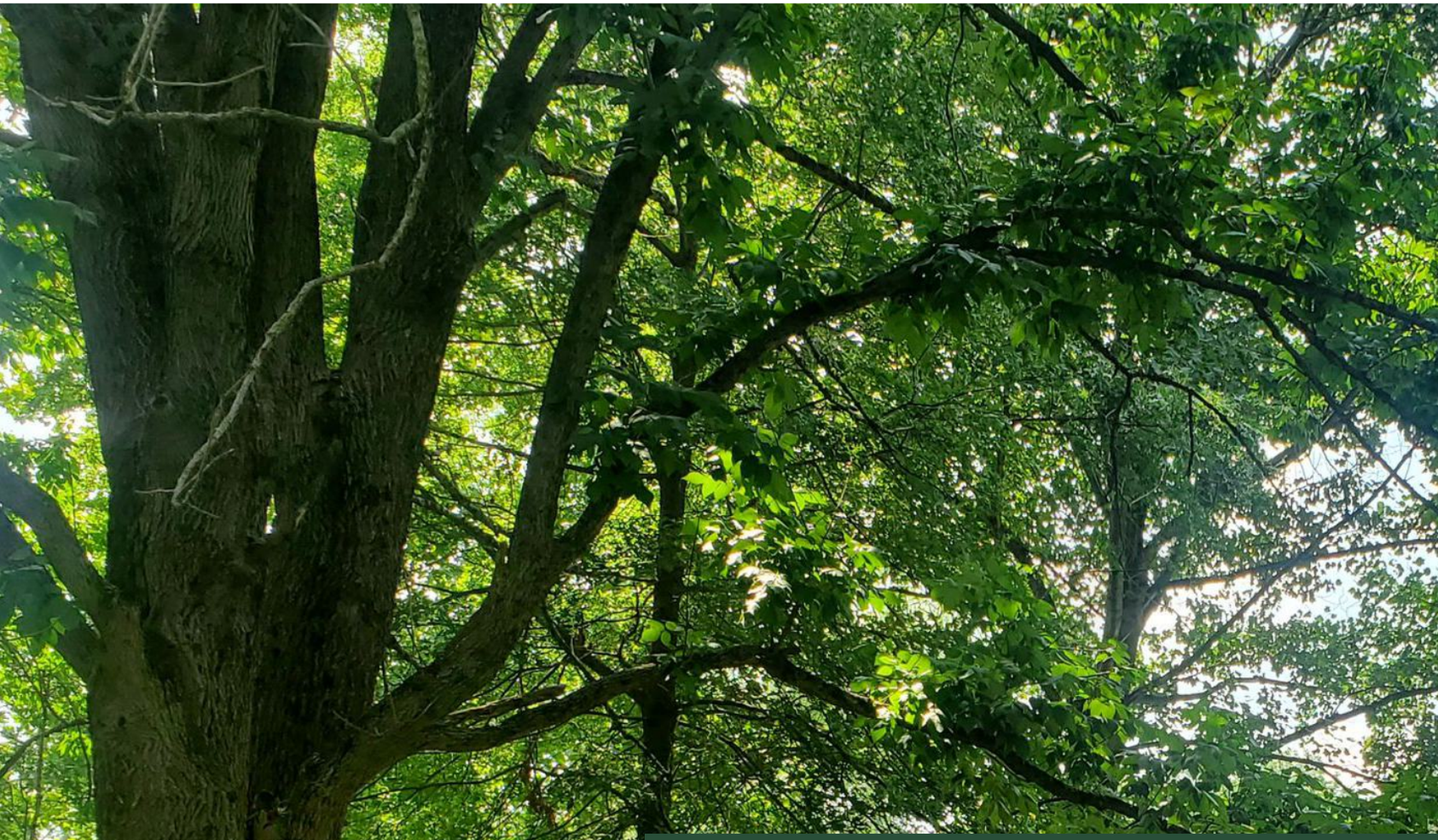


Tree Canopy Assessment 2010-2022

Delaware County, PA

PREPARED BY:

The University of Vermont

PREPARED FOR:

Delaware County, Pennsylvania

May, 2025

THE NEED FOR GREEN

Trees provide essential ecosystem services, like reducing stormwater runoff, cooling the pavement in the summer and providing wildlife habitat. Trees are an indispensable part of Delaware County's infrastructure. Research shows that these green assets can improve social cohesion, reduce crime, and raise property values.

