
# 2022 Tree Planting Plan
# City of Huntington, Indiana

Prepared by:
Rae Handy, Urban Green Infrastructure Intern
McKinney Climate Fellow & ERI Resilience Cohort

Prepared for:
City of Huntington, Indiana
300 Cherry St # 101, Huntington, IN 46750

ACKNOWLEDGEMENTS

Thank you to all partners in the support of the culmination of this tree planting plan. I want to express great thanks for the support of several City of Huntington community members including Mayor Richard Strick, Amber Rensberger, Steve Yoder, Pam Pranger, and my fellow intern, Qidi Zhu.

# EXECUTIVE SUMMARY

During the summer of 2022, from May 29 through August 5, the Urban Green Infrastructure (UGI) intern for the City of Huntington, IN conducted an urban tree canopy assessment. **Urban tree canopy (UTC)** refers to the layer of tree leaves, branches, and stems that provide tree coverage of the ground when viewed from above. Improving a city's urban tree canopy can have numerous benefits, such that trees reduce heating and cooling utility costs, enhance property values, lower air temperatures, provide stormwater management, reduce water, air, and noise pollution, provide more shade, provide wildlife habitat, and boast aesthetic and community benefits with improved quality of life for Huntington residents. These tree benefits contribute to resilience planning for a more sustainable, equitable future. An urban tree canopy assessment can help a community measure, monitor, and improve tree cover over time, and combat threats that can lead to tree canopy loss. The aim of the following tree canopy assessment and resulting tree planting plan is to inform community members and decision-makers about their urban forest resources and, more specifically, the amount of tree canopy that currently exists and the amount that could exist in the future.

Tree planting priorities can be based on a range of factors, including the amount of available planting space, more equitable locations within the city, proximity to habitat corridors, and others. This report discusses the benefits of urban tree canopy coverage, its role in supporting resilient urban communities, and the importance of equitable urban tree canopy. In addition, the methodologies are outlined regarding data collection and subsequent analysis. The priority areas were determined based on the results of the urban tree canopy assessment, which was created using a weighing scheme of various factors for Huntington's community needs (including canopy coverage, floodplain, soil permeability, socioeconomic and demographic data among others). These weighting scheme variables containing certain geographical, demographic, and social data contributed to the creation of a visual priority tree planting map. The priority planting map helped in determining two priority areas within Huntington where trees can be planted. After assessing these priority sites, further tree recommendations were given in the following report.

Tree canopy data was assessed and analyzed to create the city tree planting, which provides quantifiable data to identify and prioritize environmental resilience initiatives. The purpose of this **tree planting plan** is to provide goals aligned with the Huntington community needs and values for the urban tree canopy. Setting tree canopy and tree planting goals can be used to develop community priorities that guide tree planting to carry out priority planting projects. Huntington may consider ongoing public outreach to determine community tree needs, future investments in tree education, as well as revisiting ordinances to create a new city tree ordinance. Trees are recognized as a valuable public infrastructure; therefore, funding could support the planting, maintenance, and expansion of the Huntington community's urban forest in determined priority planting areas. Future tree planting projects and tasks will help enhance the environmental quality of the city of Huntington, making it a healthier and more vibrant place to live.

# TABLE OF CONTENTS



## TABLES



## FIGURES



## APPENDICES

# INTRODUCTION & BACKGROUND

Huntington is a small town in Northern Indiana that sits alongside interstate 69 with approximately 17,000 residents. The city has pledged their dedication to sustainability and preservation in the hopes of bettering the long-term health of the community. In addition, Huntington has taken initial steps towards a more sustainable and environmentally friendly city through projects including the establishment of an arboretum at Evergreen Park, conducting flood surveys, brank stabilization projects, green space incorporation, renewable energy transitions, and decreasing food waste among others. Their goal is to understand the long-term health of the community by quantifying the wellbeing of residents and visitors to the city, economic integrity, and environmental health. The City of Huntington is dedicated to the future of their community with ongoing sustainability efforts to enhance the quality of their city.

In recent years, extreme weather events such as drought, extreme heat, and extreme precipitation have become more prevalent in Indiana (Kyuhyun and Hamlet 2018; Widhalm et al. 2018). Urban tree canopies serve as protections against these impending extreme weather events, mitigating the effect of soil erosion, flooding, and the risk of heat stress among other benefits (Widhalm et al. 2018; Wolch et al. 2014). Researchers estimate that tree canopy cover in urban areas across the U.S. averages only 27% (Dwyer and Nowak 2000). Huntington's current urban tree canopy is approximately 24% according to the most recent UTCC assessment by Davey Resource Group (DRG). The complete land cover classifications, including tree canopy, impervious and pervious surfaces, bare soil, and water for Huntington can be found in **Table 1.** and shown in **Figure 1.** Increasing canopy coverage provides health benefits and increases the resilience of the Huntington community; the incorporation of equity into a tree planting plan not only enhances the level of resilience for the community overall, but works to address communities without urban tree canopy coverage (Riley and Gardiner 2020). Studies show that urban green space distribution in lower socioeconomic communities have fewer green space amenities (Van den Bosch et al. 2016; Urban Green Spaces Report. The absence of green space recreation in low-income socioeconomic residential areas is also linked to lower physical activity and higher levels of obesity, contributing to higher mortality risks (Van den Bosch et al. 2016). Lower-income communities are typically stripped of tree benefits due to lack of urban tree canopy. By planting trees in priority areas, resilience can be established to mitigate the effects of future extreme weather events, provide tree benefits, and improve the quality of life for residents, which can help ensure economic, social, and environmental prosperity for Huntington.

The data for this assessment was provided to the City of Huntington by the Davey Resource Group and used by the McKinney Climate Fellow to produce the 2022 tree planting plan. Their partnership is essential to accomplish the city's forestry goals and increase the amount and diversity of trees in Huntington. The purpose of this planning report is to outline potential locations for tree planting within the City of Huntington to increase the community's resilience to environmental change with an emphasis on equitably growing urban tree canopy cover.

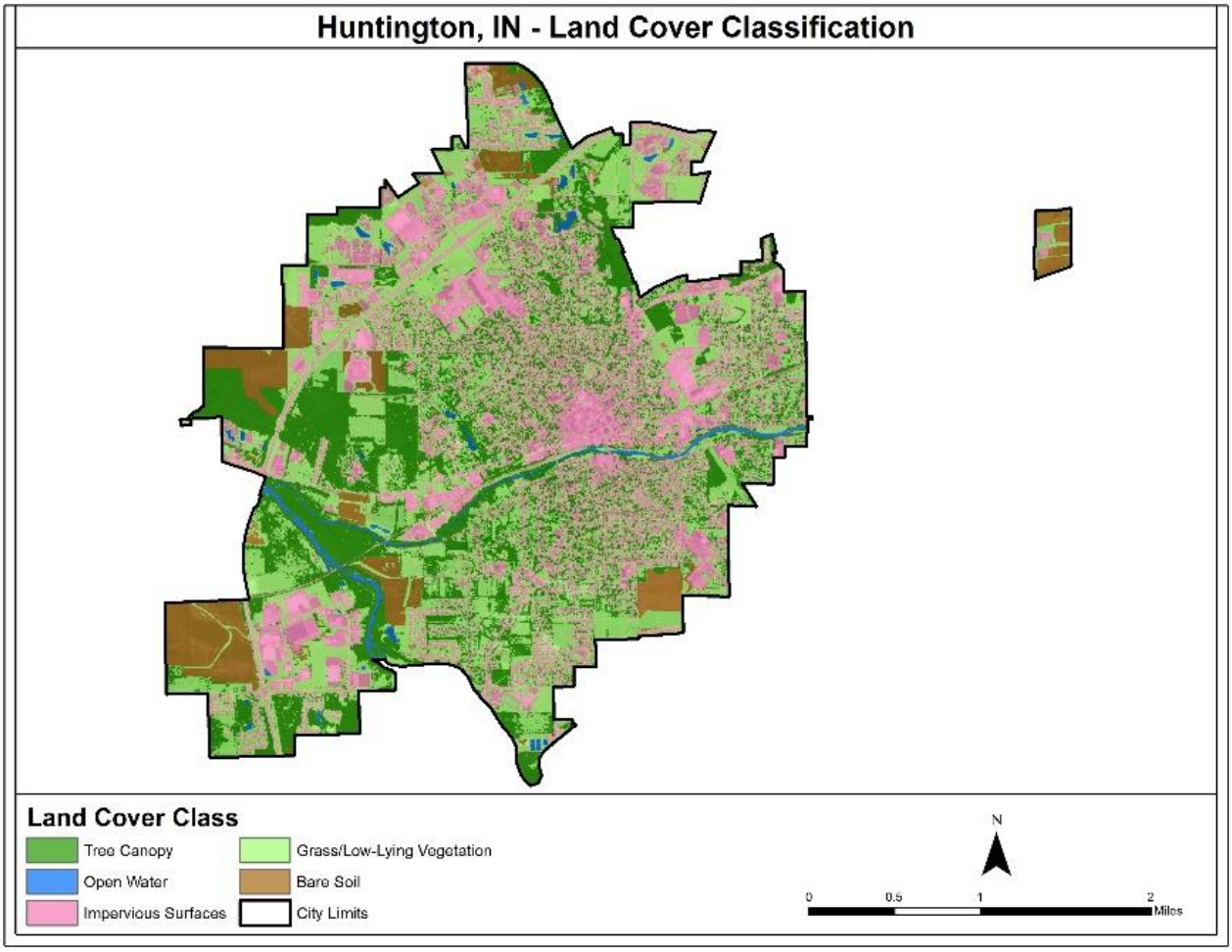



**Figure 1.** Map of the land cover type for Huntington, IN

**Table 1.** Land cover classification for Huntington, IN by acreage and percent coverage

| Land Cover Classification | Acres | Percent |
|---|---|---|
| Tree Canopy | 1,496.86 | 24.77% |
| Impervious Surfaces | 1,677.31 | 27.76% |
| Pervious Surfaces | 2,332.11 | 38.60% |
| Bare Soil | 449.24 | 7.43% |
| Open Water | 87.00 | 1.44% |

## PURPOSE

The purpose of this planning report is to assist in giving guidance on the planting, protection, and preservation of trees within Huntington, particularly, to outline locations for tree planting that increase the community's resilience to environmental change with an emphasis on equitably growing urban tree canopy cover. This plan was conducted to assess priority planting locations for Huntington using several data sources to analyze a variety of factors that can contribute to tree canopy urban community benefits. The analysis included datasets provided from DRG, the US Department of Agriculture, and US Census Bureau among others. The resulting analysis deliverable was a priority planting map, showing plantable areas in both public and private properties across the city of Huntington.

