



# HAZARD, KENTUCKY COMMUNITY TREE REPORT



PREPARED BY THE URBAN FOREST INITIATIVE  
AT THE UNIVERSITY OF KENTUCKY

## OVERVIEW

Trees offer a multitude of invaluable benefits that positively affect our health and the health of our environment. Trees enhance human well-being by reducing stress, improving happiness and providing green spaces for relaxation and recreation. Beyond their natural beauty, trees play a crucial role in mitigating climate change. Trees intercept run-off and absorb storm-water; they absorb carbon dioxide and filter particulates from the air. They provide shade and lower temperatures through evapotranspiration. Trees enhance biodiversity, providing habitat for various wildlife and enhancing overall ecosystem benefits. Tree have also been shown to enhance property values.



Hazard and Perry County welcome sign, courtesy of Creative Commons



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# PROJECT INFORMATION

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## PROJECT PURPOSE & FUNDING

The University of Kentucky Urban Forest Initiative (UFI) received grant funding through the U.S. Department of Agriculture Landscape Scale Restoration (LSR) Program to evaluate the tree canopy in four Kentucky communities with populations of less than 50,000: Berea, Georgetown, Hazard, and Paducah. The overall project goal is to enhance the community tree canopy, specifically through community forestry education, engagement and outreach, and skills training, with the longer-term goal of enhancing tree stewardship to build community resiliency to climate change.

In winter 2020, the Urban Forest Initiative (UFI) selected Hazard as an appropriate community for inclusion in the project due to its population size (<50K), its geographic location (southeast Kentucky), its topographic characteristics (mountainous), and the presence in the community of an institute of higher education (Hazard Community and Technical College). We initially engaged with individuals in government entities (county, city) and the community college to garner interest in and support for the project. A community visit by the UFI team in April 2021 confirmed its suitability and specific sites in the Hazard community were identified as appropriate for tree mapping.

Hazard is facing the effects of changing climate patterns accompanied by unprecedented flooding. Tree loss associated with these events, coupled with tree loss associated with infestations by introduced exotic insect pests and disease, exacerbates the problems, and creates mounting challenges. Tree canopy assessments can identify potential risks and vulnerabilities, which may enable proactive measures for mitigation and longer term management of tree resources. Understanding the community tree canopy can also guide land use planning decisions, including strategic tree plantings, prioritizing tree care and maintenance, and optimizing allocation of resources for tree-related initiatives. Enhancing Hazard's tree canopy will improve the capacity to intercept stormwater and may reduce downstream impacts associated with heavy rainfall. This report can help identify areas within the community that could benefit from treeing efforts.

Members of the Hazard community have shown a commitment to sustainability and green initiatives, evident in their active participation in tree and environmental programming such as Tree Week and Arbor Day. In this project, local residents were incorporated in community forestry data collection through volunteer opportunities. Others became more deeply trained through the UFI TreeCATs training program (explained later in this document). Direct engagement with local tree resources helps foster a sense of place, collective ownership, and stewardship of natural resources, and ultimately instills an active and engaged cohort of tree advocates. This engagement will empower individuals to raise awareness about the importance of trees and encourage active participation in community forestry initiatives.

This report presents an analysis of tree canopy in Hazard, Kentucky between 2019 and 2023, at the scale of canopy coverage across the city and county, and at specific public sites in Hazard. The report provides information about overall tree canopy coverage, as well as site specific details regarding tree species, size, tree health, and geographic location across specific public sites. Information within this report can contribute to effective management and stewardship of Hazard's community tree resources, contributing to the long-term sustainability, climate resiliency, and well-being of the area.



The Urban Forest Initiative team and Hazard community leaders gather in downtown Hazard to kick-off the tree inventory project.



Hazard community members work together to measure and collect data for a local Ginkgo tree.

## TREE INVENTORY VS. TREE CANOPY ASSESSMENT

A tree inventory and a tree canopy assessment serve distinct but complementary purposes in understanding and managing community forests. A tree inventory is site-specific; it involves systematically cataloging individual trees within a specific area, capturing relevant data such as species, size, condition, and location. A tree inventory helps identify the number, distribution, and diversity of trees, providing a detailed snapshot of a local tree population; it is an outstanding management tool.

In contrast, a tree canopy assessment provides general information about the extent of tree cover within a given area. It involves analyzing spatial coverage of tree canopies, measuring factors such as the percentage of ground shaded by tree canopies, tree density, and vertical stratification. A tree canopy assessment offers insights into the overall benefits provided by the community forest, such as stormwater mitigation, shade provision, temperature regulation, and carbon sequestration. By assessing the canopy, it becomes possible to quantify the ecosystem services provided by trees and understand their contribution to the natural environment.

For this project UFI staff utilized both tree inventory and canopy assessment. Tree inventories were completed at specific sites; canopy assessments were completed using i-Tree Landscape to draw comparisons at different scales and assess patterns within the community. Both lend important insights to the overall composition, value, and potential of Hazard's community forest, and provide guidance for management decisions.<sup>1</sup>

<sup>1</sup>Calculating existing tree canopy coverage is done via aerial imagery and remote sensing using a USFS website called i-Tree Landscape that assesses the natural benefits and fiscal value of urban trees and forests. i-Tree Landscape utilizes various data inputs and analyses regarding ecosystem services provided by trees in a specific landscape. Ecosystem services were calculated using i-Tree Eco.



Inventorying trees on Hazard and Community Technical College Main Campus

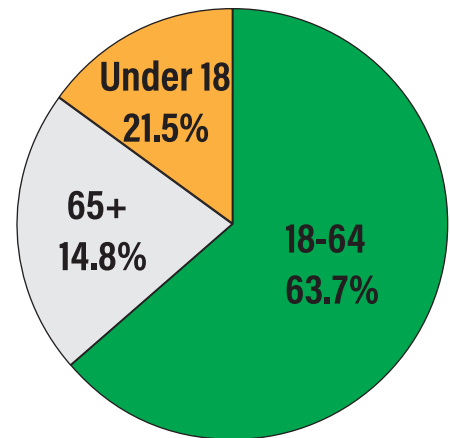
## BACKGROUND

Hazard is situated in the coalfields of southeastern Kentucky near the North Fork of the Kentucky River. It is the county seat of Perry County, which boasts a population of 27,929 (2020 Census Bureau). Like much of eastern Kentucky, Hazard's topography is characterized by steep ridges and valleys ("hollers"). Community development is restricted by useable land, as most of the region has significant topographic challenges and flat land is scarce. Most undeveloped land is covered in hardwood forests with intermittent fast-growing conifers. There are numerous coal mining sites across Perry County that were impacted by mountaintop removal in the early 2000s, a mining method that deployed dynamite to loosen coal-ridden seams across hilltops. This coal extraction method impacts tree canopy cover and hilltop hydrology. As sites lose tree canopy and other natural vegetation, rainwater transport and erosion are exacerbated, stream valleys quickly fill with rainfall, and downstream flooding is worsened.

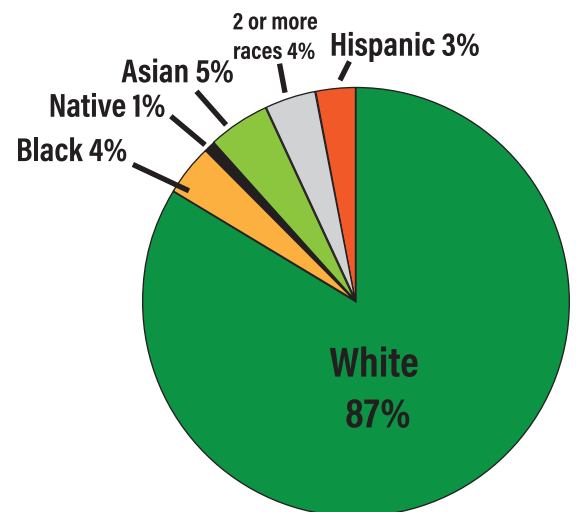
Hazard had its highest population in the 1930s and 1940s when coal mining was in its heyday and nearly 7,400 people lived there. Since then, mining automation has reduced demand for labor and Hazard's population has slowly declined to 5,263 (2020 US Census Bureau). According to the 2020 US Census, Hazard's share of residents under age 18 (21.5%) is lower than the statewide average of 22.3%. Only 15% are older than 65 years, compared to 17.6% for the state.

