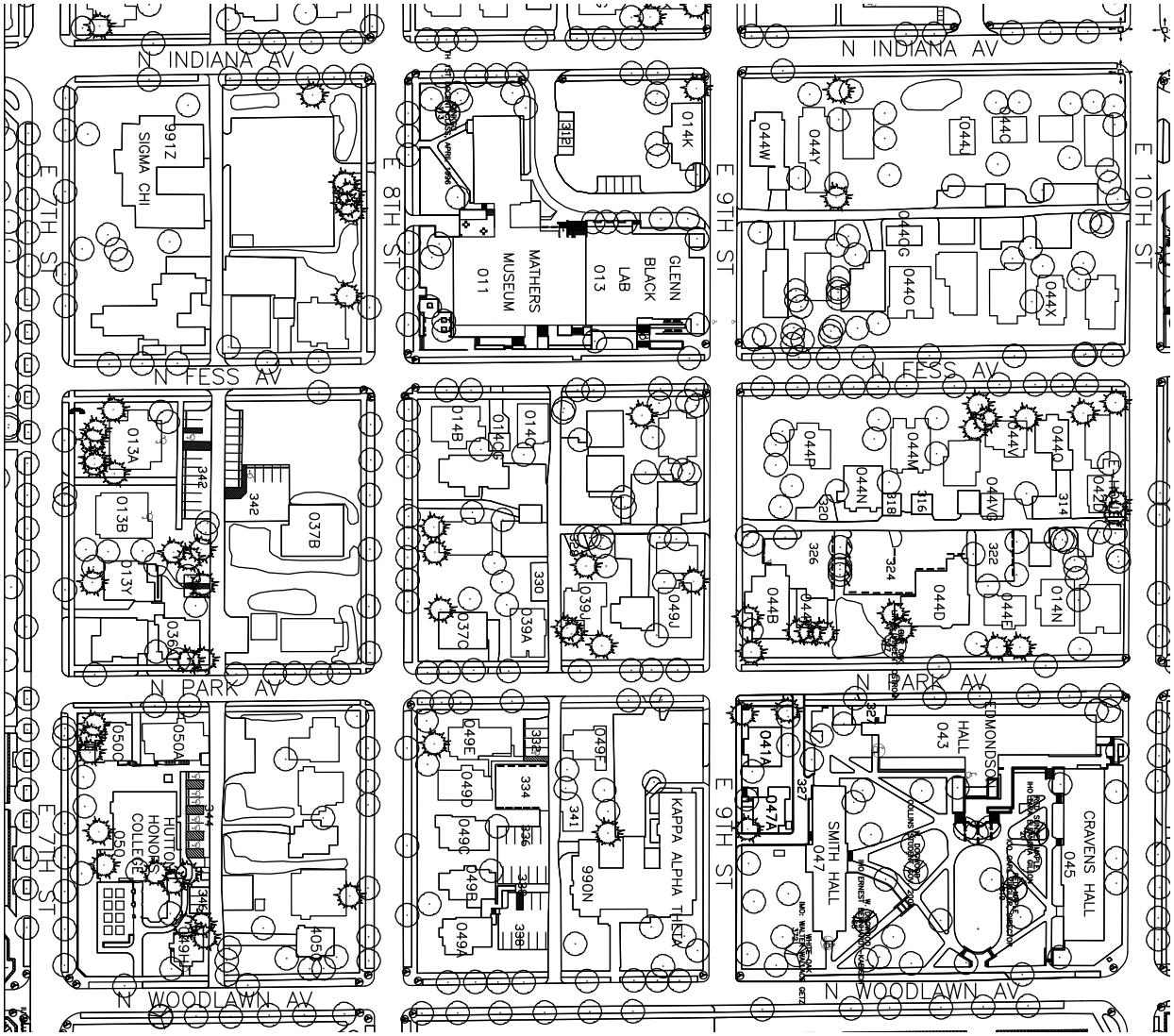

University Courts Street Trees: Maintaining Neighborhood Character and Achieving Urban Forest Sustainability in the Face of Future Disturbances

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INDIANA UNIVERSITY SPEA

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SPEA-E522, Professor Burnell Fischer, Spring 2014

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Introduction & Historical Background

In the Spring of 2014, graduate students in the Urban Forest Management class at Indiana University's School of Public and Environmental Affairs, led by Professor Burnell Fischer, conducted a case study of the urban forest in the University Courts neighborhood, an area largely owned by Indiana University. The University Courts neighborhood is comprised of nine city blocks extending from 7th Street to 10th Street between Indiana Avenue to the west and Woodlawn Avenue to the east (Figure 1). Planned development in the neighborhood, including the replacement of six historic homes with a new building, provided the trigger for the study.

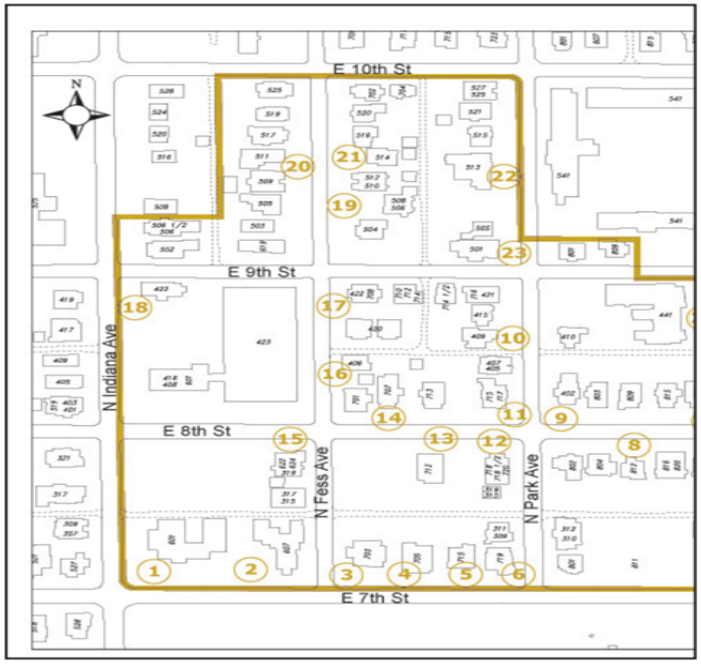

Figure 1. A map of the University Courts Neighborhood. Image from A Walk Through the University Courts, a document produced by the City of Bloomington Housing and Neighborhood Development office, retrieved 6 May 2014, available: http://bloomington.in.gov/media/media/application/pdf/12570.pdf.