As with any community, Delaware County faces a host of environmental challenges while seeking to balance development and conservation. A healthy and robust tree canopy is crucial for maintaining this balance, providing the Delaware County community with a resource that will impact the health and well-being of generations to come.

TREE CANOPY ASSESSMENT

For decades governments have mapped and monitored their infrastructure to support effective management practices. Traditionally, that mapping has primarily focused on gray infrastructure, including features such as roads and buildings; however green infrastructure, like trees, is often unaccounted for. The Tree Canopy Assessment protocols were developed by the USDA Forest Service to address this deficiency and help communities better understand their green infrastructure through tree canopy mapping and analytics.

A Tree Canopy Assessment can provide vital information to help governments and residents chart a greener future by helping them understand the tree canopy they have, how it has changed, and where there is room to plant additional trees. Since the development of this protocol, Tree Canopy Assessments have been carried out for over 100 communities in North America. In partnership with the Delaware County Office of Sustainability, the University of Vermont Spatial Analysis Lab and SavATree Consulting completed the following study to address tree canopy in Delaware County. A high-level geospatial analysis was completed over the 2010 - 2022 timeframe to better understand losses, gains, and overall changes to the canopy. This study did not identify species, health, or causes of change within the canopy. Further consultation would be required for these components.

Tree Canopy is defined as the layer of leaves, branches, and stems that provide tree coverage of the ground when viewed from above.

THE TREE CANOPY ASSESSMENT PROCESS

This project employed the USDA Forest Service's Urban Tree Canopy assessment protocols and made use of federal, state, and local investments in geospatial data. Tree canopy assessments should be completed at regular intervals, every 3-5 years.

Data from remote sensing forms the foundation of the tree canopy assessment. We use high-resolution aerial imagery and LiDAR to map tree canopy and other land cover features.

The land cover data consist of tree canopy, grass/shrub, bare soil, water, buildings, roads/railroads, and other impervious features.

The land cover data are summarized by various geographical units, ranging from the property parcel to the watershed to the municipal boundary.

The report (this document) summarizes the project methods, results, and findings.

These tree canopy metric summaries are an exhaustive geospatial database that enables the Existing and Possible Tree Canopy to be analyzed.

The tree canopy metrics data provide basic summary statistics in addition to inferences on the relationship between tree canopy and other variables.

The presentation, given to partners and stakeholders in the region, provides the opportunity to ask questions about the assessment.