Nearly 87% of Hazard residents are white; blacks represent 4%, Asians comprise 5%, and 3% of the community identifies as Hispanic. Like many other eastern Kentucky communities, Hazard struggles with a lack of jobs that pay a living wage. Median household income for Perry County in 2021 was \$40,577; 26.7% of Hazard's population is below the poverty line, which is higher than the statewide average of 16.5%.

### AGE DISTRIBUTION OF HAZARD



### RACIAL DISTRIBUTION OF HAZARD



Although still identifying as a coal town, Hazard is also a regional center for commerce and health care within rural eastern Kentucky. Its major employers include Hazard Community and Technical College, Appalachian Regional Healthcare Medical Center, Wayne Supply (a Caterpillar facility focusing on heavy equipment needed in mining), and Sykes Enterprises, a logistics and customer experience company.

Hazard has a vibrant and dynamic downtown, fueled by locally owned small businesses, an emerging artist community, and energy brought by students from Hazard Community and Technical College and the University of Kentucky College of Medicine Center for Excellence in Rural Health. The Lexington Herald-Leader wrote about a phenomenon in which former eastern Kentucky residents are returning home from larger cities (March 2023) and cited an end to the “brain drain” as more natives are investing in their hometowns and starting new businesses.<sup>2</sup> This cultural and economic renaissance has driven increased interest in enhancing the quality and aesthetics of the community, including a desire for a healthy and vibrant community tree canopy; this project report provides a tool to facilitate this.

<sup>2</sup>Childress, Rick. (2023, March 18). "'An Appalachian renaissance:' Why these young people say they're staying in Eastern Ky." *Lexington Herald Leader*. <https://www.kentucky.com/news/state/kentucky/article272979435.html>

## OVERVIEW OF STUDY AREAS

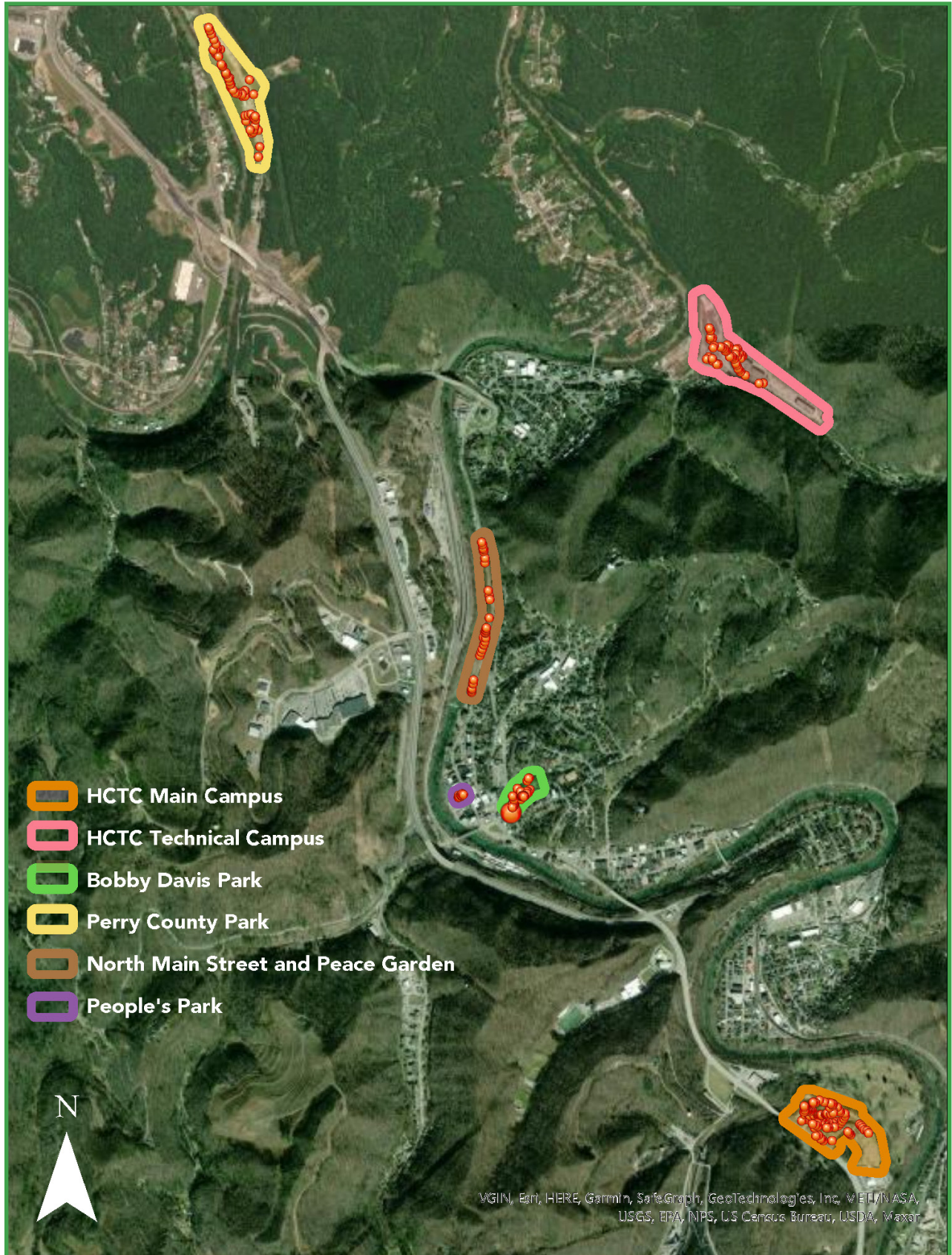
Hazard developed on ribbons of high ground along the KY 15 Bypass and KY 80. For tree mapping and identification, UFI selected sites that were publicly owned. See Figure 1 on following page for map of sites selected.

### Sites Selected

- + Hazard Community & Technical College (HCTC) – Main Campus
  - + HCTC – Technical Campus
    - + Bobby Davis Park
    - + Perry County Park
- + North Main Street/Peace Garden
  - + People’s Park



Figure 1. Sites in Hazard where trees were inventoried and mapped in association with this project.



In total, 284 trees were measured, mapped, identified, and georeferenced across these six sites. Within the city limits, Hazard's tree canopy is 65%, but in developed areas of the community, this drops to ~21%. Predictably, tree abundance, diversity, and health vary among sites.

A breakdown of each site and the number of trees mapped is provided in Table 1, in addition to the collective ecological benefits of trees mapped and measured, as per the methodologies of i-Tree Eco (see Appendix for i-Tree Eco methodologies). Discussion of ecological benefits calculated within the table is provided on the next page.

Table 1. Summary of six tree mapping sites in Hazard and estimates of the ecosystem services those trees provide.