University Courts has undergone periods of development and redevelopment since the arrival of Indiana University to its current location in the late 1800s. It is a designated historic district and is home to the only brick-paved streets remaining in Bloomington (Bunn 2014). The neighborhood is comprised of many historic houses, duplexes, apartments, fraternities, sororities,

and Indiana University offices constructed with brick or limestone and topped with slate or clay tile roofs. The neighborhood's early development was shaped by notable architects like John Lincoln Nichols, who was the first architect from Bloomington, (John L. Nichols House, 2013; John Nichols, 2014) (1859-1929), and Alfred Grindle (1863-1940), originally from England (https://bloomington.in.gov/documents/viewDocument.php?document_id=3320, City of Bloomington 1988).

Architectural styles of this area are Colonial Revival (707 East 8th Street), Georgian Revival (607 East 7th Street), Tudor Revival (715 East 7th Street), Mission/Spanish Colonial Revival (719 East 7th Street), Bungalow/Craftsman (712 East 8th Street), and Prairie (825 East 8th Street). In the 1960s some of the houses were demolished, and their lands were used to build new offices for Indiana University (https://bloomington.in.gov/documents/viewDocument.php?document_id=3320, City of Bloomington 1988).

The district has a history of serving as home to Greek letter organizations. The first building in the neighborhood, built by John L. Nichols in 1906, serves fraternity Sigma Chi. Burns & James' 1931 sorority house still houses Kappa Alpha Theta today. Two other Greek houses once resided in University Courts but have been lost, one to fire and one to University development (University Courts Historic District 2013).

Impending University development has the potential to disrupt both the character of the neighborhood and the neighborhood's trees. The University has plans to displace the Phi Gamma Delta fraternity and give them permission to build a new chapter house in University Courts, requiring the demolition of six houses, including historically significant ones at 402 North Park, and 803, 809, 815, and 825 East 8th Street (Figure 2) (Bunn 2014,

http://bloomingtonthenandnow.wordpress.com/2013/08/27/historic-preservation-committee-asks-iu-to-reverse-demolition-plans-for-university-courts-houses/). The University also plans to extend Woodlawn, a major infrastructure project that will likely affect the stretch of Woodlawn in University Courts (Indiana University 2009). These future disturbances provide an opportunity to assess the neighborhood's street trees and recommend strategies for maintenance and improvement of the University Courts urban forest.

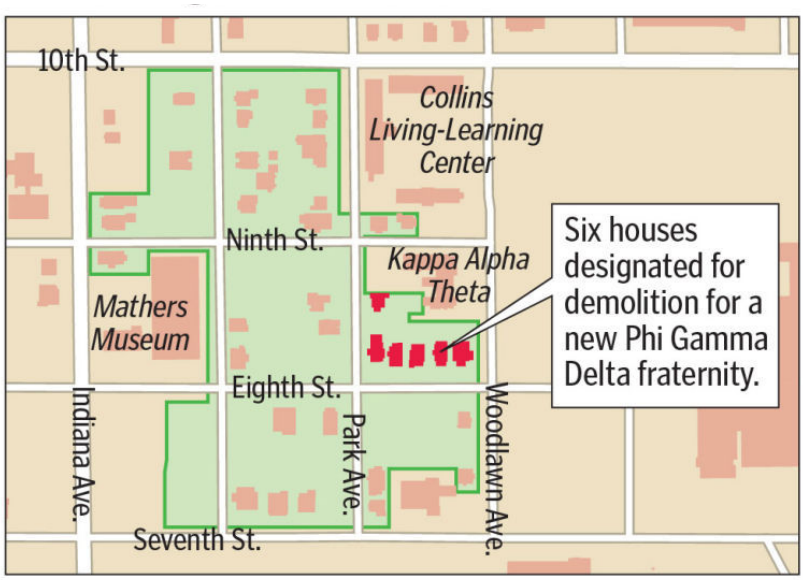

Figure 2. A map showing the houses that will be demolished to allow the construction of the fraternity house in University Courts, Image by Stewart Moon, from the Herald-Times Online, retrieved 6 May 2014, available: http://www.heraldtimesonline.com/news/local/university-courts-historic-district-approved/article_6dfbc716-e49d-5bb1-b2b4-dda0e5eee6c6.html?mode=image&photo=0.

Inventory & Data Analysis

An inventory of all trees and planting sites in the University Courts neighborhood was conducted by Urban Forest Management undergraduate and graduate students on April 1, 2014. This data provides useful insights that speak to the character of the urban forest and inform strategies for promoting a robust, resilient urban forest in the neighborhood.

Tree Prevalence and Presence

The University Courts neighborhood boasts 151 trees in with 50 planting sites available. The proportion of available planting sites and filled tree spaces is 25% and 75%, respectively, of the total planting sites in the University Courts Neighborhood (Figure 3).