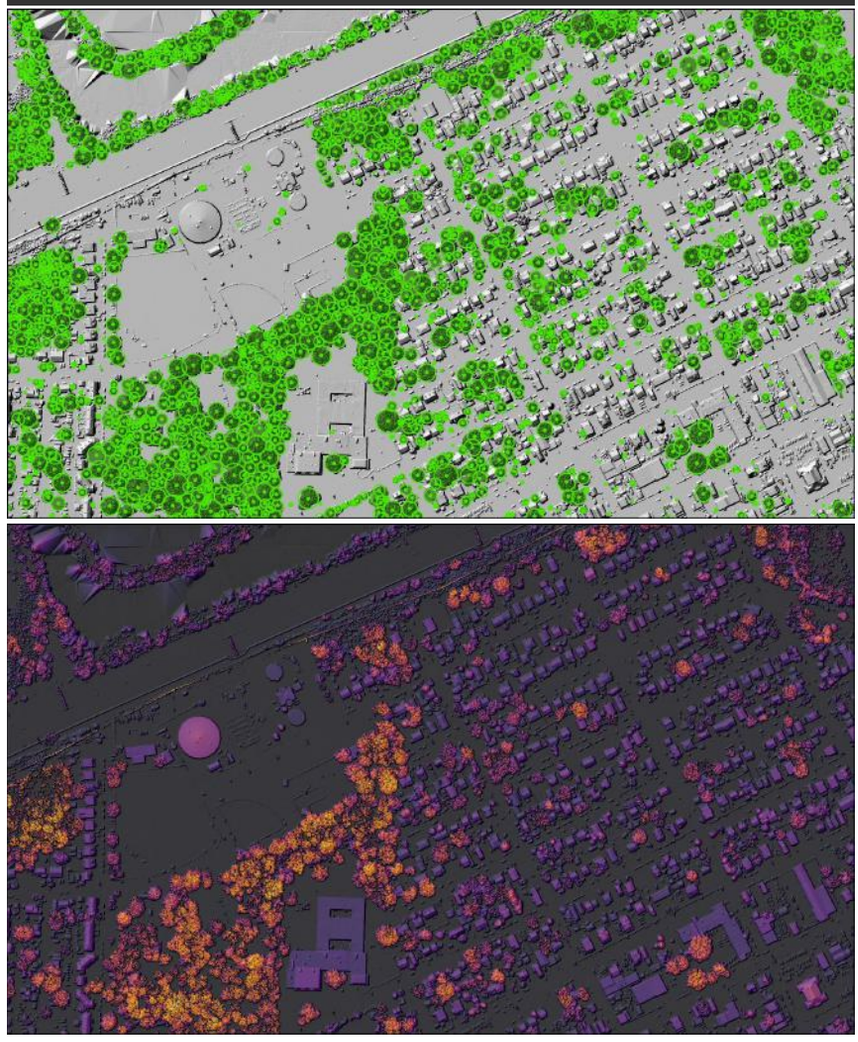
The Importance of Good Data

This assessment would not have been possible without Delaware County's investment in high-quality geospatial data, particularly LiDAR. These investments pay dividends for a variety of uses, from urban forestry planning and stormwater management to solar potential mapping. Good data supports good governance.

MAPPING THE TREE CANOPY FROM ABOVE

Tree canopy assessments rely on remotely sensed data in the form of aerial imagery and light detection and ranging (LiDAR) data. These datasets, which have been acquired by various governmental agencies in the region, are the foundational information for tree canopy mapping. Imagery provides information that enables features to be distinguished by their spectral (color) properties. As trees and shrubs can appear spectrally similar, or obscured by shadow, LiDAR, which consists of 3D height information, enhances the accuracy of the mapping. Tree canopy mapping is performed using a scientifically rigorous process that integrates cutting-edge automated feature extraction technologies with detailed manual reviews and editing. This combination of sensor and mapping technologies enabled the county's tree canopy to be mapped in greater detail and with better accuracy than ever before. From a single street tree along a roadside to a patch of trees in a park, every tree in Delaware County was accounted for.

Tree Canopy Mapping



Figures 1 and 2. Locations of individual trees and their crowns (top) that were derived from the 2015 LiDAR (bottom) in Tinicum Township.

The high-resolution land cover that forms the foundation of this project was generated from the most recent LiDAR, which was acquired in 2015 for a majority of the study area and 2022 where available. Compared to national tree canopy datasets, which map at a resolution of 30-meters, this project generated maps that were over 1,000 times more detailed and better account for all of the county's tree canopy.

Land Cover Mapping

Figure 3. High-resolution land cover of the same area in Tinicum Township developed for this project.