<b>SUMMARY OF ECOSYSTEM BENEFITS ACROSS ALL SITES</b>						
Site	Site Area (Acres)	No. trees mapped	Stormwater captured (gal.)	Pollution removed (oz.)	Carbon sequestered (lbs.)	Monetary benefit (\$)
HCTC (Main campus)	19.6	98	13,681	523	1,403	\$154
HCTC (Technical Campus)	13.9	40	1,177	327	783	\$99
Bobby Davis Park	4	52	1,177	327	767	\$99
Perry County Park	14.6	51	496	220	805	\$85
North Main St/ Peace Garden	3.9	33	416	205	720	\$70
People's Park	0.07	10	40	14	50	\$6
<b>Total</b>	<b>56.07</b>	<b>284</b>	<b>16,987</b>	<b>1,616</b>	<b>4,528</b>	<b>\$513</b>

## ECOSYSTEM BENEFITS

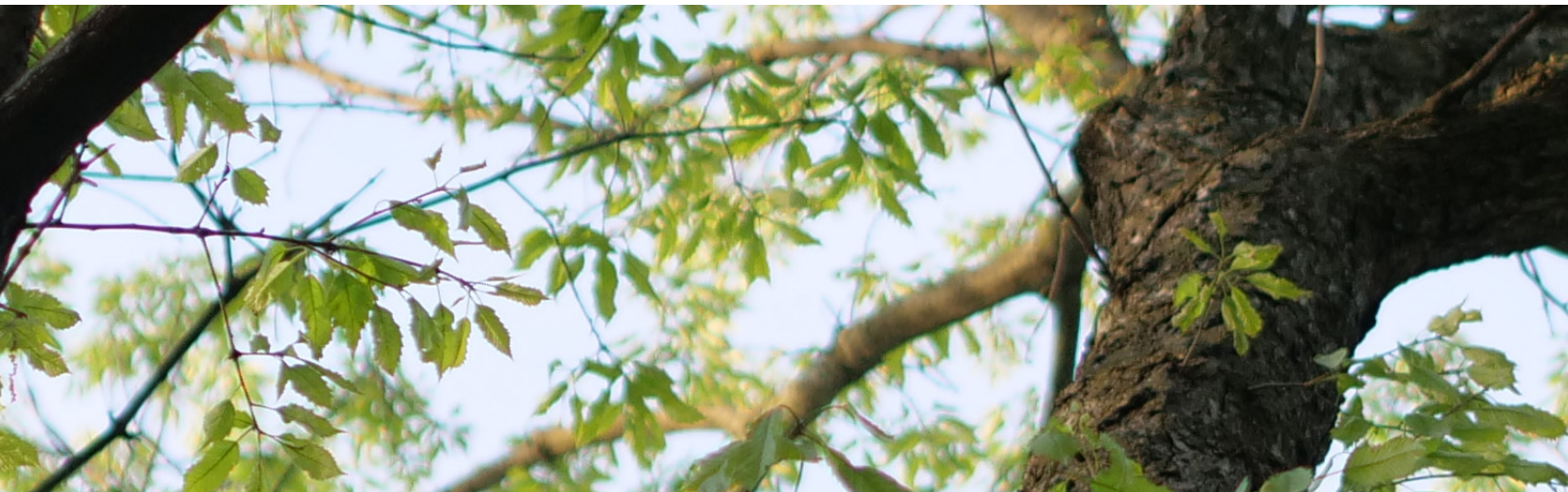
+ **Stormwater captured** is an estimate of the ability of trees measured, based on their size and leaf canopies. This number is a metric which evaluates the trees' ability to reduce erosion caused by falling rain, provide a surface area where rain can land and evaporate, and take up water through root networks and soil infiltration.

+ **Pollution removed** addresses the collective power of trees measured to capture carbon monoxide (CO), nitrogen dioxide (NO<sub>2</sub>), ozone (O<sub>3</sub>), particulate matter less than 2.5 microns (PM2.5), particulate matter between 2.5 and 10 microns (PM10) and sulfur dioxide (SO<sub>2</sub>). These pollutants negatively impact air quality and public health concerns, such as asthma and heart disease.

+ **Carbon sequestered** estimates the amount of atmosphere-warming carbon embedded within the trees measured, including their growth, minus estimated carbon lost through decomposition due to tree mortality. Trees are especially important stores of carbon; through the process of photosynthesis, plants convert carbon dioxide and water into oxygen. Trees absorb carbon dioxide and release oxygen.

+ **Annual monetary benefit** quantifies the three metrics described above; that is, it estimates the monetized value of wholesale ecosystem benefits of trees on site. It estimates the compensatory value trees provide to that site, based on 2016 dollars.

The detailed tree canopy reports with ecosystem benefits summaries for each of the six sites in Hazard follows.



# TREE INVENTORY REPORT

## HAZARD COMMUNITY & TECHNICAL COLLEGE - MAIN CAMPUS

Since its establishment in 1968, HCTC has been an integral part of the Hazard community. It is located on a cleared, ~25-acre site overlooking the North Fork of the Kentucky River. The campus tree canopy is maintained to provide an attractive environment for the campus community. Academic buildings and parking lots are shaded with sizable trees.

In June 2021, 98 trees comprising 18 species were identified and mapped. All trees north of HCTC Stephens Library were mapped. The wooded area in the southeast sector was not incorporated into the analysis.



Figure 2. Trees inventoried and mapped on HCTC Main Campus.

## TREE CANOPY AT HCTC MAIN CAMPUS

Of the mapped trees, hawthorn is most abundant but there are also mature and well-established willow oaks, pin oaks, and red maple. While the hawthorns provide aesthetic value, because of their relatively small size they don't contribute substantially to stormwater mitigation or carbon capture. Focusing on larger, fast-growing, shade-producing native tree species will pay dividends in treeing efforts on this site.

**98** trees  
measured

**18** species  
identified

Table 2. Tree species at HCTC Main Campus having a Relative Importance Value  $\geq$  3% (importance relative to the total number of trees inventoried on site).<sup>3</sup>

HCTC MAIN CAMPUS TREES					
Species (Common name)	Species (Scientific name)	Number of trees	Species relative abundance (%)	Relative basal area (% of site total)	Relative Importance Value (%)
willow oak	<i>Quercus phellos</i>	11	11.2%	20%	15.6%
pin oak	<i>Quercus palustris</i>	9	9.2%	18.8%	14%
hawthorn	<i>Crataegus sp.</i>	18	18.4%	4.1%	11.2%
red maple	<i>Acer rubrum</i>	12	12.2%	8.7%	10.5%
Shumard oak	<i>Quercus shumardii</i>	7	7.1%	11%	9%
northern red oak	<i>Quercus rubra</i>	5	5.1%	10.2%	7.7%
white ash	<i>Fraxinus americana</i>	5	5.1%	2.9%	4%
eastern redbud	<i>Cercis canadensis</i>	6	6.1%	1.4%	3.8%
flowering dogwood	<i>Cornus florida</i>	4	4.1%	2.8%	3.5%
river birch	<i>Betula nigra</i>	1	1%	5.2%	3.1%
	Other	20	20.4%	15%	N/A
	<b>Total</b>	<b>98</b>	<b>100%</b>	<b>100%</b>	<b>N/A</b>

<sup>3</sup> See appendix for definitions of relative abundance, basal area, and importance value.

# TREE INVENTORY REPORT

## HAZARD COMMUNITY & TECHNICAL COLLEGE - TECHNICAL CAMPUS

Sitting on ~14 acres that back up to a woodland, the HCTC Technical Campus is home to many of the college's technical programs and is located approximately 3 miles from the main campus. Forty trees of 10 different species were identified and mapped in June 2021. The woodland located behind campus was not incorporated into this site report.



Figure 3. Trees inventoried and mapped on HCTC Technical Campus.

## TREE CANOPY AT HCTC TECHNICAL CAMPUS

White ash represents the most abundant species but there are also mature and well-established sugar maple, silver maple, and white pine. The white ash are compromised due to infestation by the invasive, tree-killing emerald ash borer. Many of these are beyond rescue and this represents an opportunity for re-treeing; replacing with a diverse set of large, fast-growing, shade-producing native tree species is recommended.

**40** trees  
measured

**10** species  
identified

Table 3. Tree species at HCTC Technical Campus having a Relative Importance Value  $\geq 3\%$  (importance relative to the total number of trees inventoried on site).