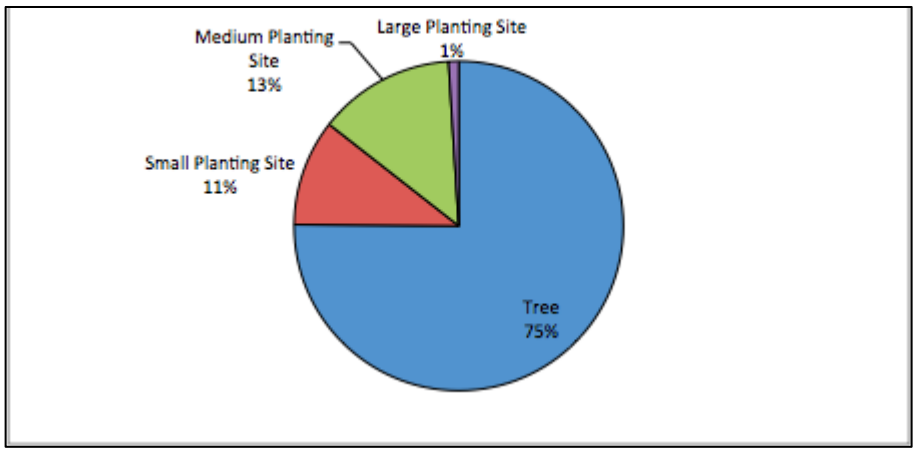

Figure 3. Available and filled planting sites in University Courts.

With 75% of all planting sites currently occupied by a tree, the University Courts neighborhood's proportion of filled tree sites is representative of the entire City of Bloomington's urban forest (Fischer et al. 2007).

The distribution of street trees in University Courts is quite uneven in both tree presence and planting site availability (Figure 4).

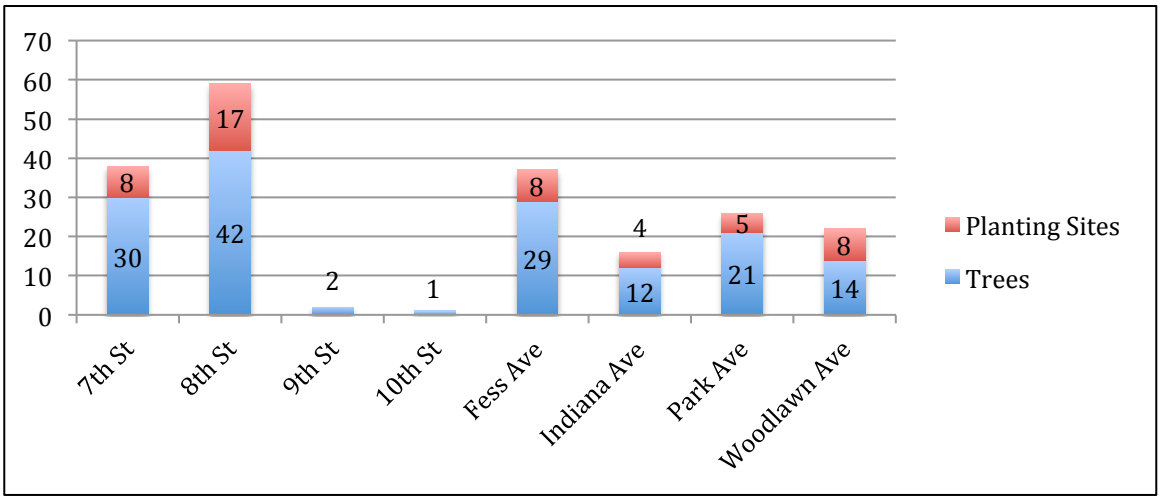

Figure 4. Distribution of Trees and Planting Sites by Street in University Courts Neighborhood, 2014.

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With almost no room for any trees on 9th and 10th Streets, the majority of trees and planting sites are located on the remaining streets. Eighth Street leads in both existing trees and available spaces, while 7th Street, Fess Avenue, and Woodlawn Avenue also present substantial planting opportunities. Indiana University plans to extend Woodlawn Avenue all the way north to the State Road 45/46 Bypass, meaning the existing street will likely undergo a facelift as the University strives to make its path "a ceremonial pedestrian walk" (Indiana University 2009). While there is plenty of room for tree plantings in the University Courts neighborhood, aesthetic improvement projects need to take into consideration the sustainability of such projects to achieve maximum impact and benefits.

Sustainability of Existing Street Trees: Species Diversity and Size Distribution

Sustainability of an urban forest can be defined as the ability of the urban forest to continue to provide benefits in time and space that outweigh the costs associated with growing and maintaining the urban forest (Clark et al. 1997). While it is difficult to fully assess the total sustainability of the urban forest in a neighborhood, primarily because costs and benefits often cannot be valued precisely or objectively, some measures can inform the ability of an urban forest to exist, thrive, and grow into the future. Measurements taken during the spring 2014 University Courts neighborhood street tree inventory, including size class and tree species, can show the resilience of the urban forest in the face of potential future threats and normal urban tree mortality.

Species diversity is an important indicator of an urban forest's ability to sustain itself despite threats such as pests or diseases. Because pests and diseases typically specialize in attacking only a specific type of tree (e.g., Emerald Ash Borer and the Chestnut Blight), a good defense mechanism for maintaining overall forest health is species diversity. Although not

supported by a body of research, two widely accepted rules are applied to desirable levels of species diversity. The first is the "10% rule;" one species should not constitute more than 10% of the urban forest. The second rule, the "10%-20%-30% rule," expands on that idea and states that urban forest should be made up of no more than 10% of a single species, 20% of a single genus, and 30% of a single family. Analyzing the diversity of the University Courts neighborhood trees with respect to these rules presents some cause for concern and necessitates appropriate future planning if promoting a resilient urban forest is a desired outcome (Figures 5-7).