LANDCOVER

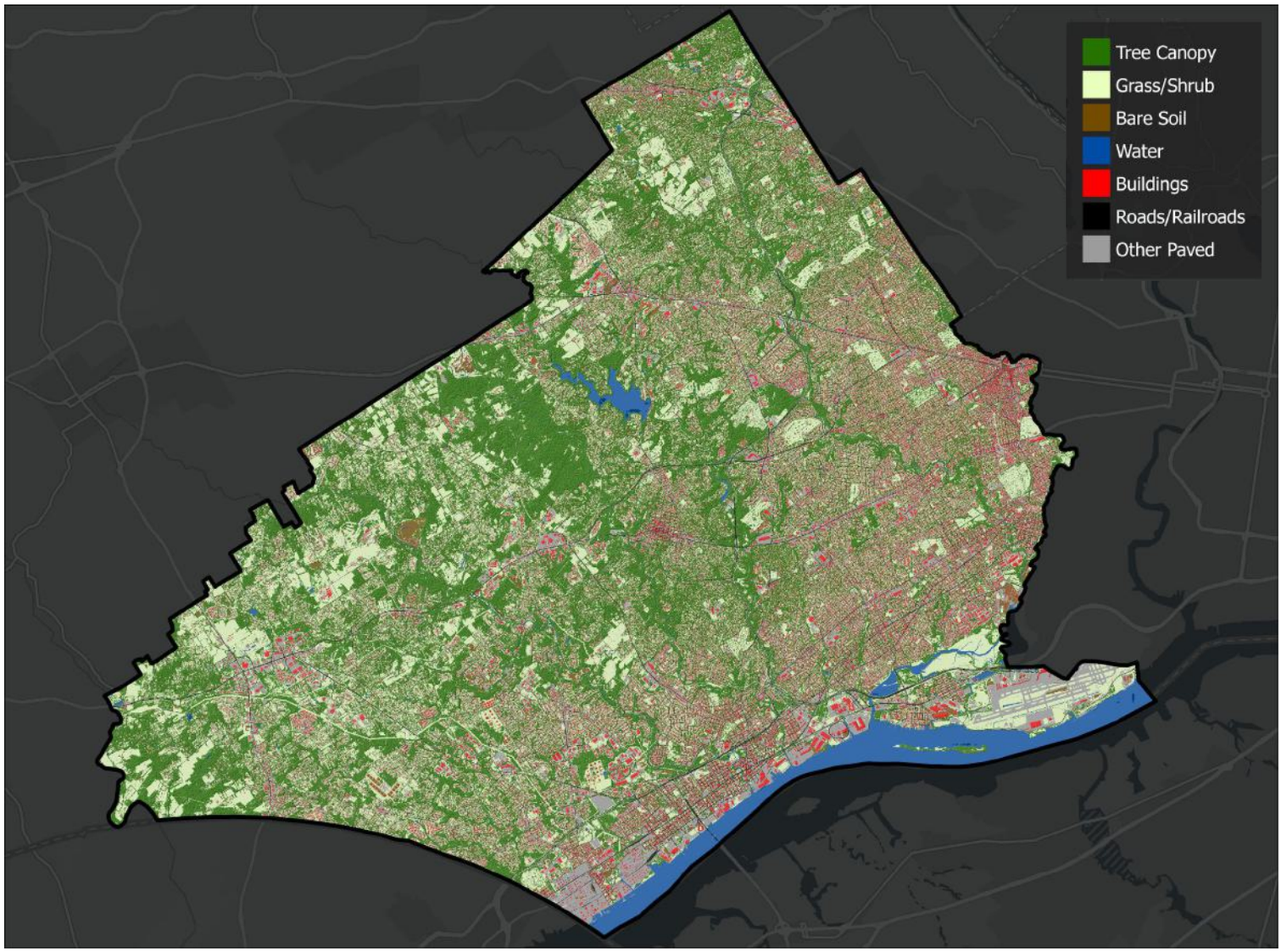


Figure 4. The new 2022 landcover for Delaware County was used in this assessment to quantify existing tree canopy, possible tree canopy - vegetated, possible tree canopy - impervious, and not suitable. The following terminology is used throughout this report.

Key Terms

Existing Tree Canopy - The amount of tree canopy present when viewed from above using aerial or satellite imagery.

Possible Tree Canopy - **Vegetated:** Grass or shrub area that is theoretically available for **the** establishment of tree canopy.

Possible Tree Canopy - **Impervious:** Asphalt, **concrete** or bare soil surfaces, excluding roads and buildings, that are theoretically available for the establishment of tree canopy.

Not Suitable - Areas where it is highly unlikely that new tree canopy could be established (primarily buildings and roads).

Measuring Tree Canopy Change

Area Change - the change in the **area of** tree canopy between 2010 and 2022.

Relative % Change - the magnitude of change in tree canopy based on the amount of tree canopy in 2010.

Absolute % Change - the percentage point change between 2010 and 2022.

TREE COUNT

1,627,700 Individual Trees

Delaware County has over 1,627,700 individual trees, an estimate that was derived from the 2015 LiDAR data.

Tree Crowns & Centroids

Trees, like all living things, require attention, care, and maintenance to thrive. In addition to quantifying the county's tree canopy acreage and percent coverage, this study produced an estimate of the number of individual trees in Delaware County. This analysis was performed using the 2015 LiDAR data. While not a replacement for field-based inventories, LiDAR provides a unique advantage in that all of Delaware County's trees can be counted. With Delaware County having an estimated over 1,627,700 trees, it is important that tree maintenance remains a high priority for land managers and property owners. Tree maintenance and care activities will ensure that these critical green infrastructure assets thrive.