HCTC TECHNICAL CAMPUS TREES					
Species (Common name)	Species (Scientific name)	Number of trees	Species relative abundance (%)	Relative basal area (% of site total)	Relative Importance Value (%)
white ash	<i>Fraxinus americana</i>	17	42.5%	20.2%	31.3%
sugar maple	<i>Acer saccharum</i>	5	12.5%	19%	15.7%
silver maple	<i>Acer saccharinum</i>	3	7.5%	20%	13.8%
white pine	<i>Pinus strobus</i>	3	7.5%	10.3%	8.9%
Bradford pear	<i>Pyrus calleryana</i>	3	7.5%	6.7%	7.1%
Kentucky coffee	<i>Gymnocladus dioicus</i>	1	2.5%	8.9%	5.7%
ginkgo	<i>Ginkgo biloba</i>	3	7.5%	3.4%	5.5%
Norway spruce	<i>Picea abies</i>	2	5%	5%	5%
Norway maple	<i>Acer platanoides</i>	1	2.5%	3.9%	3.2%
	Other	2	5%	2.6%	N/A
	<b>Total</b>	<b>40</b>	<b>100%</b>	<b>100%</b>	<b>N/A</b>

# TREE INVENTORY REPORT

## BOBBY DAVIS PARK

Bobby Davis Park overlooks downtown Hazard on about four acres situated between residential and commercial districts. The park has many well-maintained walking paths and is home to a Heritage Herb Garden and the Bobby Davis Museum, which houses historical information and artifacts about Hazard and the region. The park serves as a cultural, historical, and social gathering space for the community and can be rented for events. Fifty-two trees of 15 species were identified and mapped in June 2021.

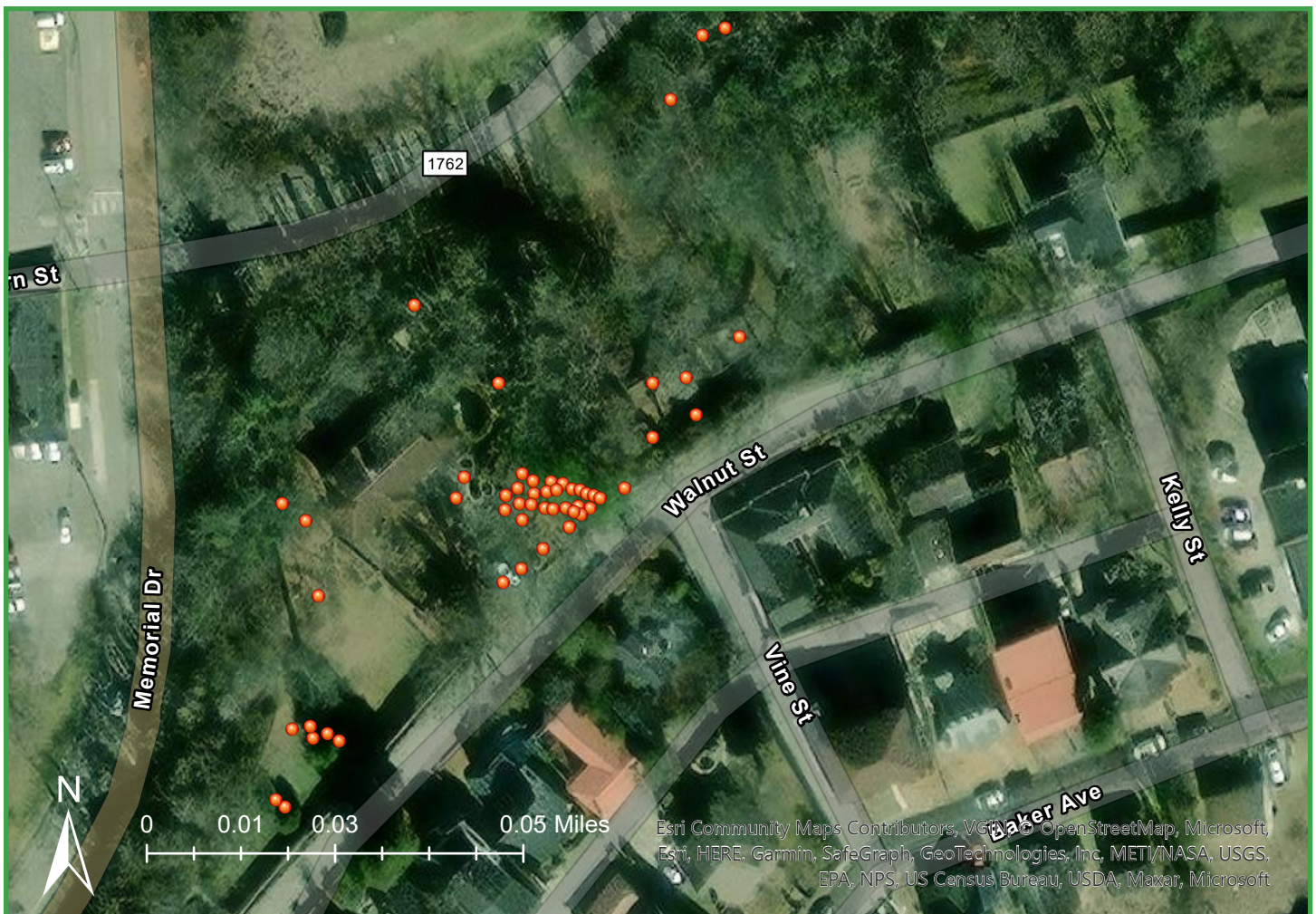


Figure 4. Trees inventoried and mapped at Bobby Davis Park.



## TREE CANOPY AT BOBBY DAVIS PARK

Eastern hemlock represents the most abundant species, but other significant species mapped include southern red oak, flowering dogwood, and sweetgum. The eastern hemlocks are infested with the exotic tree-killing hemlock woolly adelgid; a treatment regime should be implemented to preserve these large trees. Non-native, invasive Bradford pear are also present on site and their proliferation should be prevented in order to maintain and promote the growth of native flora at this site.

**52** trees  
measured

**15** species  
identified

Table 4. Tree species at Bobby Davis Park having a Relative Importance Value  $\geq 3\%$  (importance relative to the total number of trees inventoried on site).

BOBBY DAVIS PARK TREES					
Species (Common name)	Species (Scientific name)	Number of trees	Species relative abundance (%)	Relative basal area (% of site total)	Relative Importance Value (%)
southern red oak	<i>Quercus falcata</i>	7	13.5%	42%	27.7%
sweetgum	<i>Liquidambar styraciflua</i>	5	9.6%	22%	15.8%
eastern hemlock	<i>Tsuga canadensis</i>	10	19.2%	12.1%	15.7%
flowering dogwood	<i>Cornus florida</i>	8	15.4%	1.7%	8.5%
pin oak	<i>Quercus palustris</i>	1	1.9%	12.4%	7.2%
Bradford pear	<i>Pyrus calleryana</i>	5	9.6%	2.2%	5.9%
American holly	<i>Ilex opaca</i>	4	7.7%	0.2%	4%
eastern red cedar	<i>Juniperus virginiana</i>	1	1.9%	4%	3%
	Other	11	21.2%	3.4%	N/A
	<b>Total</b>	<b>52</b>	<b>100%</b>	<b>100%</b>	<b>N/A</b>

# TREE INVENTORY REPORT

## PERRY COUNTY PARK

Perry County Park is one of the largest parks in the county with several options for outdoor recreation; it is located along the North Fork Kentucky River tributary.

In June 2021, 51 trees of 12 species were identified, measured, and mapped. Associated woodlands surrounding the park were not mapped or incorporated into the analysis.



Figure 5. Trees inventoried and mapped at Perry County Park.

## TREE CANOPY AT PERRY COUNTY PARK

Bradford pear, a non-native species, is most abundant. Also prominent are silver maple, eastern redbud, and red maple. Limiting the proliferation of Bradford pear and planting and promoting growth of large, fast-growing, shade-producing native species will benefit this site. Bradford pear do not provide significant shade and are not very resilient to high winds; it is recommended these non-native species be replaced in due time.