The goal of the 2022 McKinney Climate Fellowship was to identify areas of Huntington in most need of urban tree canopy coverage increase through GIS analysis and community engagement, culminating into the development of an equity-focused tree planting plan for the identification of specific planting sites. The projected outcome of this project is increased canopy cover within the city of Huntington in areas that have compounding socioeconomic factors in addition to high heat stress and lack of healthy or sufficient urban tree canopy coverage. Success of this tree planting plan looks like getting support from target communities and providing tree maintenance education for eventual ownership and care of newly planted trees in neighborhoods. The incorporation of tree education would allow Huntington residents to become environmental stewards, benefiting the community and aiding the newly planted trees in turn to grow into thriving, healthy trees. Over time, Huntington may eventually become a city with a forest.

## GLOSSARY TERMS & KEY CONCEPTS

**Adaptation:** Taking action to prepare for and adjust to both the current and projected impacts of an event. In human systems, the process of adjustment to actual or expected climate and its effects, to moderate, harm, or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects human intervention, which may facilitate adjustment to expected climate and its effects.

**Community:** A human community is a social unit with commonality such as place, norms, religion, values, customs, or identity. Communities may share a sense of place situated in a given geographical area. When referring to a tree community, a forest (community of trees) includes the overstory, or upper tree layer of the canopy, as well as the understory, a layer consisting of trees and shrubs located beneath the canopy but above the forest floor.

**Deliverable:** A deliverable is a tangible or intangible good or service produced as a result of an intentional project in the form of a report, a document, a map, or any other building block of an overall project or plan.

**Ecosystem Services:** Ecological processes or functions having monetary or non-monetary value to individuals or society at large. These are frequently classified as supporting services such as productivity or biodiversity maintenance, provisioning services such as food, regulating services such as climate regulation or carbon sequestration, and cultural services such as tourism or spiritual and aesthetic appreciation.

**Equity:** Equity refers to the principle of fairness and justness in burden-sharing and is a basis for understanding how societal impacts are distributed in and by society. Whereas **equality** means providing the same to all, equity means recognizing that we do not all start from the same place and must acknowledge and adjust imbalances. The process is ongoing, requiring us to identify and overcome intentional and unintentional barriers arising from bias or systemic structures. Equity is often aligned with fairness and justness applied to the responsibility for societal impacts and policies across diverse narratives.

**Environmental Justice:** Justice that links development and human rights to achieve the sharing of burdens and benefits and its impacts equitably and fairly. Similar to **social justice,** which is just and fair relations within society that seek to address the distribution of wealth, access to resources, opportunity, and support according to principles of justice and fairness.

**Forest Fragmentation:** Describes the emergence of discontinuities in an organism's preferred environment, causing population fragmentation and ecosystem decay; often in tandem with **habitat connectivity**, the degree to which a landscape facilitates or impedes animal movement and other ecological processes.

**Geographic Information Systems (GIS):** A geographic information system is a type of computer database system that creates, manages, analyzes, and maps all types of geographic data, which can contribute to improved visual communication and management efficiency in decision-making.

**Green Infrastructure:** The interconnected set of natural and constructed ecological systems, green spaces, and other landscape features. It also includes trees, wetlands, parks, green open spaces, original forests, grassland, and woodlands, as well as building and street-level design interventions that incorporate vegetation. Green infrastructure provides services and functions in the same way as conventional infrastructure.

**Impervious Surfaces:** A constructed surface such as sidewalks, roads, parking lots or driveways covered by water impenetrable materials such as asphalt, concrete, brick, pavers, stone and/or highly compacted soils. Impervious surfaces cannot adequately absorb heat or water as natural, pervious surfaces.

**Mitigation:** Measures taken to reduce adverse impacts, such as planting trees to reduce flooding impact, tunnels under roads to allow wildlife to pass from one side to the other and so on; mitigation can mean restoration, enhancement, creation, and preservation of natural habitats.

**Pervious Surfaces:** An area that releases as runoff a small portion of the precipitation that falls onto it; examples include greenery such as lawns, gardens, parks, forests that can absorb water and other liquids.

**Resilience:** The capacity of social, economic, and environmental systems to cope with a hazardous event, trend, or disturbance, responding in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation.

**Right-of-Way (ROW):** Public right-of-ways refer to land, property, or interest acquired for or devoted to a transportation facility. An example would be the area of lawn grass between the road and the sidewalk for tree planting.

**Sustainability:** Sustainability means meeting our own needs without compromising the ability of future generations to meet their own needs. In addition to natural resources, we also need social and economic resources in a dynamic process that guarantees the persistence of natural and human systems in an equitable manner.

**Urban Tree Canopy Cover (UTC or UTCC):** Urban tree canopy is the leafy, green, overhead cover from trees that community groups, residents, and local governments maintain in the landscape for beauty, shade, wildlife habitat, energy conservation, stormwater mitigation, and a host of public health and educational values.

**Urban Heat Island Effect:** Areas of dense impervious surfaces (pavements, buildings, and other surfaces that absorb and retain heat), typically within urban city infrastructure occur cause a warming effect with concentrated higher temperatures in these urban areas. This can cause increases in energy costs (e.g., for air conditioning), higher air pollution levels, higher risk of heat stress, and higher risk of heat-related illnesses.

## KEY ROLES AND PARTNERS

The Fellow met with local stakeholders and government officials to gain community knowledge, consult for tree expertise, receive insight about local governance expertise, and to conduct an urban tree canopy analysis. The stakeholders are as listed here:

**The McKinney Climate Fellow (MCF):** The 2022 McKinney Climate Fellow, Rae Handy, was responsible for conducting stakeholder engagement, refining the non-plantable city areas delivered by DRG, conducting GIS spatial analysis to create a priority map and determine priority planting areas, writing the tree planting plan, identifying grants, and formulating recommendations for city application.

**Local Government Contacts:** Mayor Richard Strick for the City of Huntington, Indiana worked with Ms. Handy on multiple aspects of the project, giving insight into local governance and invaluable guidance throughout the internship. Amber Rensberger and Jesse Brown, Assistant(s) to Mayor Strick, and Kevin Krauskopf, the Communications Coordinator for the City of Huntington, assisted with stakeholder identification and contact information, as well as survey dispersal. Steve Yoder, the Superintendent for Huntington Parks and Recreation served as an informational resource over the city's parks and potential planting sites, provided immense support, and helped supply additional background information as requested. Dr. Collin Hobbs, a biology professor at Huntington University, assisted with tree species insight, expertise, and recommendations, relaying knowledge regarding tree species around Huntington and information regarding planting in the public rights-of-way. Pam Pranger, a local government volunteer and taskforce member, provided information regarding previous plans and tree ordinances, exciting discussions, and unique local knowledge about the Huntington community. Kathryn Lisinicchia, a Huntington resident on the Mayor's Advisory Council for Environmental Stewardship (MACES), assisted in discussions of potential planting sites and grant materials. Ed Farris, with the Huntington Purdue Extension, also provided urban forestry resources. Adam Cuttriss, the Director of Public Works and Engineering Services; Ben Bond, Huntington's GIS Coordinator; Bryn Keplinger, the Director of Community Development & Redevelopment; and Tim Bischoff, the City Services Superintendent, provided information regarding future development plans and

data for the city. In addition, a plethora of other connections were made and consulted over the course of this fellowship.

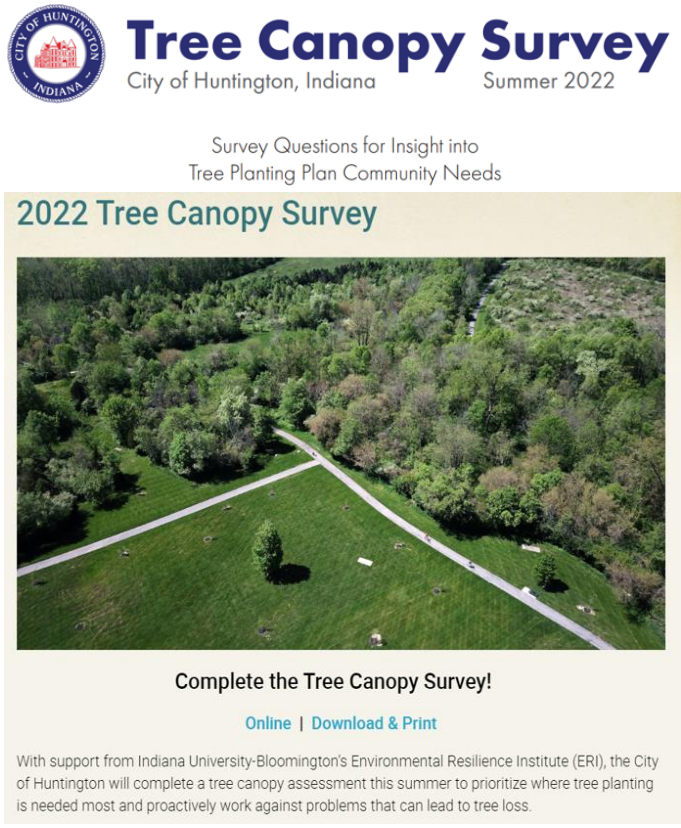
**The Environmental Resilience Institute (ERI) Staff:** The ERI staff provided support to the Fellow through bi-weekly check-ins, office hours, providing key materials and resources, work plan templates, and coordinating weekly guest speakers whose advice helped in the creation of this plan. Anagha Gore, the Resilience Programs Coordinator, and Matthew Flaherty, the Resilience Implementation Manager, assisted with any concerns or questions the McKinney Climate Fellows (MCF) participating in the Urban Green Infrastructure (UGI) Fellows had. Hannah Gregory, the GIS Specialist, also provided necessary GIS assistance and tree information to fellows as needed.