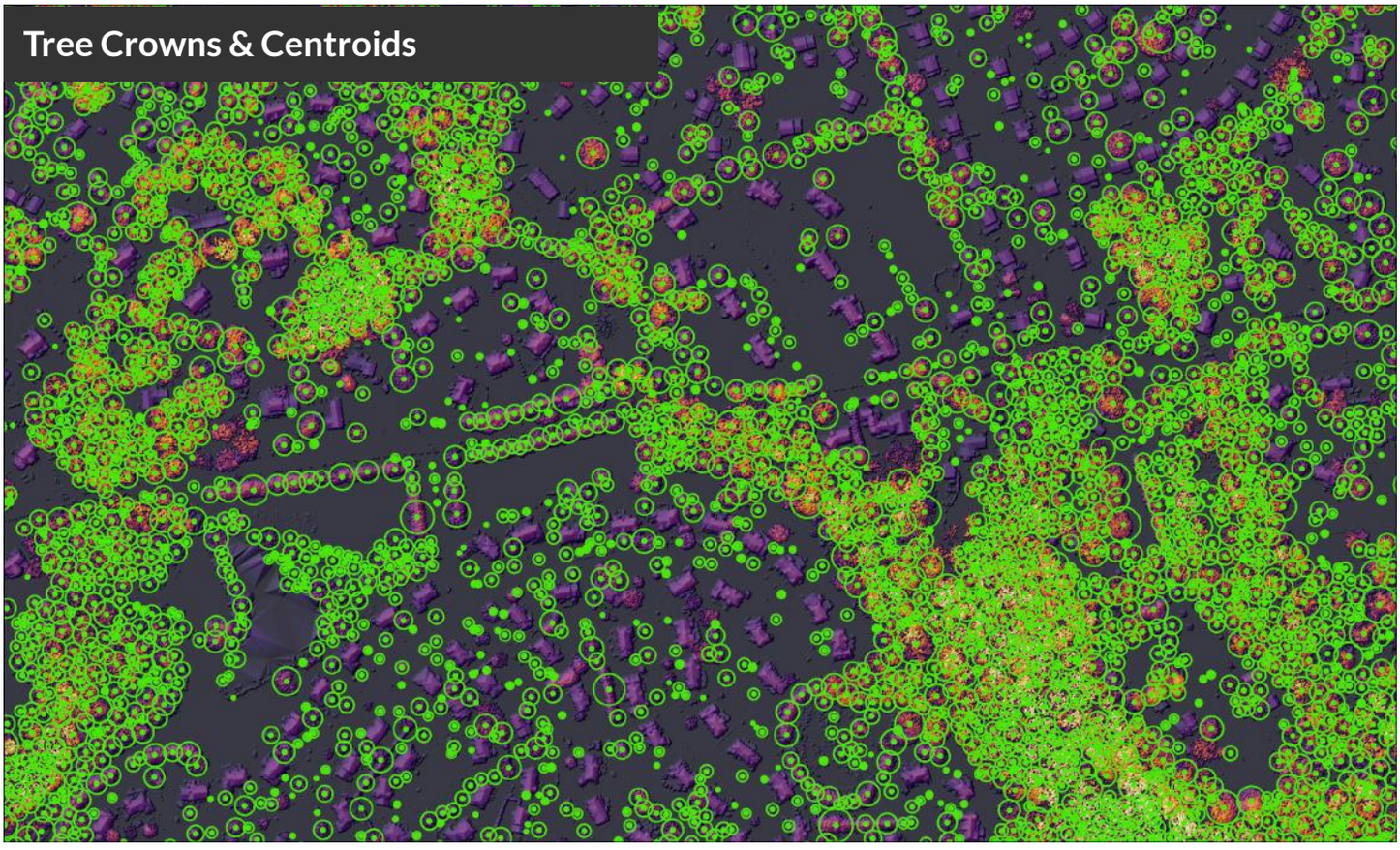


Figure 5. Tree centroids (dots) and tree crowns (circles) mapped from the 2015 LiDAR. Tree mapping from LiDAR involves finding relative high points for each tree, then tracing down until a height inflection point is reached, marking the edge of the crown. This approach to individual tree mapping is most accurate where there is a clear differentiation in tree crowns and is less accurate in forested stands where crowns may overlap.