**51** trees measured      **12** species identified

Table 5. Tree species at Perry County Park having a Relative Importance Value  $\geq$  3% (importance relative to the total number of trees inventoried on site).

PERRY COUNTY PARK TREES					
Species (Common name)	Species (Scientific name)	Number of trees	Species relative abundance (%)	Relative basal area (% of site total)	Relative Importance Value (%)
Bradford pear	<i>Pyrus calleryana</i>	16	31.4%	38.9%	35.2%
silver maple	<i>Acer saccharinum</i>	11	21.6%	18.1%	19.8%
shumard oak	<i>Quercus shumardii</i>	1	2%	21.1%	11.5%
eastern redbud	<i>Cercis canadensis</i>	6	11.8%	3.5%	7.6%
red maple	<i>Acer rubrum</i>	6	11.8%	1.7%	6.7%
boxelder	<i>Acer negundo</i>	3	5.9%	4.2%	5%
white ash	<i>Fraxinus americana</i>	1	2%	5.6%	3.8%
Machurian walnut	<i>Juglans mandshurica</i>	2	3.9%	2.7%	3.3%
ornamental crabapple	<i>Malus sp.</i>	1	2%	3.5%	2.8%
	Other	4	7.8%	0.6%	N/A
	<b>Total</b>	<b>51</b>	<b>100%</b>	<b>100%</b>	<b>N/A</b>

# TREE INVENTORY REPORT

## NORTH MAIN STREET + PEACE GARDEN

Running through the heart of downtown, North Main Street and its adjacent Peace Garden comprise a scenic throughfare lined with historic buildings and modern establishments, with a bridge crossing over the Northern Fork of the Kentucky River.

In June 2021, 33 trees were measured and mapped, and five species were identified.

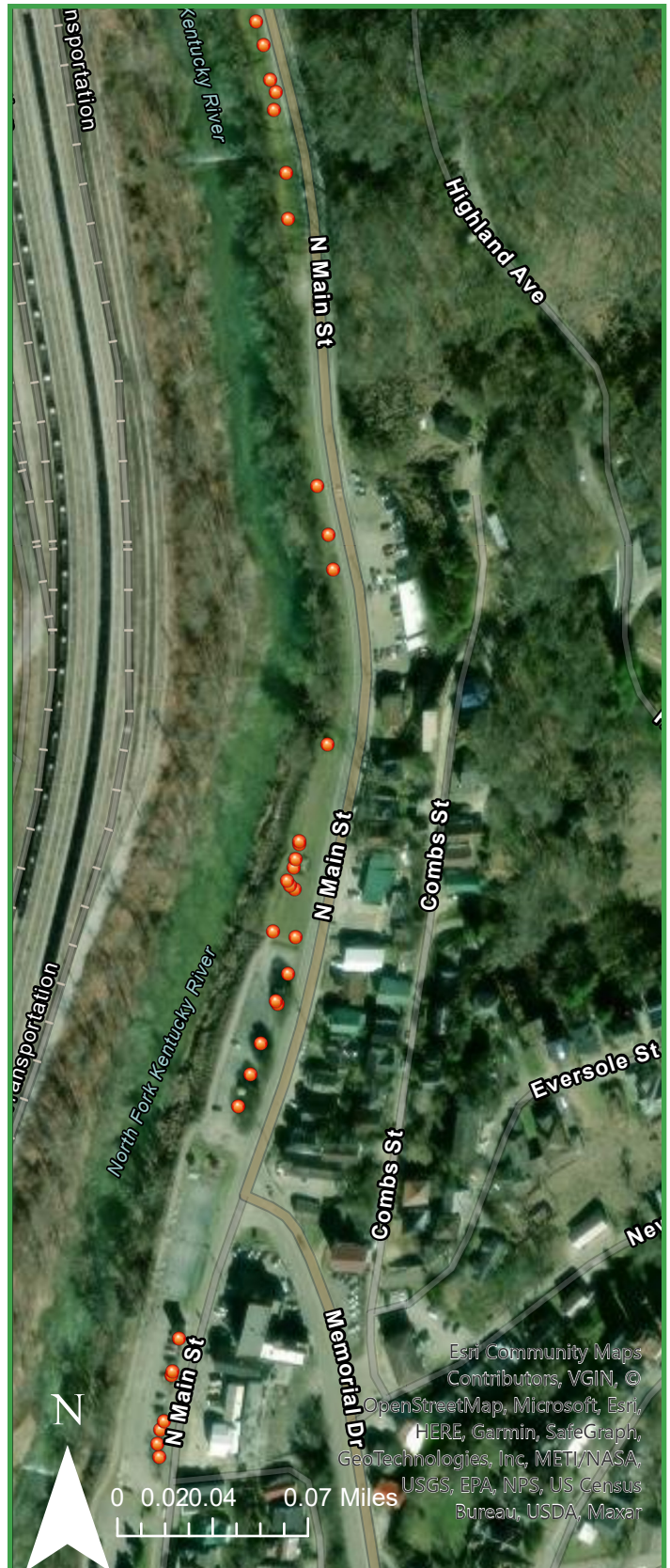


Figure 6. Trees inventoried and mapped at North Main Street and Peace Garden.

## TREE CANOPY AT NORTH MAIN STREET + PEACE GARDEN

The most abundant species are the non-native Bradford pear and flowering dogwood. Preventing proliferation of the Bradford pear into surrounding woodlands and working toward their replacement with a diverse set of native species is advisable. Keeping an interesting mix of trees with appropriate characteristics for the area and managing for aesthetics are important for this site.

**33** trees  
measured

**5** species  
identified

Table 6. Tree species at North Main Street/Peace Garden having a Relative Importance Value  $\geq 3\%$  (importance relative to the total number of trees inventoried)

NORTH MAIN STREET + PEACE GARDEN TREES					
Species (Common name)	Species (Scientific name)	Number of trees	Species relative abundance (%)	Relative basal area (% of site total)	Relative Importance Value (%)
Bradford pear	<i>Pyrus calleryana</i>	13	39.4%	74.3%	56.9%
flowering dogwood	<i>Cornus florida</i>	13	39.4%	12.2%	25.8%
eastern redbud	<i>Cercis canadensis</i>	2	6.1%	10.3%	8.2%
ornamental cherry	<i>Prunus sp.</i>	4	12.1%	3.1%	7.6%
silky dogwood	<i>Cornus amomum</i>	1	3%	0%	1.5%
	<b>Total</b>	<b>33</b>	<b>100%</b>	<b>100%</b>	<b>N/A</b>

# TREE INVENTORY REPORT

## PEOPLE'S PARK

People's Park is an approximately 0.07-acre (~3000 ft<sup>2</sup>) greenspace situated between two buildings on Main Street directly across from the Perry County Courthouse. Surrounded by benches, it is a place to enjoy lunch or take a break from the workday.

In June 2021, ten trees were mapped and three species were identified.



Figure 7. Trees inventoried and mapped at People's Park.

## TREE CANOPY AT PEOPLE'S PARK

Of the three species, Chinese dogwood are most abundant, followed by American beech. This site should be managed for aesthetics and for keeping the trees a manageable size. Given the physical constraints of the site, the beech trees may outgrow their space; they should be managed for height and shape.

**10** trees  
measured

**3** species  
identified

Table 7. Tree species at People's Park having a Relative Importance Value  $\geq$  3% (importance relative to the total number of trees inventoried on site).