**Davey Resource Group (DRG):** DRG supplied the necessary data and instructions for an urban tree canopy assessment and priority planting setup, which involved LiDAR surveys of Huntington. Aren Flint, the Senior Associate Consultant, provided information about the processes of ground-truthing and assessing priority planting sites for where trees could be planted from previous experience. Nick Antenucci also assisted in GIS map troubleshooting. DRG offered GIS data analysis and support, and assisted with much of the data processing, as well as compiled a final UTC assessment for the entirety of Indiana using the tree planting plans from all 2022 Fellows participating in the UGI Cohort.

**Soar Strategies, Inc.**: Dr. Janine Hill, the founder and president of Soar Strategies, Inc. provided invaluable diversity, equity, and inclusion trainings and one-on-one sessions with the Fellow and City of Huntington. Her insight and approach to teaching and learning about the incorporation of equity assisted greatly in thinking about the narratives of lower socioeconomic communities regarding tree canopy coverage.

## SURVEY RESULTS & INSIGHT

In the initial weeks of the fellowship, a survey was formulated with specific questions tailored to the community, which were reviewed by several community members and government employees. The survey was dispersed to get a sense of the community's perception of trees and tree benefits, providing an outlet for residents to voice comments, and assisting in the identification of priority planting areas. This survey was made available via online announcements on the Huntington local government social media and website, in the local newspaper, pamphlets in local businesses, and postings within Huntington's parks. At the end of the survey, survey respondents were required to say where in Huntington they reside by district. Open to responses for approximately one month, the survey received a total of 80 responses.



Survey respondents were given 5 statements about trees and asked to rank the importance of them. **Figure 2.** shows the responses to one of these tree benefit ranking questions. Averaging all tree benefit responses, residents valued tree benefits with the selection of 'Strongly Agree' with a maximum of 83.8% and minimum of 67.5%. Amongst all of the tree benefits, residents favored shading from trees the most, followed by water quality control, air purification, and that trees improve the quality of life for residents.

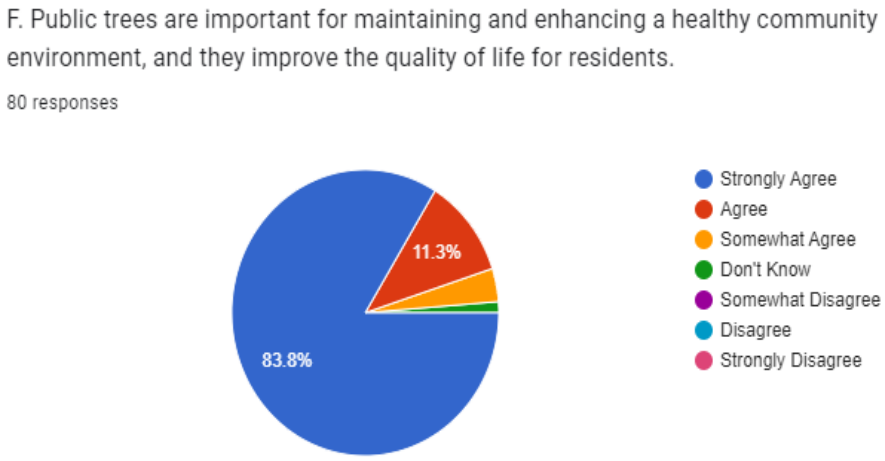



**Figure 2.** Example survey response for tree benefit ranking

Survey respondents were also asked to note areas that they thought Huntington might need more trees, with the majority saying POWs, parks, and school grounds were of priority, shown in **Figure 3.**

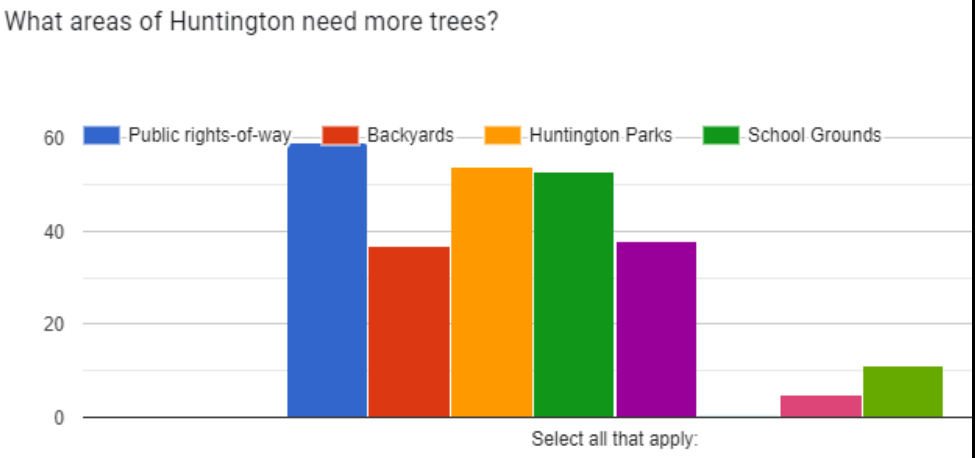



**Figure 3.** Survey responses for areas that need more trees

**Figure 4.** shows the variety of districts that survey respondents reside in. The most responses were received from residents living in the 5th district and least in the 3rd district.

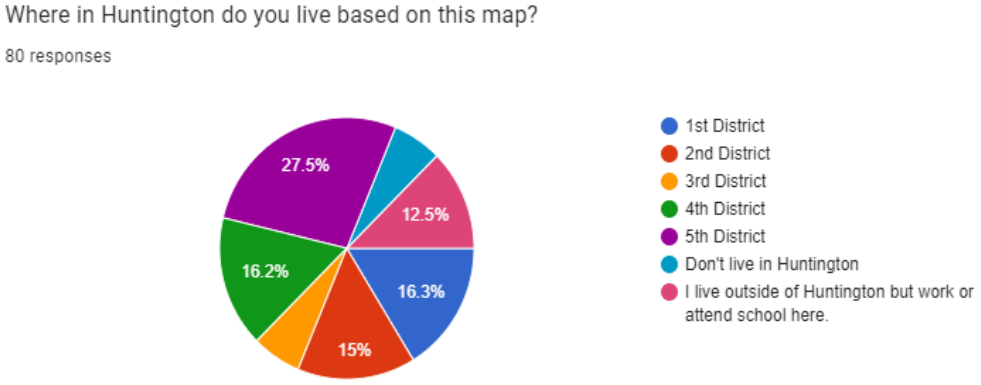



**Figure 4.** Percentage of respondent residence by district

The full list of survey questions can be found at:
https://www.huntington.in.us/egov/documents/1655469489_86468.pdf

Several common responses and notable quotes are listed below:

At least 33 of the 48 responses within the optional comment box for "Have you experienced or witnessed flooding in Huntington? If so, where?" responded with flooding experiences near the Little River and the Wabash River. Backyards were also prevalent responses, along with street names including: downtown Huntington, Elm St., Stults Rd., E High and Jefferson, W Park Dr., E Washington St., and Meridian.

When asked about areas in which more trees could be planted in the city, 14 responses in the optional comment box suggested more trees be planted on school grounds, in parking lots, downtown, storefronts, sidewalks, subdivisions, city streets, and the land surrounding hospitals.

> "*There are too many areas, especially walking along sidewalks, where there is no shade, making it uncomfortable on hot days.*"

> "*Shade along public walkways is important, and I don't want to live in an asphalt and concrete temperature hellhole.*"

> "*We need shadier and quieter streets. The anti- pollution and anti-flooding benefits are good as well. The trees have not been replaced 1:1 as they've been taken down. Now we need to play catch-up in restoring the streetscape.*"

A respondent's experience with city tree removal:

> "*The City does a good job removing diseased and damaged trees. The trees we do have are pleasant to look at and provide benefits like shade, noise reduction, and homes to wildlife. But the trees on the tree lawns and in the public parks are not being replaced, resulting in a lot of empty lawn space. I understand that trees that destroy pavements and cause other problems could not be replaced in kind, but I know the City has a replacement tree list meant to avoid those problems in the future. The problems is that those replacement trees never seem to show up*."

When asked about ranking the city's overall tree canopy (1 being the best, 5 the worst), one respondent stressed the proper selection of tree species and planning, saying,

> "*I have a rank of 5. This is mainly due to the above ground utilities in the city and throughout our neighborhoods. I understand the need for public utilities as I work as a utility arborist and have seen first-hand the wrong type of trees being planted under utility lines. As these trees grow and mature, they must be pruned over and over. Causing the tree to ultimately decline also creating poor aesthetics. Drive down anyone of our city streets or ally's and you will see first-hand this issue. Again, if we work to inform our city officials and the community about "right tree" this can be 100% avoided. Several trees in our parks are in decline as well. I'm also an ISA certified tree risk assessor and fully understand the hazards these trees pose in public space. Poorly planned and managed trees are very detrimental to life and property.*"

Regarding trees in public areas:

> "*Trees in public spaces, especially street trees, have it rough and often struggle. Trees often look like they have not received enough water and have been damaged either accidentally (weed whipping) or purposely*."

On the importance of trees:

> "*Trees are beneficial to the environment and to the overall health of wildlife and our communi*ty."