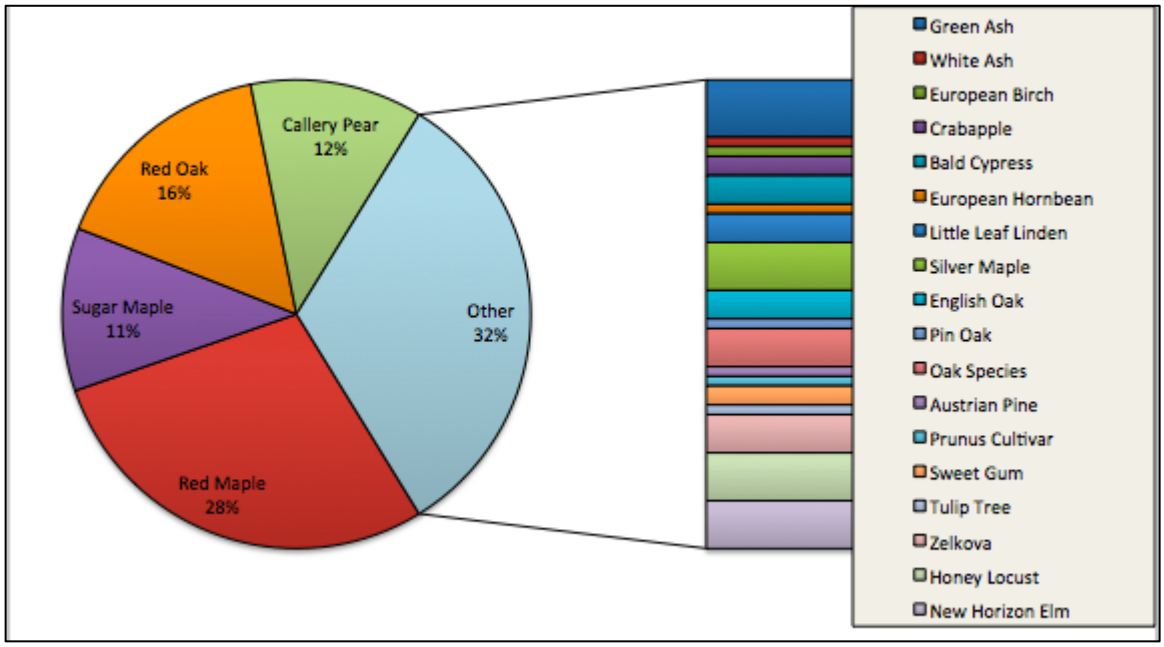

Figure 5. Street Tree Species Diversity in University Courts, 2014.

The species representation in the University Courts neighborhood shows that 4 species each constitute more than 10% of the total trees (Figure 5). Red maples (*Acer rubrum*) make up almost one-third (28%) of all trees in this neighborhood, while red oaks (*Quercus rubra*), Callery pears (*Pyrus calleryana*), and sugar maples (*Acer saccharum*) make up more than a third of all trees (16%, 12%, 11% respectively, for a total of 39%). These four species dominate the neighborhood, amounting to two-thirds of all street trees in University Courts.

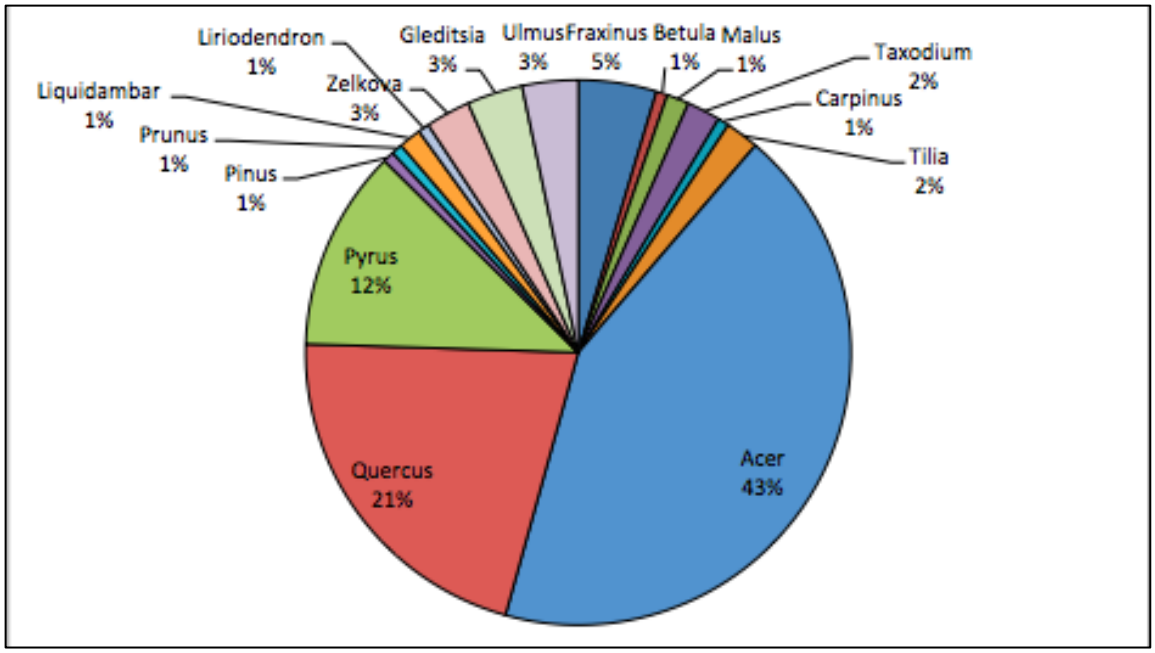

Figure 6. Street Tree Genus Diversity in University Courts, 2014.