PEOPLE'S PARK TREES					
Species (Common name)	Species (Scientific name)	Number of trees	Species relative abundance (%)	Relative basal area (% of site total)	Relative Importance Value (%)
Chinese dogwood	<i>Cornus kousa</i>	5	50%	85%	67.5%
American beech	<i>Fagus grandifolia</i>	4	40%	5.3%	22.7%
flowering dogwood	<i>Cornus florida</i>	1	10%	9.7%	9.9%
	<b>Total</b>	<b>10</b>	<b>100%</b>	<b>100%</b>	<b>N/A</b>

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## PROJECT OUTCOMES

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+ **Tree inventory:** A total of 284 community trees were mapped, identified, and georeferenced across six sites in the community. Site reports and ecosystem services were generated for each.

+ **Training:** TreeCATs is a 20-hour virtual urban and community forestry workshop exposing participants to concepts addressing urban and community forestry infrastructure, tree identification and stewardship, tree pests and diseases, planning and design, trees and wellness, greenspace equity, and career paths. Offered by UFI annually, TreeCATs workshops have graduated 90 students to date, including 8 from Hazard as a part of this project (2 in 2022, 4 in 2021, 2 in 2020). Hazard TreeCATs have leveraged the knowledge, skills, and professional connections that they've acquired through this program into active engagement in tree stewardship within the Hazard community.

+ **Education:** Several Hazard TreeCATs have used their training as impetus to develop an ad hoc tree advisory committee, which is an essential step for obtaining certification as a Tree City USA community ([arborday.org/programs/treecityusa/](http://arborday.org/programs/treecityusa/)).

+ **Engagement:** Tree Week is an annual event celebrating trees and greenspaces where we live. Hazard has had Tree Week engagement for several years, but this project served to fuel further enthusiasm and engagement.

+ **Employment:** Education and work force development prospects. Hazard is included in UFI's application for Urban and Community Forestry funding from the federal 2023 Inflation Reduction Act. UFI submitted a multimillion dollar proposal to educate, engage, and employ future generations in urban and community forestry; the subaward to HCTC would be \$1.6 million. This workforce development grant will provide UCF training, include an experiential component, and provide opportunities for future employment in the region.



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# SUGGESTIONS

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## RECOMMENDATIONS FOR HAZARD'S TREE CANOPY

+ **Develop a Tree Management Plan.** Create a comprehensive tree management plan that outlines goals, strategies, and guidelines for tree planting, maintenance, and removal. The plan should address tree species selection, planting locations, maintenance practices, and long-term care.

+ **Protect mature trees.** Large trees provide the greatest benefits, so protect them now and into the future! Develop and enforce a clearly defined plan for tree protection during construction and development efforts. Outstanding examples of a diverse mix of mature trees can be found at Bobby Davis Park, where the eastern hemlock are interspersed with southern red oak and sweetgum. The Urban Tree Foundation (UTF) provides many useful resources for cities in the form of tree protection, planting and care standards and specifications, all found online at [urbantree.org](http://urbantree.org).

+ **Consider replacing non-native trees.** Trees situated along Main Street include Bradford pears, which are not native to Kentucky and are invasive. Bradford pears have spread throughout the state, causing damage to natural habitats and pushing out native species. This species is often selected for their shape and quick growth, but they are short-lived, their wood is weak, and they are not resilient to windstorms. A long term tree canopy plan should include plans to replace these trees.

+ **Mulching.** Across the six sites surveyed, most trees lacked mulching, which is an easy and highly effective means of caring for trees. Officials should consider using coarse organic mulch 3 – 5" deep (except near the tree trunk where there should be none), ideally extending to the canopy edge. Proper mulching prevents damage from mowers and string trimmers and also improves soil structure and moisture retention.

+ **Install smaller trees strategically throughout the landscape.** People's Park contains ten trees on a small (3,000 sq ft) site, including four American beech which will likely grow very tall, in a way that outsizes their small site capacity. Additionally, these trees likely suffer root compaction due to the constricted footprint of plantable land in the park. Smaller scale trees should be placed here, and the beech trees should be managed for height and aesthetics.

+ **Plant properly.** Properly plant young trees in appropriate locations (account for maximum height and ensure adequate rooting space) to avoid conflicts with wires, buildings, and pavement. Provide plenty of water for the first 3 years while new roots establish.

## ADDITIONAL RECOMMENDATIONS

The Arbor Day Foundation has numerous programs designed to recognize, enhance, and protect community tree canopies by providing recognition to entities that work to that goal. Hazard has many entities that are strong candidates for these prestigious awards.

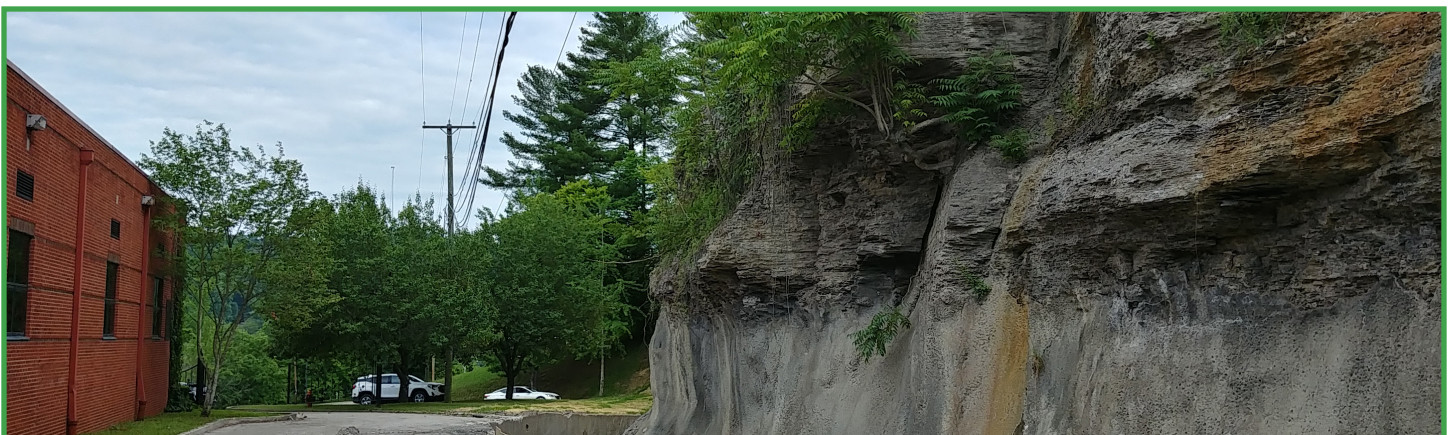
**+ Tree City USA:** Developed by the Arbor Day Foundation to honor communities demonstrating a commitment to effective tree canopy management. Hazard is well on its way to meeting the Tree City USA criteria, including taking significant steps to establish a tree advisory board, implement a community forestry program, observe Arbor Day with public celebrations, and allocating funds for tree care.

Hazard has an ad-hoc Tree Advisory Committee, but the City of Hazard should consider appointing a Tree Advisory Board, adopt a tree protection ordinance, and make progress toward becoming a Tree City USA. Details on how to become a Tree City can be found at [arborday.org/programs/treecityusa](http://arborday.org/programs/treecityusa).

**+ Tree Campus Higher Education USA:** Tree Campus Higher Education USA is a companion program that can provide HCTC with attainable goals to promote their campus tree canopy and create a sense of place for their students. Involving students in tree-related service learning projects helps grow the next generation of tree advocates. Additionally, trees can significantly reduce energy consumption on campus, as well as absorb carbon dioxide and mitigate impacts of climate change.

**+ Tree Campus K – 12:** This program is an initiative aimed at promoting environmental education and advocacy among students from kindergarten through high school. It encourages implementing tree planting and care projects, fostering a deeper connection to nature as well as a sense of responsibility for their local tree canopy.

**+ Tree Campus Health Care:** This program is designed to promote the integration of green spaces and trees in healthcare facilities. Through this initiative, healthcare institutions are encouraged to plant trees and implement nature-based therapies, recognizing the positive impact of trees on patient well-being and staff morale.