## METHODOLOGIES

To help the Huntington community increase its canopy coverage, an urban tree canopy assessment was conducted to assess land cover using aerial imagery. In order to create a priority planting plan, a 'No Planting Sites' analysis was accomplished through visual investigation by the Fellow, community members, and employees of the city of Huntington. Using Google Earth, the Fellow marked the locations of land that needed included or removed from the site list, along with areas already included that needed to be expanded or shrunk. 'No Planting' location polygons were created from DRG data by taking all grass, open space, and bare ground areas and combining them into a single dataset. Non-feasible planting areas such as agricultural fields, recreational fields, major utility corridors, airports, ROWs were noted, reviewed, and approved by city officials before the tree canopy assessment and analysis proceeded. Using raster-based analysis, several variables were then retrieved from verified, reputable datasets (as listed below in **Table 2.**) were weighted in a determined weighting scheme, in consultation Mayor Strick, to create the final priority planting map. These data were used to find suitable planting locations within public rights-of-way and private property. For further, more in-depth ArcGIS Pro instructions and methodologies, refer to **Appendix Section A.** The following list describes each weighted variable that was used to create the priority planting map. Once the priority planting map was created, the Fellow utilized GIS to analyze high-priority sites in Huntington. The Fellow identified two high-priority areas and confirmed them with Mayor Strick. After these locations were selected, the Fellow walked the sites and compiled a list of possible street tree species for planting in each site and potential planting locations in public ROWs.

**Distance to Hardscape**: This variable measures the straight-line distance from all impervious surfaces prioritizing areas that are closer to existing impervious surfaces. Planting in these areas helps reduce stormwater runoff and sedimentation from impervious surfaces

**Distance to Canopy**: This variable measures the straight-line distance from all existing tree canopy prioritizing areas that are closer to the existing canopy. Planting in these areas helps to fill gaps to increase tree canopy closure, which has a great impact on wildlife habitat by providing larger corridors to support a variety of different species.

**Floodplain**: This variable uses the hydrography lines form the USDA and the slope data to identify the first major slope break which indicates the normal stream bank channel that fills during flooding events. Prioritizing planting in these potential flood areas will help in reducing floodwaters

**Soil Permeability**: This variable uses USDA soil data to determine the water infiltration rate of the soil. Areas with low rates of water infiltration cannot absorb as much water as areas of high infiltration and have higher potential for standing water and run off. Prioritizing planting in areas of low soil infiltration rates helps to reduce surface runoff and reduce pollutants and sedimentation.

**Soil Erosion**: This variable uses USDA soil data to determine the susceptibility of sheet and rill erosion of the soil. Prioritizing tree planting in areas that have a higher susceptibility of erosion helps to decrease erosion vulnerability.

**Slope**: This variable uses the DEM (Digital Elevation Model) from the USDA to measure the slope percent rise of all areas of the city. Prioritizing planting in areas that have a high percent rise in slope helps in decreasing stormwater runoff.

**Population Density**: The population density variable uses total population data from the US census Bureau at the block group or census tract level. Areas of higher population density are given a higher prioritization. Planting in these areas helps address social equity issues and provides residents equal access to nature.

**Minority Population**: The minority population variable uses ethnicity data from the US Census Bureau at the block group or census tract level. A percent of the minority population is found for each delineated census area. Areas of higher percentages of minority population are given a higher prioritization. Planting in these areas helps address social equity issues and provides residents equal access to nature.

**Median Household Income**: The income variable uses median household data from the US Census Bureau at the block group or census tract level. Areas of lower median income are given a higher prioritization. Planting in these areas helps address social equity issues and provides residents equal access to nature.

**Population (Population Density and Minority)**: Data shows percentage of population that are minority in each census tract. Percentages are classified into five groups using quantile classification within ArcGIS ranking from 0 to 4. A ranking of 0 is given to areas with lower percentages of minority population. This ranking increases as the percentage of non-white residents increases. Planting in these high priority areas may help address social equity issues and provide residents equal access to nature. Population Density is found by taking the number of residents within each census tract and dividing by the number of square miles to get population per square unit. A ranking of 0 is given to areas with lower density of residents. This ranking increases as the density of residents increases.

**Social Equity**: To identify and prioritize planting potential based on social equity, US Census data was used. Census data included ethnicity, median household income, and population density. Higher priorities of social equity give a focused effort of providing trees and tree canopy to all citizens regardless of social status. These priority areas are deemed to have the greatest return due to their importance of providing residents of the community equal access to nature.

**Stormwater**: To identify and prioritize planting potential based on the stormwater analysis, locations were assessed with several environmental features, including proximity to hardscape, proximity to canopy, floodplain proximity, soil permeability, slope, and soil erosion factor (K-factor). These factors are based on historic projects completed by DRG for stormwater analysis.

**Urban Heat Island**: Results of the UTC-based priority planting focus on areas of greatest need and target areas to mitigate escalating urban heat island issues. Planting in areas of high surface temperature helps mitigate urban heat islands by providing more shade to cool air temperatures and heat-absorbing pavements.

**Table 2.** Weighting scheme of priority variables used for creating the priority planting map

| Group | Criteria | Data Origin | Weighting |
|---|---|---|---|
| Urban Tree Canopy Assessment and Environmental | Distance to Hardscape | Urban Tree Canopy Assessment | 0.20 |
| | Distance to Canopy | Urban Tree Canopy Assessment | 0.05 |
| | Floodplain | National Hydrologic Dataset | 0.10 |
| | Soil Permeability | Natural Resource Conservation Service | 0.05 |
| | Soil Erosion | Natural Resource Conservation Service | 0.05 |
| | Slope | National Elevation Dataset | 0.10 |
| Urban Heat Island | Ratio of Canopy to Impervious Surface | Urban Tree Canopy Assessment | 0.15 |
| US Census | Population Density | U.S. Census Bureau | 0.10 |
| | Median Household Income | U.S. Census Bureau | 0.10 |
| | Percent Minority Population | U.S. Census Bureau | 0.10 |

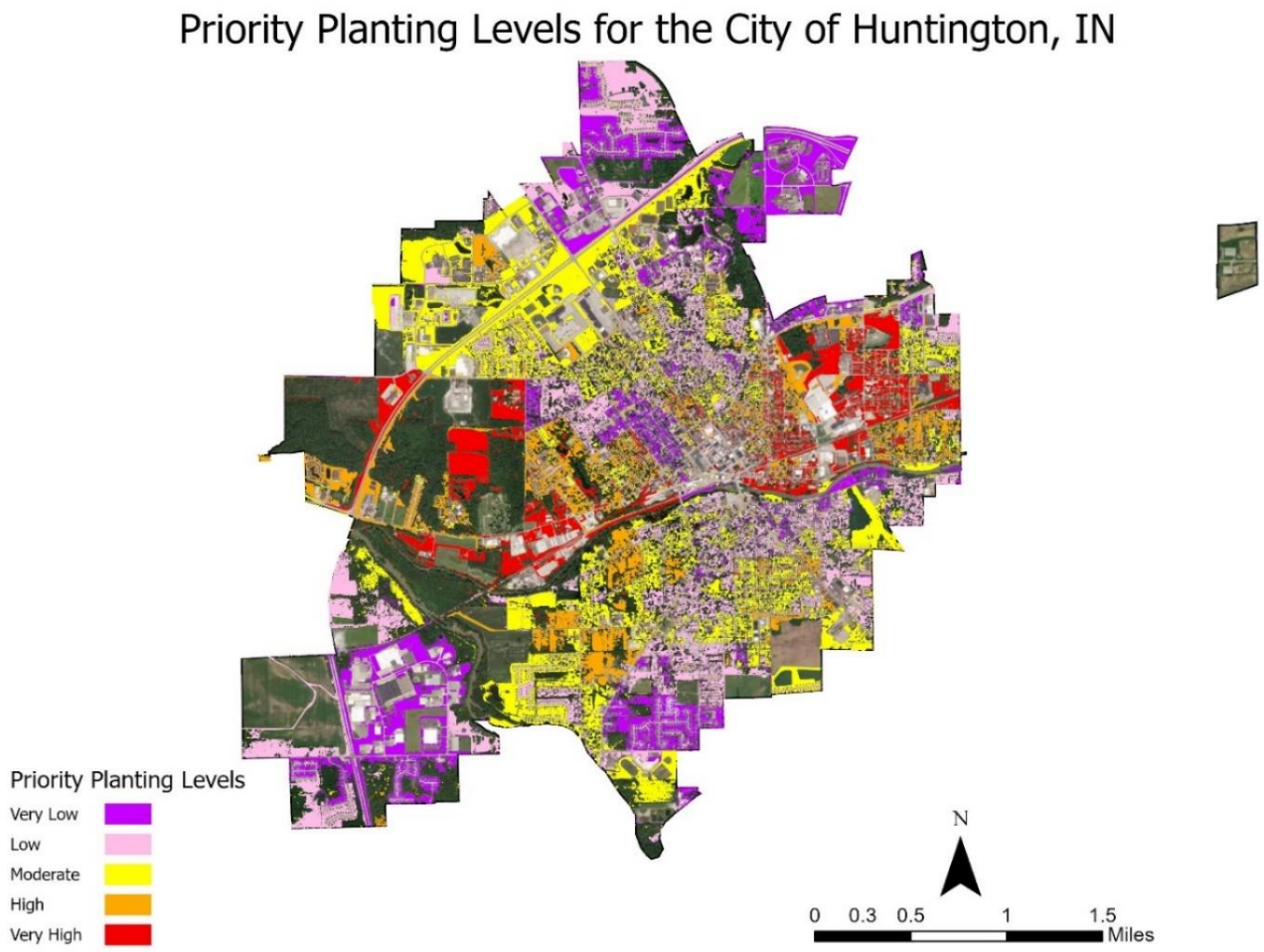



**Figure 5.** Priority Planting Map for Huntington, Indiana

## FINDINGS

Following the urban tree canopy analysis, a priority map was made looking at and incorporating several factors including topographic data, population, and socioeconomic data among others. The main priority planting map of Huntington displays areas ranking from very low to very high in terms of need for tree planting. This map utilizes the ten weighted variables listed in **Table 2.** After running the raster-dataset with the weighed variables in **Table 2.,** the resulting priority planting map is shown in **Figure 5**. Purple denotes 'Very Low' priority planting levels, Pink –'Low Priority, Yellow – 'Moderate' Priority, Orange – 'High' Priority, and finally Red denotes the 'Highest Priority' planting level within the City of Huntington. Following the creation of the priority planting level map, the Fellow consulted Mayor Strick, several government staff members, and community members, while also comparing the results with the community engagement survey responses. This map, along with zoomed-in maps of specific high-priority areas of Huntington, delineate which areas are most prone to negative impacts from the weighted variables and which are the least. These areas could benefit from the planting of trees, which would help to mitigate future extreme weather events. Overall, two main priority sites of Huntington were identified as 'Very-High Priority', which were chosen to further ground-truth and locate specific

tree planting areas within the sites. The Fellow went on site visits to see and note the most current canopy and aboveground utilities in these high priority sites. This included assessment of the size of available areas and noting the location of overhead utilities (underground utilities will need to be determined by the street and engineering departments before projects occur).