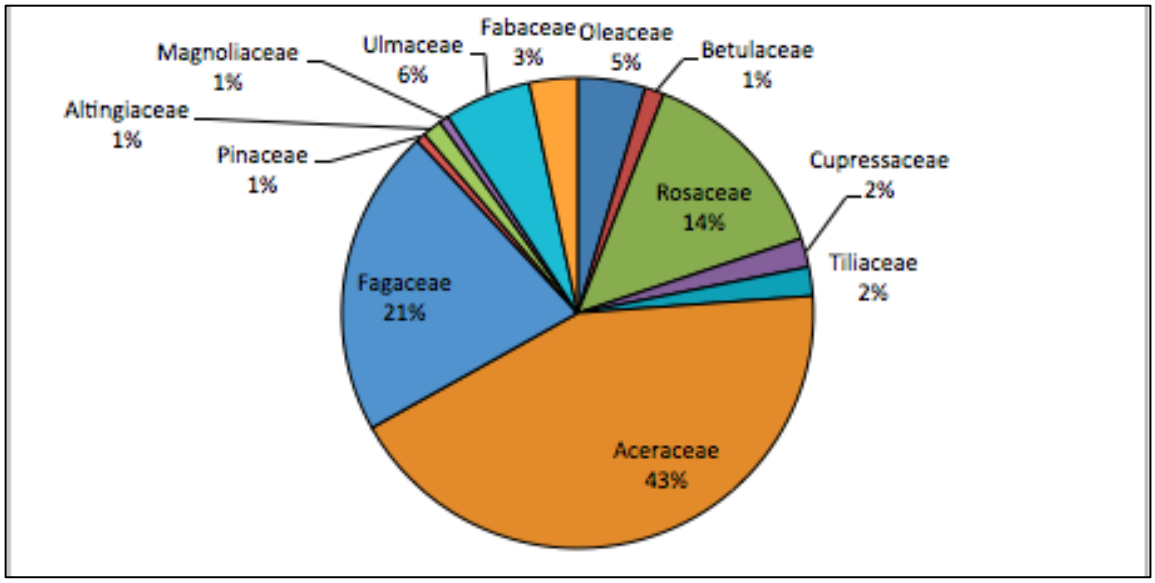

Figure 7. Street Tree Family Diversity in University Courts, 2014.

Both genus and family analyses show an overrepresentation of maples (Acer genus and Aceraceae family) and oaks (Quercus genus and Fagaceae family) (Figures 6 and 7). Maple species account for nearly half of all trees (43%) and oaks make up just over one-fifth (21%) of all street trees (Figures 6 and 7). A disturbance such as the arrival and spread of an oak-specific

or maple-specific pest or disease could significantly affect the health and/or presence of a significant portion of University Courts' urban forest. Results from analysis in light of these rules of thumb indicate that future plantings in University Courts exclude maples, oaks, and Callery pears so that the urban forest transitions to a resilient, diverse group of trees not dominated by any single species, genus, or family.

Size class or age distribution provide indications of an urban forest's ability to survive and grow as larger, older trees reach senescence and must be removed. Ideally the distribution is skewed toward smaller, or younger, trees so that there is a sufficient stream of trees to replace future losses.

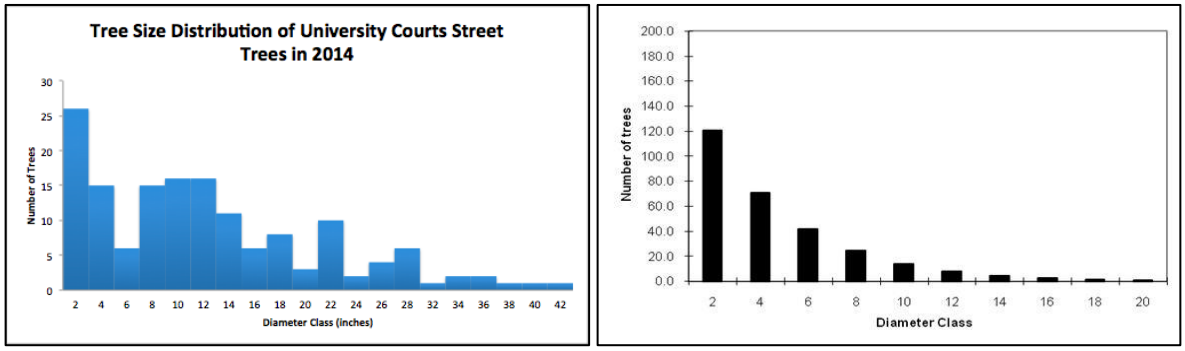

Figure 8. The current size class distribution of University Courts street trees alongside an ideal distribution in a sustainable urban forest.

The size class distribution of University Courts street trees shows a large influx of smaller trees that will grow and replace the larger trees as they die (Figure 8). This distribution represents a real-world healthily diverse forest that is sustainable as long as sufficient plantings of small trees occur periodically into the future.

Community Survey

A survey titled "Attitudes toward trees in the University Courts neighborhood" was conducted in order to better understand community values about the urban forest in University

Courts; the results are included in Appendix B. The survey attempted to discover more about people's perceptions and feelings regarding the trees and their relationship to the neighborhood. The survey was circulated by email using the free version of SurveyMonkey.com software. A notable caveat is that the survey was intended only to gain a broader understanding about perceptions of the community about trees and their neighborhood, not to generate a dataset that would be used for statistical analysis.

Survey Design and Methodology

A set of ten questions was developed for investigating different issues regarding attitudes toward trees, such as their perceived benefits and costs, the relationship of trees to neighborhood aesthetics, and attitudes toward the proposed construction of a fraternity house in the neighborhood. In addition, respondents were indirectly asked about their familiarity with the neighborhood through questions about the length of time they had worked there and the distance that they regularly walk or jog in the neighborhood.