Winding road in Hazard lined with trees

## BEYOND THE BASICS: WHAT CAN HAZARD DO?

There are numerous ongoing efforts beyond this Landscape Scale Restoration project that promote community forestry in Hazard. These include:

+ **Arbor Day:** Tree planting initiatives on reclaimed surface mines have engaged dozens of school age children from the community. Kentucky Power officials have distributed free trees to interested residents, and UFI has partnered with Kentucky Division of Forestry to distribute additional free seedlings to Hazard residents.

+ **Pathfinders:** Pathfinders of Perry County is a non-profit citizen action group that promotes community well-being, engagement, outdoor recreation, and education. Pathfinders members are engaged in tree outreach activities and contributed to the tree mapping efforts summarized in this report. Pathfinders can serve as important tree ambassadors in the region.



Appalachian Mountains, photo courtesy of pixabay.com

- + **Promote Tree Planting and Green Spaces:** Encourage community members to plant and care for trees on their properties. Organize tree planting initiatives in public spaces, parks, and along streets. Promote the benefits of green spaces and educate residents about the positive impacts of trees on the environment, health, and quality of life.
- + **Engage and Educate the Community:** Conduct workshops, seminars, and educational campaigns to raise awareness about urban and community forestry. Teach community members about proper tree care, the importance of biodiversity, and the role trees play in mitigating climate change and improving air quality.
- + **Establish Partnerships:** Collaborate with local government agencies, nonprofit organizations, and businesses to support urban forestry initiatives. Seek partnerships to secure funding, expertise, and resources for tree planting, maintenance, and education programs.
- + **Implement Tree Inventories and Monitoring:** Expand tree inventory to further assess the existing tree population in the community. Use the data to identify areas where tree planting is needed and to monitor the health and growth of existing trees. Regular monitoring helps identify issues such as pests, diseases, or hazardous trees that require attention.
- + **Implement Tree Protection Policies:** Advocate for tree protection ordinances and policies that regulate tree removal and encourage tree preservation during development projects. Encourage the enforcement of existing tree protection regulations and work towards strengthening them if needed.
- + **Foster Community Engagement:** Organize volunteer events, tree care workshops, and community tree planting days to engage residents actively. Encourage community ownership and involvement in urban forestry projects by establishing neighborhood tree stewardship programs or tree adoption programs.
- + **Support Professional Training and Certification:** Provide opportunities for individuals to receive training and certification in urban forestry and arboriculture. This helps ensure that there are skilled professionals available to guide and assist with tree planting, maintenance, and tree care practices within the community.
- + **Monitor and Evaluate Progress:** Regularly assess the effectiveness of urban and community forestry initiatives. Monitor the growth and health of trees planted, track community engagement, and evaluate the impact of urban forestry efforts on the environment and community well-being.

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# APPENDIX

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## METHODOLOGY

The following terms are commonly used to describe trees.

- + **Relative abundance (%)** is defined as the number of individuals of a species (or genus, or family) out of the total number of trees in a given area.
- + **Basal area** is a measure of the trunk area an individual tree occupies, which is strongly correlated with the canopy size. Basal area is calculated using: Basal area =  $\pi * r^2$ ; where  $r$  = radius (1/2 of tree DBH).
- + **Relative basal area** is the sum of the basal area of each tree of a given species divided by the total basal area of all trees in the area.
- + **Importance value** is an average of the relative basal area and relative abundance of each tree species. Here 'importance value' refers to the extent to which a tree species occupies a given land area, calculated from the proportion of individual trees (relative abundance) and proportion of tree basal area (relative basal area) of each tree species relative to the total.
- + **Diameter at breast height (DBH)** is a common measure of tree size and is defined as trunk diameter 4.5 feet above the ground. Many factors can affect tree size and growth, including species, age, site, soil, and land use history.

### Data Collection Tools: Arc Collector, Microsoft Excel, and i-Tree Eco

Tree inventory data were collected using Arc Collector, a mobile field data collection application developed by Environmental Systems Research Institute (ESRI) using a tree inventory form developed by Nic Williamson (ISA Certified Arborist; former UFI Coordinator). Statistics on tree diversity, size and health were collected analyzed and graphs were created using Microsoft Excel. Information on tree ecosystem benefits was calculated using i-Tree Eco©, a peer-reviewed and freely available software.

## Data Collection Process & Volunteer Training

UFI tree experts trained staff and volunteers to provide the knowledge and skills needed for accurate data collection, and a quality control process was implemented to ensure reliability and consistency. Trained supervisors and experienced arborists were present during data collection, actively overseeing data collection and providing real-time guidance and support.

By incorporating volunteer training and implementing quality control measures the tree inventory data collection process benefited from a collaborative and systematic approach. Incorporating volunteer tree mappers fosters community engagement and participation and strengthens one's sense of place. Our quality control checks ensured production of reliable and high-quality data that will serve as a valuable resource for community planning, tree management, and decision-making processes.

Enthusiasm for the project was amplified by inclusion of HCTC students in UFI's Spring 2021 virtual TreeCATs (Community Arboriculture Trainees) training, wherein several HCTC students and Hazard community members were paid a \$200 stipend to participate in the five-week online course which covers urban and community forestry.

With assistance from a HCTC Pathfinder volunteer, in June 2021 the UFI team mapped and inventoried trees at the Hazard Community and Technical College (HCTC) Main Campus and HCTC Technical Campus; Bobby Davis Park; Perry County Park, North Main Street/ Peace Garden; and People's Park. Individual trees within a designated area were identified, measured, and georeferenced.





Appalachian Mountain scenery, photo courtesy of unsplash.com

# Downtown, North Main Street

Hazard, KY



## Background

In June 2021, the University of Kentucky Urban Forest Initiative (UFI) team mapped trees at several sites around Hazard, including a section of N. Main St. between City Hall and the Coastal gas station (mapped trees appear as pink dots in above map). Here is a tree canopy summary of our findings. This effort was part of the UFI Landscape Scale Restoration project.

## About the Trees

**33 trees, 5 species**

The trees along North Main St. in Hazard are important public trees for pedestrians on the River Arts Greenway and for motorists traveling to and from downtown. This greenspace has ample overlooks to the North Fork Kentucky River, and a number of flowering landscape trees which would create visual appeal, particularly in spring. The largest trees along this stretch were the Callery ('Braford') pear, which is problematic due to this species' tendency to invade native ecosystems.

Trees mapped along North Main St.

Tree species	# of trees	% total
Bradford pear	13	39%
flowering dogwood	13	39%
ornamental cherry	4	12%
eastern redbud	2	6%
silky dogwood	1	3%
total	33	100%

### Overall health



### Species diversity



### Size diversity



## Considerations

- N. Main St. trees are in **good health** and provide a fair number of **tree benefits** (e.g. visual appeal to downtown) at this important public roadway.
- N. Main St. had **poor species diversity**, largely due to the presence of many Bradford pear trees. This species, widely planted in decades past, is now a known invasive species. N. Main St.'s maturing Bradford pears are an abundant seed source that birds will readily spread, and can ultimately result in the crowding out of native trees and ecosystems.
- Dogwoods, cherries and redbuds are smaller growing species, ideal on this stretch of road where rooting space is limited and overhead utility wires exist. There are areas where large canopied trees could be planted. With proper care, current trees and those yet to be planted will grow and provide valuable shade to the park and walking path, enhancing the **size diversity** of trees at this important public space.



## Beware...Bradford pear

Bradford pear's beautiful spring bloom led in its widespread planting. Poor structure, resulting in frequent branch failures in wind, snow and ice, and this species' severe threat (KY Exotic Pest Plant Council) to native ecosystems create problems for the health of our community forests.



# Learn more about your trees and what they do for you!

## Common Hazard trees\*

\*based on 282 trees from 6 sites in 2021.