From a first glance, it is noticeable that the area of ACRES Land Trust and its surroundings, as well as two residential areas east of downtown Huntington are delineated red areas of highest priority. When selecting planting locations, the possible locations were narrowed down to these two residential areas (**Figures 3 & 4.**). There are also areas of moderate priority with high and low planting areas intermixed both in the Northwest part of Huntington (near Walmart) and the Southwest part of the city (below Little River).

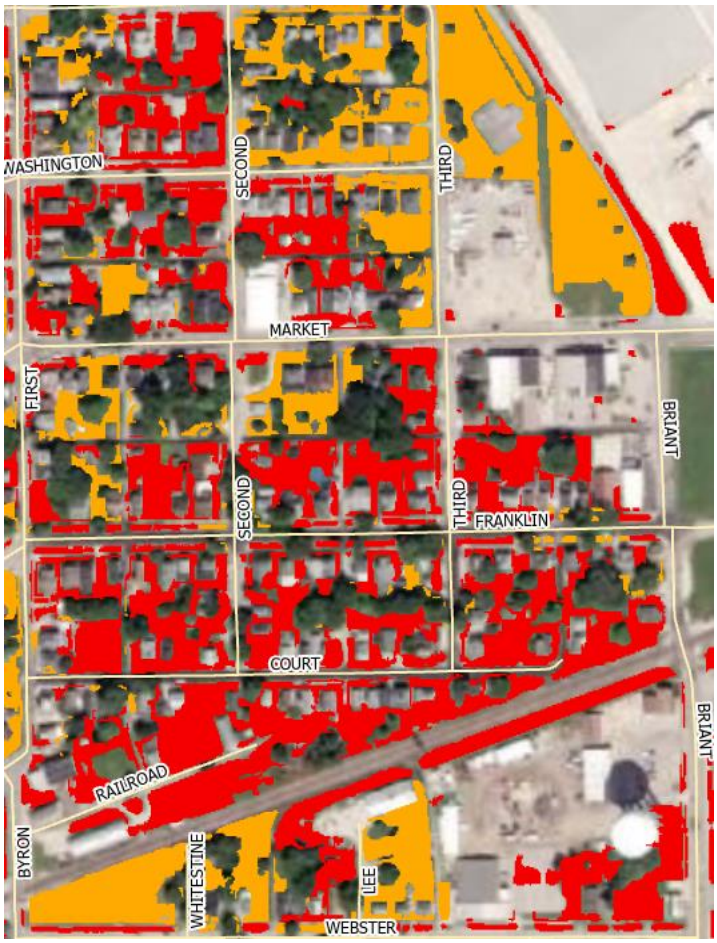



**Figure 3.** Priority Planting Site 1

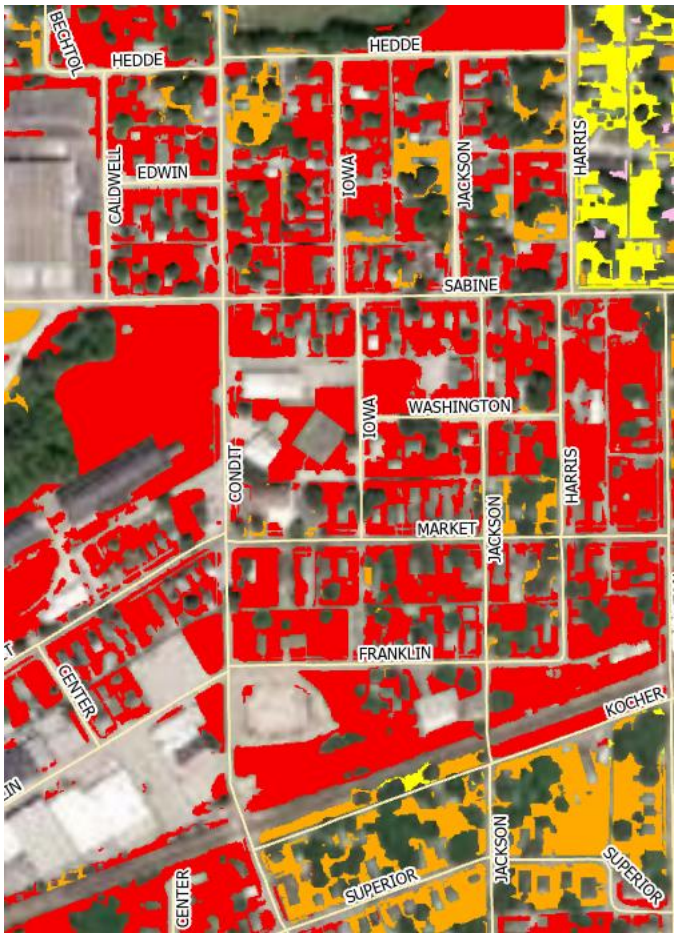



**Figure 4.** Priority Planting Site 2

**Figure 3.** Depicts a high priority area from Washington St. to Court St. (North to South) and Briant St. to First St. (East to West)
**Figure 4.** Depicts a high priority area from Hedde to Franklin (North to South) and Harris to Condit (East to West)

These sites are both extremely urban residential areas with increased heat island effect and temperatures that would be remediated through planting more trees within these areas.


**Figure 5.** ACRES Land Trust, surrounding area

ACRES Land Trust, shown in the two main red areas in **Figure 5.** is a nonprofit organization dedicated to protecting natural and working lands in northeast Indiana (among other states) and is already conducting ongoing wetland restoration and reforestation at Pehkokia Woods in Huntington. This is a very high priority area that has the potential to reconnect already existing forest to reduce habitat fragmentation and increase forest connectivity for the maximum potential of tree benefits offered. This Land Trust would be a great partner for consideration to the city of Huntington for future tree efforts.

**Figure 6.** Memorial Park (containing Sunken Garden), Huntington's flagship park is show between the area of St. Felix and Park (North to South) and Dimond to Bartlett (East to West). This would be a great area to consider for future tree plantings, as well as the surrounding communities outlined in high and moderate priority planting due to their urban heat island effect and other variables within the weighting scheme.

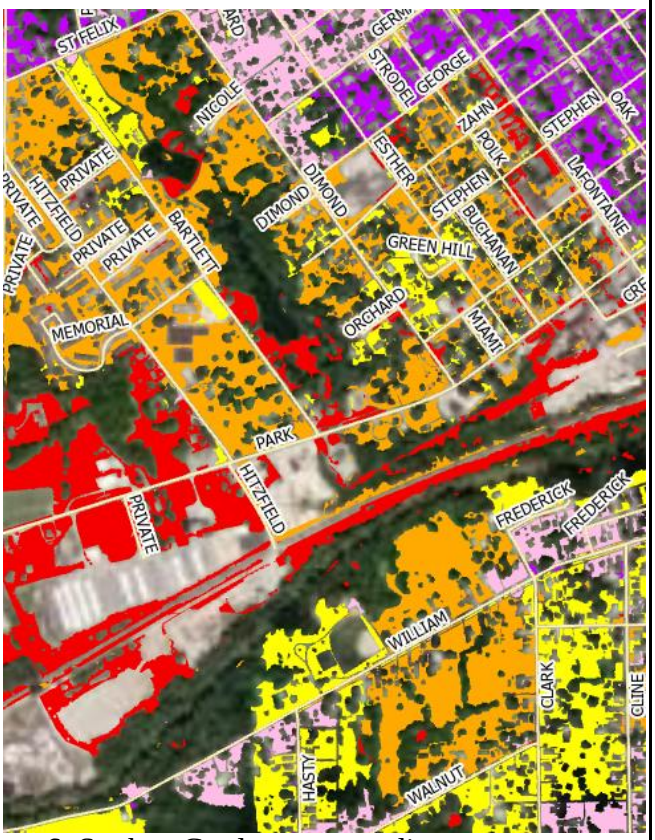



**Figure 6.** Sunken Garden, surrounding residential areas

# RECOMMENDED TREE SPECIES FOR FUTURE PLANTING

As part of this report, the Fellow added recommendations to Huntington's Neighborhood Tree Planting List (2018). This list includes species that have high tolerance to full sun and drought resistant species, which would allow easier tree maintenance in the first three years of tree management after planting. When seeking out the preferred species, the Fellow wanted to emphasize Indiana native trees that could thrive in Huntington's soil type Zone 5b while consulting Purdue Extension's Utility Friendly List and several other cities' street tree lists (Bloomington and Lafayette, IN). The following section lists the recommended tree species for future planting based on tree size.

Proper landscaping and tree planting (e.g. within the public ROW, depicted in **Figure 7.**) are critical components of the atmosphere, livability, and ecological quality of a community's urban forest. In planting new trees, utilities (aboveground and underground), existing trees, grow space dimensions, and other dimensions should be noted. The tree species listed below have been evaluated for factors such as size, disease and pest resistance, seed or fruit set, and availability. Deciduous, coniferous, and evergreen trees are included within the small, medium, and large tree categories below. The following tree list, with common name, scientific name, and cultivars, is offered to assist all relevant community personnel in selecting appropriate tree species. These trees have been selected because of their aesthetic and functional characteristics and their ability to thrive in the soil and climate conditions in Zone 5b on the USDA Plant Hardiness Zone Map. This subzone has a minimum average temperature of -10° to -15°F. Tree availability will vary based on availability within nurseries and tree farms.