The target population was divided into two groups: residents and people who work in the neighborhood. The research team considered that knowing some history about the neighborhood, as well as being familiar with its streets and developments, were two relevant qualities that survey respondents should have. Meeting these requirements turned out to be challenging considering that the majority of residents are temporary (most of them are IU students), hence the research team decided to survey only the people who work in the neighborhood. The decision responded to the expectation that this group would tend to be more stable in time, increasing the likelihood they would know the history and characteristics of the neighborhood.

The research team identified 97 persons working in the neighborhood and an additional 15 people whose work is regularly related to offices at University Courts. Since the survey

software has a limit of 100 respondents, the survey was sent to all 97 people working in the University Courts neighborhood plus 3 people of the second group. Thirty-seven responses were collected over the survey's open period spanning 12 days. Respondents were informed about the confidentiality of their responses, and they were not asked for any personal information.

It is important to acknowledge potential biases on the outcome of the survey. The first and most important is that responses reflect the view of a minority of people who live or work in the neighborhood, so it likely does not reflect the view of a larger community. The second potential bias is that respondents are likely disproportionately more interested in trees than those that did not respond, as this targeted interest provided a greater incentive to participate. This would reflect a more favorable attitude toward trees than may exist in reality. Finally, the age range of respondents is expected to be higher than an entirely inclusive survey because workers in the neighborhood are likely older than many of the student residents. The survey may fail to reflect the perception of the trees and neighborhood across different ages and stages of life.

Results

The responses from the survey provide insight into the University Courts community's attitudes toward trees and their neighborhood. Because the vast majority of respondents affirmed that trees make the appearance of the neighborhood nice or very nice, there is evidence of a strong relationship between the importance of trees for scenic beauty and the aesthetics of the University Courts neighborhood (Figure 9). Overall, respondents considered ecosystem services and shading the main benefits of trees in the University Courts historic district (Figure 9).

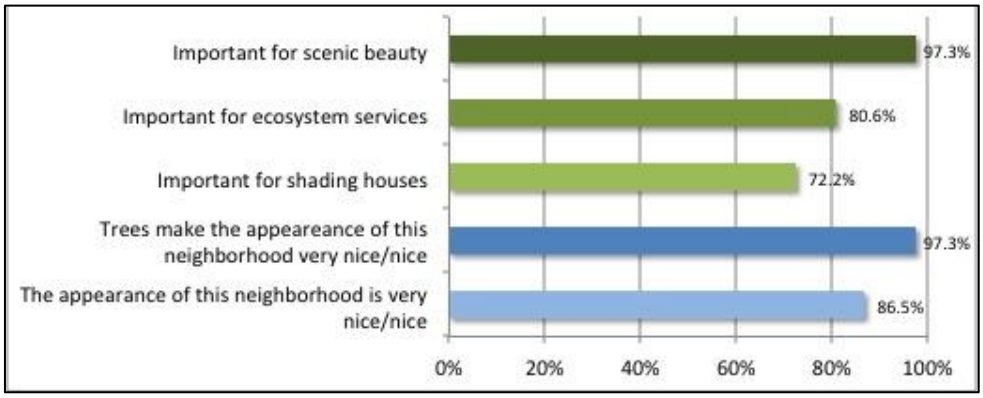

Figure 9. Community perception about trees and the University Courts neighborhood.

Respondents considered negative aspects of trees, such as costs of maintenance or messiness, less important than benefits (Figure 10). The responses to both questions about the benefits of trees and the negative aspects of trees in the University Courts neighborhood show a clear positive attitude toward trees.

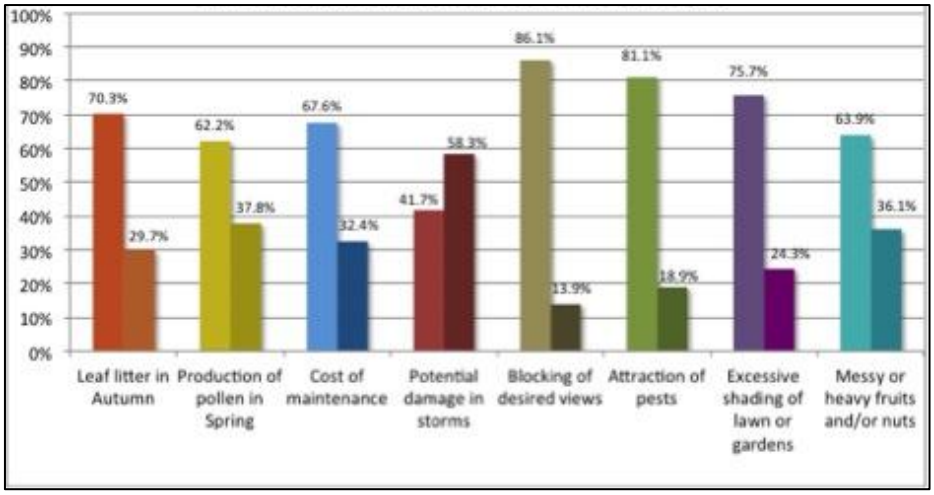

Figure 10. Community perception of negative aspects of trees. Not Important | Somewhat or Very Important.

The proposed construction of a fraternity house in the University Courts neighborhood triggered, in part, this study, and the survey aimed to learn what the community felt about the proposal. The responses show a clear negative opinion (Figure 11).