Bradford pear



flowering dogwood



white ash



red maple



eastern redbud

Need help identifying trees? Try reaching out to your local extension agent! Many great resources can also be found at [https://forestry.ca.uky.edu/tree\\_id](https://forestry.ca.uky.edu/tree_id). Photos courtesy of Janet James.



## What's best for your yard?

Hazard is located in the Appalachian Plateau ecoregion of Kentucky, known for its mountainous terrain. Whether you'd like a large shade tree or small decorative tree, there are many good choices! When picking a tree, consider:

- available space
- nearby trees
- exposure to elements (sunlight, water, poor soils, winds, roads)

Use the Linktree URL at the bottom of the page, which contains many resources including species suggestions for your region. Check for conflicts with sidewalks, power lines, and underground utilities that will affect your choice.



## Take care of the trees you do have!

Young trees need care during their first few years to become established. Be sure to:

- water regularly, especially during periods of hot, dry weather
- mulch properly with 2"-4" of coarse, organic mulch
  - maintain space between the mulch and the tree trunk
- prune lightly to develop good structure as the tree grows to avoid problems later



Enjoy your trees!

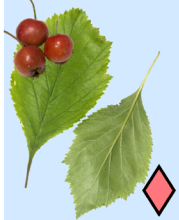
<https://linktr.ee/uficomunitytreeproject>

# Hazard Community and Technical College Main Campus Tree Canopy



## Top 5 HCTC trees\*

\*based on 98 trees mapped in 2021



Hawthorne



Red maple



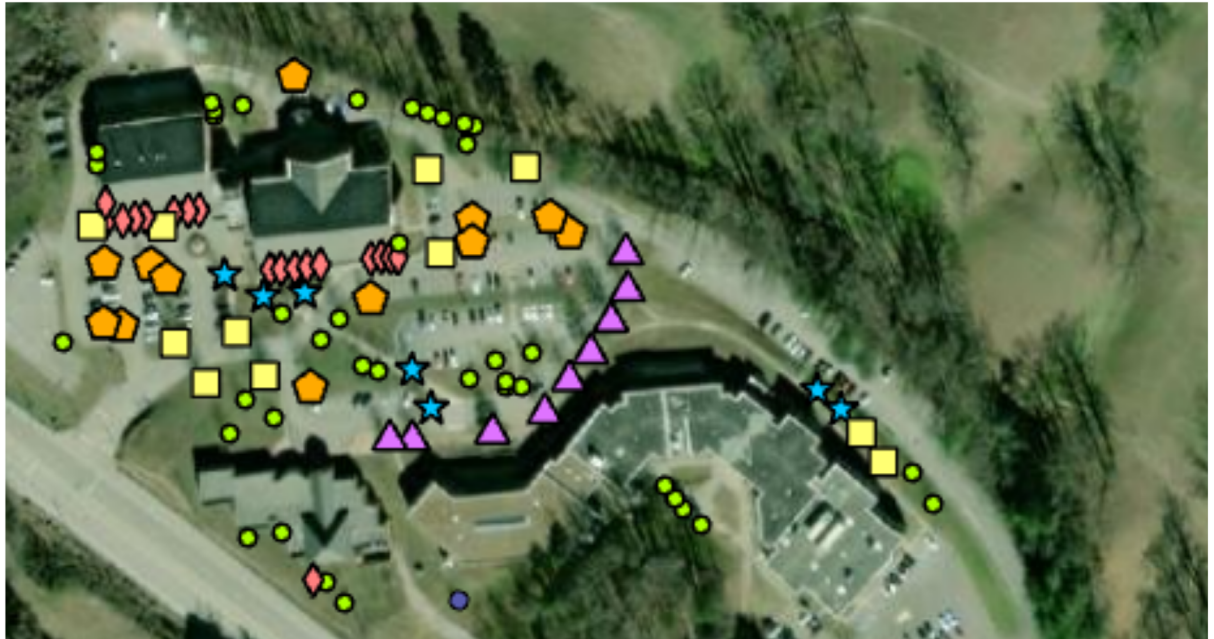
Willow oak



Pin oak



Shumard oak

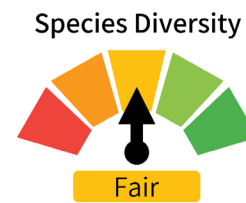


HCTC's campus is home to 98 trees made up of 20 different species. These trees act to protect the environment through the benefits listed below, such as capturing stormwater and sequestering carbon. But trees also provide many other benefits! In addition to being beautiful and providing much needed shade, they benefit the mental and physical health of all of us on campus. Maintaining a diverse, healthy tree canopy is important to protecting those benefits! Do you see spots on campus where our tree canopy could be improved?



**Annual tree benefits... and growing!**

**13,681** gallons of stormwater captures



**523** ounces of pollution removed

**1,403** pounds of carbon sequestered



**\$202,301** replacement value (total, not annual)

Tree species	# of trees	% total
◆ Hawthorne	18	18%
◆ Red maple	12	12%
□ Willow oak	11	11%
△ Pin oak	9	9%
★ Shumard oak	7	7%
● other	41	42%
<b>total</b>	<b>98</b>	<b>100%</b>

Scan here to learn more and read the full, in-depth report on the UFI website!

Data for this report was collected by the University of Kentucky Urban Forest Initiative team and Hazard volunteers in June 2021.

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## RESOURCES + CITATIONS

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### ADDITIONAL RESOURCES

**Ecological regions of Kentucky:** [uky.edu/hort/Ecological-Regions-of-Kentucky](http://uky.edu/hort/Ecological-Regions-of-Kentucky)

**Tree Identification Resources:** [forestry.ca.uky.edu/tree\\_id](http://forestry.ca.uky.edu/tree_id)

**Urban Tree Foundation:** [urbantree.org](http://urbantree.org)

**Trees are good, tree owner information:** [treesaregood.org/treeowner](http://treesaregood.org/treeowner)

**Green Cities, Good Health:** [depts.washington.edu/hhwb](http://depts.washington.edu/hhwb)

**Vibrant Cities Lab:** [vibrantcitieslab.com](http://vibrantcitieslab.com)

**Tree Equity Score:** [treeequityscore.org](http://treeequityscore.org)

### CITATIONS

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## PROJECT TEAM

The UK LSR Team includes UFI co-leads Mary Arthur, Ph.D., emeritus professor of Forestry, Lynn Phillips, Ph.D., A.I.C.P, Associate Professor of Geography, Lynne Rieske-Kinney, Ph.D., Professor of Forest Entomology, and Chris Sass, Ph.D., Associate Professor of Landscape Architecture. The broader LSR team includes Ned Crankshaw, Ph.D., Professor of Landscape Architecture and Interim Dean of the College of Design, (LA, Design), Ellen Crocker, Ph.D., Assistant Professor of Forestry Extension, Jonathan Larson, Ph.D., Assistant Professor of Entomology Extension, Mr. Rob Paratley (Adjunct Instructor of Forestry), Jeff Stringer, Ph.D., Professor of Forestry Extension, Mr. Shane Tedder, UK Facilities Sustainability Coordinator), Nic Williamson (Facilities, former UFI Coordinator and Forestry Extension), Grace Coy (former UFI Coordinator and Forestry Extension), Shelby Grow and Allison Eades (former UFI Outreach Coordinators and LA). The tree mapping efforts of UFI interns Felix Lowery and James Worthington, and Pathfinders intern Jadyne Hughes, form the basis of the site reports.

## ABOUT THE URBAN FOREST INITIATIVE

The Urban Forest Initiative (UFI) at the University of Kentucky works to improve understanding and appreciation of the role of trees in and near human communities. UFI focuses on tree inventory work on community trees, linking those trees to the ecosystem benefits they provide while addressing areas for improvement in the diversity and distribution of trees among species, age, and size. UFI also contributes to the greater collaborative network of community forestry professionals and advocates across the state to promote sharing knowledge and best practices of tree canopy stewardship in and beyond Kentucky.