*Huntington's Neighborhood Tree Planting List* (2018)*, Purdue Extension's Utility-Friendly Trees List, City of Bloomington Street Tree List, Indiana Tree Care Manual, Dirr's Hardy Trees and Shrubs* (Dirr 2013), *Manual of Woody Landscape Plants (5th Edition)* (Dirr 1988), and the Purdue Extension list of best native Indiana trees to plant for climate resilience were consulted to compile this suggested species list.

### SMALL TREES for <u>Under Power Lines</u> – 15 to 30 Feet in Height at Maturity (3-4 feet from pavement)

1. Winter King Thornless Hawthorn (*Crataegus viridis*)
2. Service Berry (*Amelanchier grandiflora,* Shadblow, numerous exist)
3. Allegheny Serviceberry (*Amelanchier laevis*)
4. Flowering Dogwood (*Cornus florida)*
5. Pagoda Dogwood *(Cornus alternifolia*)
6. Kousa Dogwood (*Cornus kousa*, numerous exist)
7. Cherry Dogwood (*Cornus mas cornelian*)
8. Eastern Redbud (*Cercis canadensis*)
9. Ironwood/Hophornbeam (*Ostrya virginiana)*
10. Star Magnolia (*Magnolia stellata)*
11. Flowering Crabapple (*Malus sp.*)
12. Cockspur Hawthorn (*Crataegus crus-galli*)
13. Thornless Cockspur Hawthorn (*var. inermis*)
14. Ivory Silk Japanese Tree Lilac (*Syringa reticulata*)
15. Paperbark Maple (*Acer griseum*)
16. Three-Flower Maple (*Acer triflorum*)

17. Amur Maackia (*Maackia amurensis*)
18. Higan Cherry *(Prunus subhirtella*, 'Pendula')
19. Common Chokecherry (*Prunus virginiana*, 'Schubert')
20. Foster's Holly (*Ilex* x *attenuate*)
21. Techny Arborvitae (*Thuja occidentalis*)
22. Keteleeri Juniper (*Juniperus chinensis*)
23. Hetz Columnar Juniper (*Juniperus chinensis*, 'Hetzii Columnar')

**MEDIUM TREES– 31 to 45 Feet in Height at Maturity (5-6 feet from pavement)**

1. Linden (*Tilia cordata* varieties: Redmond, Greenspire, Glenleven)
2. Silver Linden (*Tilia tomentosa*, 'Sterling')
3. Red Maple (*Acer rubrum* varieties: Bowhall, Red Sunset, October Glory)
4. Pacific Sunset Maple (*Acer truncatumx, Acer plantinoides*, 'Warrenred')
5. Sweet Gum (*Liquidambar stryaciflua,* 'Rotundiloba')
6. Red Horsechestnut (*Aesculus* x *carnea*)
7. American Hophornbeam (*Ostrya virginiana*)
8. American Yellowwood (*Cladrastis kentukea*, 'Rosea')
9. Sawtooth Oak (*Quercus acutissima*)
10. Atlantic Whitecedar (*Chamaecyparis thyoid*es, numerous exist)
11. Eastern Redcedar (*Juniperus virginiana*)
12. Eastern Arborvitae (*Thuja occidentalis,* numerous exist)
13. Golden Raintree (*Koelreuteria paniculate*)
14. Amur Corktree (*Phellodendron amurense,* 'Macho')
15. Amur Chokecherry (*Prunus maackii,* 'Amber Beauty')
16. Sargent Cherry (*Prunus sargentii*)

**LARGE TREES– Greater than 45 Feet in Height at Maturity (<u>at least</u> 8 feet from pavement)**

1. Sugar Maples (*Acer saccharum,* Green Mountain, Legacy, Apollo Maple, etc.)
2. Red Oak (*Quercus rubrum*)
3. Northern Red Oak (*Quercus rubra*, 'Splendens')
4. Scarlet Oak (*Quercus coccinea*)
5. Overcup Oak (*Quercus lyrata*)
6. Bur Oak (*Quercus macrocarpa*)
7. Chinkapin Oak (*Quercus muehlenbergii*)
8. Homestead Elm (*Ulmus* 'Homestead')
9. Accolade Elm (*Ulmus japonica* x *Wilsoniana,* 'Morton'*)*
10. White Oak (*Quercus alba)*
11. Tulip Tree (*Liriodendron tulipifera*)
12. Shumard Oak (*Quercus shumardii*)
13. Black Tupelo/Black Gum (*Nyssa sylvatica*)
14. Northern Catalpa (*Catalpa speciosa*)
15. Sugarberry (*Celtis laevigata*)
16. Basswood (*Tilia americana*)
17. Common Hackberry (*Celtis occidentalis*, 'Prairie Pride')
18. Ginkgo (*Gingko biloba*, Choose male trees only)

19. Kentucky Coffeetree (*Gymnocladus dioica*, 'Prairie Titan')
20. Dawn Redwood (*Metasequoia glyptostroboides*, 'Emerald Feathers')
21. Common Baldcypress (*Taxodium distichum*)
22. Balsam Fir (*Abies balsamea*)
23. White Fir (*Abies concolor*, 'Violacea')
24. Western Arborvitae (*Thuja plicata*, numerous exist)
25. Eastern Hemlock (*Tsuga canadensis*)

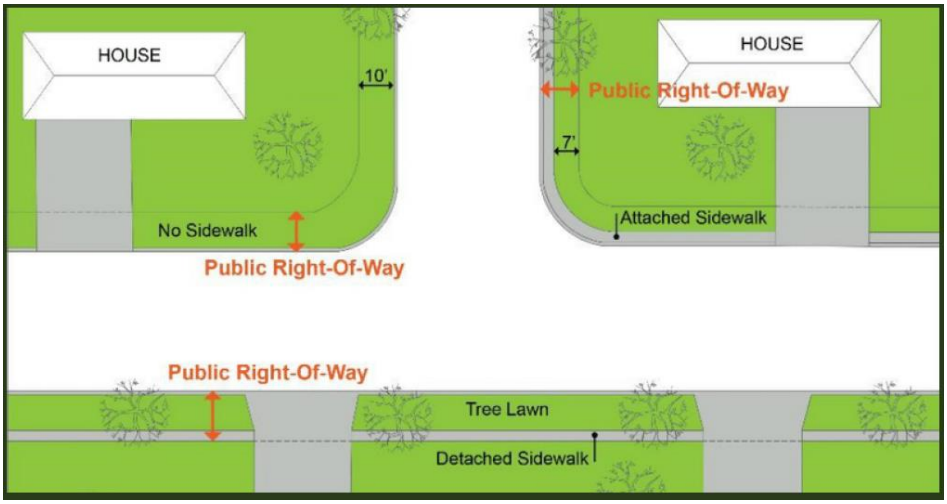



**Figure 7.** Public Right-of-Way (ROW)

## TREE MAINTENANCE

When properly maintained, trees provide communities with abundant environmental, economic, and social benefits that far exceed the time and money invested in planting, pruning, protection, and removal. An urban forest plays an important role in supporting and improving the quality of life in urban areas. It will be essential in the coming years to have concentrated efforts into creating a plan for planting, protecting, and preserving urban tree canopy within Huntington. In the development of a 5- or 10- year maintenance plan for the planted trees, an annual budget should be included for tree maintenance activities. The estimated costs relating to each tree by size is shown in **Table 3.**

The City of Huntington should be aware of the signs and symptoms of potential infestations and should be prepared to act if a significant threat is observed in its tree population or a nearby community. Factors that threaten canopy cover are both human-caused and naturally occurring; understanding potential and real threats to urban tree canopy can help a community prepare for and protect its existing canopy. For example, invasive insects and diseases can have a devastating impact on a community's urban forest and must be planned for; an established, integrated pest management plan would be recommended for these instances. Identifying and monitoring threats, understanding the economic threshold, selecting the correct treatment, properly timing

management strategies, recordkeeping, and evaluating results would assist with tree maintenance of newly planted trees and their health.


**Figure 8.** How to Properly Plant a Tree

*Planting Site Guidelines*

All planting of trees should take place between mid-Fall and early Spring (November to April) to take advantage of the dormant period for most trees and the cooler, wetter seasons of the year. However, trees can be planted throughout the growing season if properly cared for in the nursery or garden center with appropriate care. The Indiana DNR, Division of Forestry "Minimum Standards for Tree Planting" (DRG) will meet expectations during the planning, species selection, site selection, planting, and tree maintenance aspects of this project. Trees purchased will meet the size and grading standards of the American Standard for Nursery Stock as established by the American Nursery and Landscape Association. Deciduous trees (dependent on species character) will be at least 1½ inches and no more 3 inches of caliper and a minimum of 8 foot in height. Trees can be obtained from a licensed nursery, meet landscape-grade standards, and have a one-year warranty.

*Best Management Practices for Utility Corridors*

1. Avoid trees with aggressive root systems near underground water and sewer lines.
2. Plant only small maturing trees beneath overhead electrical power lines to ensure line clearance can be maintained.
3. Maintain adequate clearance from all overhead and underground utility lines to facilitate repairs and minimize impacts to trees.
4. Plant trees at least 10 feet from sewer lines, 15 feet from underground electrical power distribution lines, and 20 feet from underground electrical or gas transmission lines.
5. Plant medium trees at least 20 feet from overhead electrical distribution lines.
6. Plant large trees at least 40 feet from overhead electrical distribution lines.
7. Prune trees according to professional standards, employing natural target pruning to remove undesirable limbs at the branch collar.
8. Employ crown reduction pruning instead of tree "topping" to reduce tree size beneath utility lines.
9. Remove trees in conflict with overhead electrical power lines if clearance cannot be maintained through proper pruning.
10. Maintain at least 15-foot clearance between overhead power lines and tree limbs.