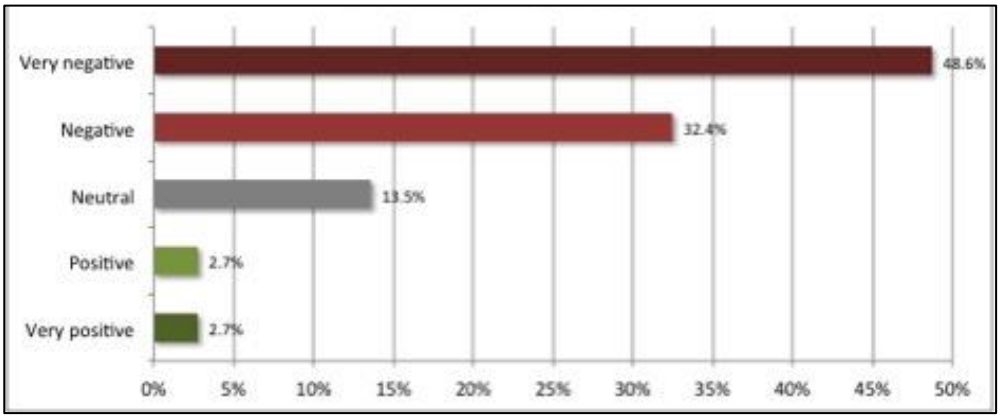

Figure 11. Attitudes toward the construction of a new fraternity house in the University Courts neighborhood.

The respondents also made a strong statement about having more trees in the neighborhood once the fraternity house has been built (Figure 12).

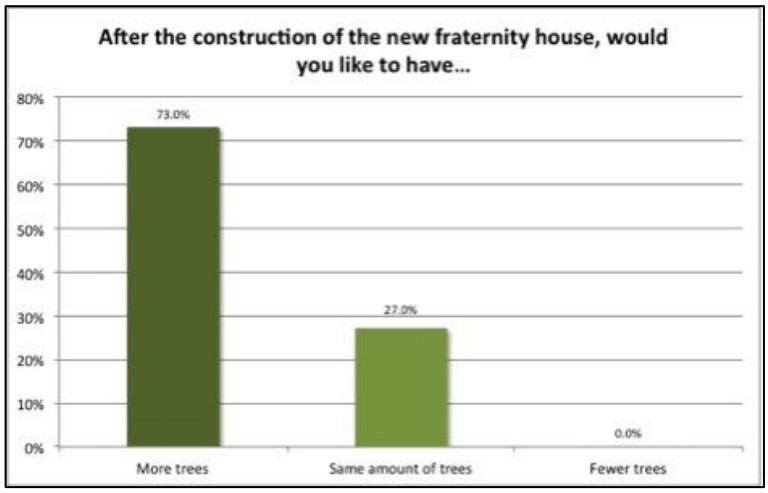

Figure 12. Community demand for trees following construction of the new fraternity house.

The survey included a question about whether respondents would be willing to participate in a hypothetical "tree-tender" program in the neighborhood to gauge interest in tree stewardship. About 70% of respondents stated that they would participate by planting trees, 64% would water trees, and more than 85% would be willing to monitor and report about the conditions of trees near their offices.

Finally, respondents were given the opportunity to provide details about any special trees in the neighborhood. The following responses were received:

1. Gingko tree near the Mather´s Museum and in front of the Tri-Delta house (3 comments).
2. The Ostrom tree in front of the Ostrom Workshop (2 comments).
3. Sycamore 7th and Park (1 comment).
4. Crabapples at 506 N. Fess and 512 N. Fess (1 comment).
5. Bradford pears at the Mathers Museum (1 comment).
6. Flowering trees (magnolia, redwood, and dogwood) (1 comment).
7. Japanese maple at the Mathers Museum (1 comment).

Conclusion: Master Street Tree Plan and Recommendations

The results from the University Courts tree inventory and the survey shaped the Master Street Tree Plan for the University Courts Historic District and provided support for the recommendations to the City of Bloomington. The Master Street Tree Plan (available in full in Appendix I) identifies the Mission Statement, Goals and Objectives, and Key Principles and Policies for the City of Bloomington regarding public trees and their relationship with people in the University Courts neighborhood.

Future disturbances, such as the construction of the Phi Gamma Delta fraternity, as well as survey results indicating a desire for more trees in the neighborhood, are the basis for the Master Street Tree Plan Mission Statement:

> "*The University Courts Street Tree Master Plan is a reasonable, responsible, and necessary way to make the neighborhood more aesthetically pleasing and to reduce tree-related problems*."

This mission is achieved through various goals and objectives developed from the results of the study. These include ensuring all open planting spots are planted, ensuring diversity of species is emphasized during tree selection, and ensuring the protection and preservation of existing street trees throughout various construction projects.

The Master Street Tree Plan for University Courts also addresses safety and health of the street trees. This study shows a healthy age class distribution for the existing trees. However, structural damage to the trees as they age, from disease or human activities, is a real concern for the University Courts neighborhood. Therefore, the Master Street Tree Plan: Key Principles and Policies delegate responsibility to the city forester to maintain the street trees in University Courts.

The provisions of the Master Street Tree Plan for the University Courts Historic District were designed with the results of this study in mind. Therefore, in order to preserve the historic character of the neighborhood, improve street tree health, and respond to faculty and students' desires for an increase in street trees, the main recommendations for the City of Bloomington are to plant all the remaining open planting spaces and to diversify tree species by reducing the proportion of maples, red oaks, and Callery pear trees. The guidance of the Master Street Tree Plan will ensure that University Courts benefits from the preservation and addition of street trees despite the construction projects to come.

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Appendix I

Master Street Tree Plan - University Courts Historic District

Mission Statement

The City of Bloomington has a legal and moral obligation to maintain healthy and safe trees on municipal land and public streets. The University Courts Street Tree Master Plan is a reasonable, responsible, and necessary way to make the neighborhood more aesthetically pleasing and to reduce tree-related problems.

Goals and Objectives

- To provide for the continuation of the existing street trees in University Courts and preserve the historic character of the neighborhood.
- To provide for planting and maintenance of a well-shaded streetscape.
- To preserve the existing tree canopy as much as possible during construction by designating tree preservation areas at the beginning of construction projects.
- To ensure diversity of tree species throughout the historic district as a key to ensuring the overall health of the urban forest.
- To ensure that each planting space in the neighborhood is planted, unless conditions prohibit doing so.

Key Principles and Policies

- It is the policy of the Bloomington Parks and Recreation Department that the city will have tree-lined streets. Therefore, each available planting space in the neighborhood will be planted.
- A street tree will only be removed and replaced if it is dead or dying, or it develops structural defects that can lead to failure of the whole tree or large portions of the tree.
- Street trees in University Courts are maintained under the provisions of the Bloomington Tree Ordinance as administered by the city forester.
- The goal of the Master Street Tree Plan is to preserve the historic nature of the University Courts neighborhood by preventing tree removal during construction projects. Another objective is to diversify tree species within the neighborhood.

Recommendations

- Plant in all remaining open planting spaces (25% of spaces in neighborhood)
- Diversify the species as much as possible by planting fewer oaks and maples

The City of Bloomington is committed to maintaining healthy and safe trees on municipal lands and public streets, and it is the mission of the Urban Forestry Program to provide a sustained, long term, and stable urban forest. The role of municipal forestry requires constant review and analysis, planning, protection, management, safety, and care, with emphasis on improving the quantity and quality of our trees. The Master Street Tree Plan is a key effort in this mission and the overall responsibility to care for city trees. It also is a necessary, proactive way to reduce adverse effects on trees during construction and other tree-related problems and preserve the historic character of University Courts.

For more information, contact the Bloomington Urban Forestry Program or the University Landscape Architecture department.

Appendix II: Survey and Results

1. How long have you worked in the University Courts neighborhood?

	Freq.	%
0 - 2 years	6	16.7%
3 - 5 years	5	13.9%
6 - 10 years	11	30.6%
11 - 20 years	5	13.9%
More than 20 years	9	25.0%
Total	36	100.0%

2. Please give your opinion about the University Courts neighborhood

	What do you think of the general aesthetics of the neighborhood?		What do you think of the appearance of trees in this neighborhood?	
	Freq.	%	Freq.	%
Very nice	15	40.5%	19	51.4%
Nice	17	45.9%	17	45.9%
Neutral	4	10.8%	1	2.7%
Poor	1	2.7%	0	0.0%
Very poor	0	0.0%	0	0.0%
Total	37	100.0%	37	100.0%

3. How important are the following potential benefits of trees in the neighborhood?

	Very important		Somewhat important		Not important	
	Freq	%	Freq	%	Freq	%
Aesthetics (scenic beauty)	36	97.3%	1	2.7%	0	0.0%
Increased property value	16	44.4%	13	36.1%	7	19.4%
Shade for yard	23	63.9%	12	33.3%	1	2.8%
Shade for house	26	72.2%	9	25.0%	1	2.8%
Fruits and/or nuts (for human consumption)	2	5.7%	16	45.7%	17	48.6%
Obstruction of unattractive views	14	38.9%	15	41.7%	7	19.4%
Creation of private space or border for property	14	37.8%	18	48.6%	5	13.5%
Habitat for animals	23	62.2%	13	35.1%	1	2.7%
Ecosystem services	29	80.6%	7	19.4%	0	0.0%

4. We also want to know if there are things you do not like about trees in the neighborhood. How significant are the following potential disadvantages of trees?

	Very important		Somewhat important		Not important	
	Freq	%	Freq	%	Freq	%
Leaf litter in Autumn	1	2.7%	10	27.0%	26	70.3%
Production of pollen in Spring	5	13.5%	9	24.3%	23	62.2%
Cost of maintenance	1	2.7%	11	29.7%	25	67.6%
Potential damage in storms	4	11.1%	17	47.2%	15	41.7%
Blocking of desired views	2	5.6%	3	8.3%	31	86.1%
Attraction of pests	1	2.7%	6	16.2%	30	81.1%
Excessive shading of lawn or gardens	0	0.0%	9	24.3%	28	75.7%
Messy or heavy fruits and/or nuts	0	0.0%	13	36.1%	23	63.9%

5. There are plans for building a new fraternity house in University Courts. How are your feelings toward this proposed construction of a new fraternity house?

	Freq	%
Very positive	1	2.7%
Positive	1	2.7%
Neutral	5	13.5%
Negative	12	32.4%
Very negative	18	48.6%

6. After the construction of the new fraternity house, would you like to have…

	Freq	%
More trees	27	73.0%
Same amount of trees	10	27.0%
Fewer trees	0	0.0%
No opinion	0	0.0%

7. How many species of trees in University Courts can you identify?

	Freq	%
All of them	1	2.7%
Most of them	10	27.0%
A few of them	26	70.3%
None	0	0.0%

8. The distance that you usually walk/jog/bike in University Courts is…

	Freq
One block or less	0
2-3 blocks	10
4.5 blocks	16
More than five blocks	11

9. If there were a "tree-tender" program on campus, would you participate in the following activities?

	Yes	No
Plant trees near your office	26	11
Water trees near your office	24	13
Monitor and report about the health of trees near your office	32	5

10. If you have a favorite or special tree in University Courts neighborhood, please describe its appearance and location:

The tree that was planted at the Ostrom Workshop dedicated to the Ostroms. Not sure if it is alive still.
Bradford Pears. They are near the Mather's Museum and in front of the Tri-Delta house. I also like the purple flowering ones, but I don't know their name!
Sycamore 7th and Park-in winter especially
All the very large trees: public and private
506 N. Fess (crabapple? white flowers in spring), 512 N. Fess (pink flowers in spring)
Gingko at the Mathers Museum
The kinko tree at 8th & Indiana. The shape of its leaves is beautiful, and this tree has added meaning for me in my job.
Love our flowering trees (magnolia, redwood and dogwood).
The Ostrom tree in front of the Ostrom Workshop
The Japanese Maple and the Gingko on the SW corner of the Mathers Museum property are pretty and different so they stand out amongst all the maples and redbuds