**Table 3.** Estimated cost (USD) for basic tree planting per unit (as needed)

| Tree Size | Tree Planting Cost (USD) | Maintenance Cost (USD) | Trimming Cost (USD) | Pruning Cost (USD) |
|---|---|---|---|---|
| ***Small Trees*** | $150-$300 | Ranging from $375-$1500 depending on tree species, size, and/or condition | ≈$80 | $75-$400 |
| ***Medium Trees*** | $200-$1,000 | | ≈$175 | $175-$600 |
| ***Large Trees*** | $1,500-$3,000 | | $300-$1,000 | $1,000-$1,800 |

## CONCLUSION, RECOMMENDATIONS, & NEXT STEPS

For successful implementation and facilitation of Huntington's urban forest urban canopy coverage health, Huntington must coordinate the general maintenance of newly planted trees, including watering, mulching, trimming, pruning, as well as planning for potential tree removal if pests, diseases, natural disasters are present. Additionally, it is of equal importance to fit this tree planting plan and future plans into Huntington's Climate Action Plan goal of attaining 30% canopy coverage by 2030 to ensure current city goals are based on actual canopy maps and plantable open space.

Land development can be positive for the local economy, but be destructive to the environment unless proper planning and appropriate protection measures are put in place to help achieve a balance between economic development and environmental conservation. Tree canopy loss, whether due to human activities or sever weather events, can be instantaneous. Tree canopy increases resulting from new plantings, natural regeneration, and growth, are slow processes that take time and commitment. By seeing what change is happening where over time, urban planners and forest managers can better direct and prioritize their efforts to maintain and increase canopy cover. Conducting another UTC assessment in the next 5- to 10- years would help to establish goals for tree planting projects and to determine progress towards city tree canopy goals that align with community objectives. A complete inventory of Huntington's trees would quantify the future breakdown of total annual benefits that trees provide for Huntington and put a dollar value on the street trees' annual environmental and aesthetic benefits. This would include an assessment of current personnel, equipment, and capacities to meet tree management needs. Another equity assessment in 5 to 10 years would be valuable to the city as well.

In addition, the DRG provided some recommendations that are pertinent as well:

- → Create realistic canopy goals with specific objectives, e.g. 30% by 2030 in Huntington (The Huntington Climate Action Plan (CAP) task force and Mayor's Advisory Council of Environmental Stewardship (MACES) would be great places to start in discussion of city tree canopy goals)
- → Involve partners in master planning to identify specific actions
- → Provide aging trees appropriate care to conserve tree canopy
- → Review policies that influence mature tree canopy preservation, and influence tree planting
- → Establish expectations of partners and lead by example via public services
- → Explore how best to encourage tree planting and canopy retention

→ Continued public and stakeholder engagement throughout the process to inform the public (due diligence), as well as receive valuable insight
→ Consider how best to communicate with residential and non-residential areas about the importance of tree planting and preservation
→ Celebrate trees within the Huntington community! (e.g. Arbor Day, Tree City USA)
→ Re-consider progress at regular intervals, realistic goals expectations, reports throughout
→ Tree ordinance drafting, carbon credits, future use of i-tree and tree canopy mapper, Indiana green city mapper, etc.
→ Hiring a city forester or arborist or consulting forester to assist further in these city efforts

### *Continued Community Engagement*

Ideally, tree canopy goals are developed in collaboration with key stakeholders, incorporating broader community needs and values related to considerations such as stormwater management, shading, livability, commerce, environmental equity, and public health. Constant public outreach and stakeholder input and engagement will assist in supporting the community's needs, as well as maximizing the ecosystem services which trees offer, and capitalizing on resilience efforts. Going forward, the Fellow advises that several factors should be monitored, including: species diversity, size distribution, condition, primary maintenance needs, 5-year strategies for tree care, annual assessment of current personnel, applicable equipment and capacities to meet management needs, and considering future construction and development. The results of the UTC analysis should be shared with all stakeholders involved with community planning, development, and community forest management.

### *Community Forestry Education, Citizen Science*

Advocating for higher awareness of the benefits trees offer would allow decision-makers and community members to understand the benefits that they can provide to the community and for the environment. When citizens, city officials and staff, developers, contractors, and community institutions are educated about the benefits of trees and the threats to the canopy cover, then can all work together to achieve urban tree canopy community goals. Trees are recognized as a valuable public infrastructure, where funding should be increased to support the maintenance, preservation, and expansion of the community's urban forest in prioritized areas. A tree care and education curriculum within Huntington, along with citizen science, science conducted by citizen volunteers, would allow for greater awareness of tree benefits and provide data for the city. Data collection could range from existing tree condition, DBH, the temperature of certain streets, and more. This tree education could also be incorporated into already existing school programs (e.g., SPARK summer program). The Fellow recommends watering planted trees in the public-right-of-ways (POWs) for three years, in coordination with the city with pruning as needed. Following the three years, local community organizations could be entrusted with tree maintenance.

### *City Services & Data Usage*

Tree inventories and on-the-ground assessments are critical for determining tree species diversity, tree size, and tree condition, interactive tools that help tree stewards and residents engage in tree care activities and report concerns. UTC Assessments could be repeated at regular intervals to examine how tree canopy is changing within the city. Conducting an urban tree canopy change analysis would also be of interest such that it would help the Huntington community to assess progress toward tree canopy goals. In the future, the Fellow strongly recommends that Huntington

look into hiring a City Forester or Arborist or utilize a consulting forester for this tree planting plan to come to fruition. A continued partnership with Davey Resource Group (DRG) for further forest management would be an option as well. Some forest mapping programs that could be utilized in the future include the Forest Service' s i-Tree program, used to collect plot data for on-the-ground tree surveys, as well as i-Tree Eco, an adaptation of the Urban Forest Effects (UFORE) model which provides a broad picture of the entire urban forest, and providing city data to the Indiana Green City Mapper. Urban tree canopy data and maps can help the public visualize the importance of canopy cover. Therefore, the constant update and revision of data should also be prioritized for Huntington. As a certified tree city with Tree City USA, Huntington could utilize this status to invite future tourism, businesses, and residents, as well as boast at their Evergreen arboretum with Arbor Day celebrations for future generations to come.

### *Policy Changes*

The review of city tree ordinances is of interest and pertinent to this plan for further success down the road and ongoing planting efforts. In revisiting current city ordinances, a new policy or goal of emphasizing forest connectivity could be developed such that, when construction projects occur, a certain amount of land could be required for restoration (e.g., requiring the planting of trees), or that a certain number of trees may not be removed under permitting requirements (e.g., The City of Atlanta, GA Tree Ordinance – Sec. 158-101 states: "No person shall directly or indirectly remove or destroy [or injure] any tree located on public property… or any tree having a diameter at breast height (DBH) of six inches or more which is located on private property…". Institutionalizing urban tree canopy goals in local ordinance, regulations, and comprehensive planning efforts going forward should be considered for the creation of a new tree ordinance for Huntington. Another example of the use of a city tree ordinance includes requiring that newly constructed or reconstructed parking lots be shaded by incorporating tree plantings into a parking lot design. Parking lot shading provisions could be enacted through a specific ordinance, but the code may be incorporated into sections of the city code related to trees, landscaping, parking lots, or elsewhere. This would contribute to the mitigation of both the urban heat island effect and increased air pollution that parking lots may facilitate. Reviewing and revising tree ordinances based on desired UTC goals can be used to protect and increase canopy for Huntington.

### *Appeal to Private Landowners*

Landscape analysis across different ownership types (private/residential, commercial, and public, including public rights-of-way) is essential for meeting urban city sustainability goals. Incorporating private land in the assessment is particularly critical because it is the dominant ownership type in urban areas within Indiana and holds the most opportunity for tree planting. Since most tree canopy is growing on private property, public outreach and education are recommended when trying to preserving and increasing tree canopy regarding private property. This is something that could be further explored in Huntington.

## ANALYSIS LIMITATIONS

Throughout the internship, there were several limitations. The main limitation was the limited 10-week time frame. Other limitations that arose included data analysis and technical issues when conducting the tree canopy assessment and analysis, which were addressed as they occurred. In addition, due to the Fellow's limited knowledge of urban forestry, and without a city forester to better direct her efforts, Ms. Handy consulted local tree expertise. The Fellow would

have liked to conduct more in-depth, meaningful community and stakeholder engagement as well. If the Fellow had more time, she would have liked to reach out to more stakeholders for their thoughts on the variable weighing system. Furthermore, the weighting scheme only utilized three sociodemographic variables within the ten variables that were provided in the template, so there could be more socioeconomic and demographic social data used in the future to address equity.

## POTENTIAL FUNDING SOURCES

Funding can come from public budgets, state grants, and assistance from private non-profits. Ideally, this project would be funded to fruition with grants. In the summer of 2021, Huntington was able to secure the Indiana DNR's Community and Urban Forestry (CUF) grant for the establishment of the Evergreen Arboretum and Arbor Day celebrations. This matching grant serves to encourage communities throughout Indiana to advance their urban forestry goals. This could be through public tree inventories, urban tree canopy assessments, storm response planning, tree planting, public, and staff education, program outreach, and the establishment and strengthening of local urban forestry goals. Due to the nature of CUF grant eligibility (qualify every other year), along with the CUF Grant not being offered this summer, Huntington will not qualify for the CUF Grant again until 2024. It is recommended that Huntington reapply once this is open to them. Another great option is to write grant proposals for application to the Huntington County Community Foundation "Make a Difference" Grants, which are typically one-time expenditures. Within the City of Huntington, funding is built into a management plan for fallen trees, parks, trails, and greenways. The Duke Energy Foundation is another option, providing the two grants: Local Impact Grant and Nature Grant, which both help strengthen and uplift communities throughout Indiana by providing funding to highlight vibrant economies, climate resiliency, justice, equity, and inclusion. Specifically, both grants offer support for initiatives in land conservation, preparedness and response for natural disasters, including access to green space in historically underserved and environmental justice communities, and communities transitioning to cleaner energy generation. The American Rescue Plan Act (ARPA) funds are also a potential for providing funding for tree maintenance and planting endeavors. Other opportunities that could be utilized by the City of Huntington include contacting Derek Veit, with the Tree Canopy Growth Fund in Fort Wayne, which provides affordable native trees for the sake of trees. Another untapped resource that the city could take advantage of is Mark Kruminaker's Forest, who regularly consults local foresters and has a plethora of native species that could be transplanted to the city for street tree and other uses.

Although the Fellow did not prepare any grant applications nor in-depth, specific site planting plans for Huntington, the attached grant materials document in **Appendix C.** provides guidance on future grants that can be utilized for city tree efforts and a general outline for future Fellows. Grant-giving organizations are usually more favorable to requests that show an in-depth knowledge of the issues, can document and define the need, and can present a prioritized, reasoned approach.

# REFERENCES


Van den Bosch, M., Mudu, P., Uscila, V., Barrdahl, M., Kulinkina, A., Staatsen, B., Swart, W., Kruize, H., Zurlyte, I., Egorov, A.I. (2016). Development of an Urban Green Space Indicator and the Public Health Rational. *Scandinavian Journal of Public Health, 44*, 159–167. https://doi.org/10.1177/1403494815615444

Beacon for Huntington, IN, at https://beacon.schneidercorp.com/Application.aspx?AppID=184&LayerID=2248&PageTypeID=1&PageID=1143

Carmel Forest Management Plan, at https://www.carmel.in.gov/home/showdocument?id=10893

City of Bloomington Tree List, at https://bloomington.in.gov/onboard/meetingFiles/download?meetingFile_id=5475

Columbus Tree Plan, at https://www.columbusufmp.org/#:~:text=All%20are%20critical%20to%20achieving,Across%20All%20Neighborhoods%20by%202030.

Conway, T.M. and Vander Vecht, J. (2015). Growing a Diverse Urban Forest: Species Selection Decisions by Practitioners Planting and Supplying Trees. *Landscape and Urban Planning, 138*, 1–10. https://doi.org/10.1016/j.landurbplan.2015.01.007

Dirr's Hardy Trees and Shrubs (Dirr 2013).

Dwyer, J.F. and Nowak, D.J. (2000). A National Assessment of the Urban Forest: An Overview. Proceedings of Society of 1999 American Foresters National Convention, Portland, OR. https://www.fs.usda.gov/treesearch/pubs/12069

Huntington Comprehensive Plan and CAP, https://www.huntington.in.us/egov/apps/document/center.egov?view=detail&id=2456

Huntington Parks and Recreation Master Plan

Huntington's Neighborhood Tree Planting List (2018), at https://www.huntington.in.us/egov/documents/1658504045_88357.pdf

Indiana Tree Care Manual (4th Edition) (2017)

Indiana Department of Natural Resources, Division of Forestry, Community & Urban Forestry. 2009. Sample Urban Statewide Inventory (SUSI).

"Indiana Community Tree Selection Guide Recommendations" Indiana's City Foresters & IDNR. Community & Urban Forestry. https://newhaven.in.gov/DocumentCenter/View/309/Tree-Selection-Guide-PDF

International Society of Arboriculture. 2005. Benefits of Trees. Tree Care Bulletin. i-Tree Tools. USDA Forest Service. www.itreetools.org

Kyuhyun, B. and Hamlet, A.F. (2018). Projected Changes in Future Climate over the Midwest and Great Lakes Region Using Downscaled CMIP5 Ensembles. *International Journal of Climatology*, 38(51), 531–553. https://doi.org/10.1002/joc.5388

Manual of Woody Landscape Plants (5th Edition) (Dirr 1988) American Forests.

Native Trees of Indiana, Purdue Fort Wayne. https://www.pfw.edu/microsites/native-trees/the-native-trees/index-of-trees?sort=category&cattype=type&cat=conifer

Nowak, D.J. and Greenfield, E.J. (2010). Urban and Community Forests of the North Central East Region. General Technical Report NRS-54. United States Department of Agriculture, Forest Service, Northern Research Station. https://doi.org/10.2737/NRS-GTR-56

Pataki, D.E., Alberti, M., Cadenasso, M.L, Felson, A.J., McDonnell, M.J., Pincetl, S., Pouyat, R.V., Setäla, H., Whitlow, T.H. (2021). The Benefits and Limits of Urban Tree Planting for Environmental and Human Health. *Frontiers in Ecology and Evolution, 9*. https://doi.org/10.3389/fevo.2021.603757

Purcell, Lindsey and Daniel, Kyle. "Tree Selection for the "Un-natural" Environment." Purdue Extension Utility-Friendly Tree List. https://www.extension.purdue.edu/extmedia/FNR/FNR-531-W.pdf

Riley C.B. and Gardiner, M.M. (2020). Examining the Distributional Equity of Urban Tree Canopy Cover and Ecosystem Services across United States Cities. *PLOS ONE, 15(2)*. https://doi.org/10.1371/journal.pone.0228499

Setting Urban Tree Canopy Goals, at http://www.americanforests.org/resources/urbanforests/treedeficti.php, November 2010

Street Tree Cost Benefit Analysis, at https://www.treeconomics.co.uk/wp-content/uploads/2018/08/GBU_Street-Tree-Cost-Benefit-Analysis-2018.pdf

Urban Green Spaces Report

Urban Tree Canopy, https://www.nrs.fs.fed.us/urban/utc/ & https://www.cwp.org/urban-tree-canopy/

"Urban Tree Canopy Assessment: A Community's Path to Understanding and Managing the Urban Forest." Forest Service FS–1121. Urban tree canopy assessment: a community's path to understanding and managing the urban forest. USDA

"Using Trees and Vegetation to Reduce Heat Islands." EPA. 2022. Using Trees and Vegetation to Reduce Heat Islands. US EPA.

Widhalm, M., Hamlet, A., Byun, K., Robeson, S., Baldwin, M., Staten, P., Chiu, C., Coleman, J., Hall, E., Hoogewind, K., Huber, M., Kieu, C., Yoo, J., Dukes, J.S. (2018). *Indiana's Past & Future Climate: A Report from the Indiana Climate Change Impacts Assessment.* Purdue Climate Change Research Center, Purdue University. doi: 10.5703/1288284316634

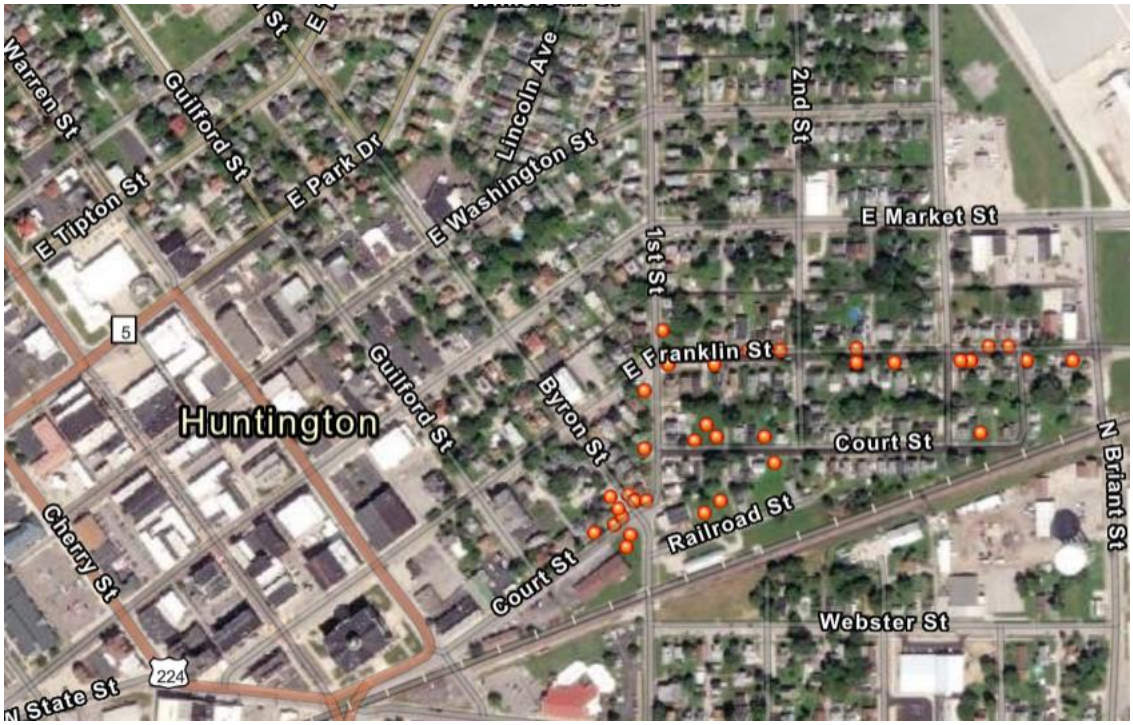
Widhalm, M., Robeson, S., Hall, B., Baldwin, M., Coleman, J. (2018). *Indiana's Climate Trends: A Resource for the Indiana Climate Change Impacts Assessment.* Prepared for the Indiana Climate Change Impacts Assessment, Purdue Climate Change Research Center.

Wolch, J.R., Byrne, J., Newell, J.P. (2014). Urban Green Space, Public Health, and Environmental Justice: The Challenge of Making Cities "Just Green Enough." *Landscape and Urban Planning*, *125*, 234–244. https://doi.org/10.1016/j.landurbplan.2014.01.017

# APPENDICES

A. See attached ArcGIS Pro Methods, written by Hannah Gregory with input from the 2022 UGI Cohort Fellows.

B. Tree Planting Locations and Tree Sizes for Priority Planting Site 1





The two figures above show images of areas where trees could be planted within planting site 1.

*Due to a Field Apps malfunction in the field while noting ROWs, these planting locations may not be viable for use nor comprehensive enough to implement, however, the general process can be used by the next Fellow and/or consulting forester/arborist for further planning and tree planting site selection.

**Table 3*.** Tree Planting Locations & Species Selections for Planting Site 1

| Location | # Trees | Address Number and Tree Size (S/M/L) |
|---|---|---|
| Court St | 18 | Corner of Guildford St. and Court St.- 1 L<br>307-1 L<br>320-1 M or L<br>332- 2 L, 1 S<br>338- 1 L<br>530- 3 M or L<br>562- 1 M or L |
| East Franklin Street | 17 | 503- 1 M or L<br>504- 1 S or M<br>528- 1 M<br>533- 1 L<br>538- 3 S or M<br>703- 2 M or L<br>708- 1 M or L<br>713-1 S<br>728- 1 S or M |

C. See attached outline of Grant Materials

D. See attached Transition Document