EQUITY & ENVIRONMENTAL JUSTICE

Environmental Equity & Landscape Resilience

Like many counties in the United States, Delaware County faces risks and challenges relating to the high density and urban environments. Trees, when properly cared for, can serve as a solution to create a sustainable and more resilient county.

To enhance resilience throughout the county, it is recommended Delaware County targets neighborhoods lacking access to tree canopy cover, and for tree planting prioritization to be further informed by the distribution of demographic groups that are typically more susceptible to environmental risks. These include historically marginalized populations like racial and ethnic minorities and residents living in poverty.

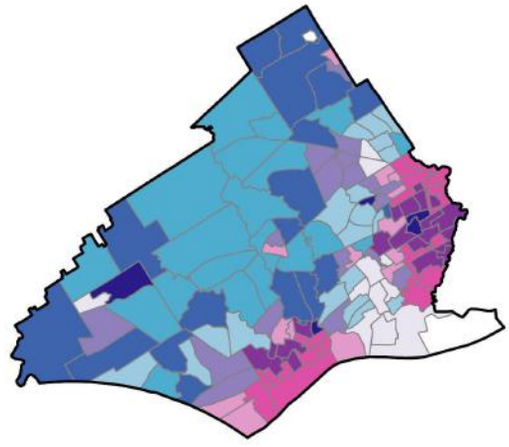
In Delaware County, distributions of census tracts with greater presence of Non-White residents and little tree canopy cover closely resemble the distributions of census tracts with greater presence of poverty and little tree canopy. It is likely that these demographics, which are typically interrelated, are also more exposed to environmental challenges due to a lack of trees available to provide important benefits that mitigate them.

SUSCEPTIBILITY AND INEQUITY

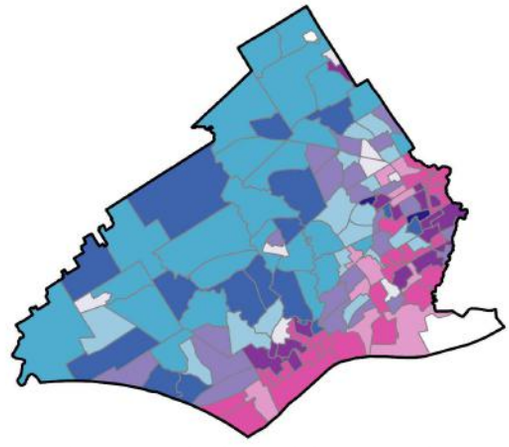
CERTAIN DEMOGRAPHICS* ARE MORE VULNERABLE TO ENVIRONMENTAL CHALLENGES

*Other demographics at greater risk include:

- Hispanic populations
- Individuals who have had strokes
- Adults over the age of 65
- Individuals exposed through daily commutes (e.g. walking or public transportation)
- Individuals living in areas with hazard risks such as sewage overflows



% Non-White (2020 ACS)



% Households with Annual Income < $25,000 (2020 ACS)

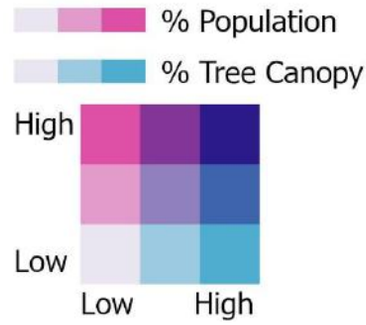


Figure 6. These maps show percent of existing tree canopy cover in relation to two demographic groups that are highly interrelated and typically within the most susceptible groups against environmental challenges. Shades of blue indicate tree canopy percentage by block group, with the darkest shade indicating higher percentages. Meanwhile, shades of pink indicate percentage of residents within each of the demographic groups, with the darkest shade indicating higher percentages.

COMMUNITY RESILIENCE

Environmental Stressors & Neighborhood Prioritization

With an increase in severe storms and extreme weather across the country, flooding and rising temperatures are two environmental challenges that impact Delaware County. Using both the Urban Flood Risk Mitigation and the Urban Cooling modules of the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) tool, we were able to identify areas that are more at risk of flooding and high temperatures with current tree canopy.

The maps below can be used to determine tree planting allocation to strengthen community resilience against flooding and rising temperatures.

Mitigation Capacity by Local Vegetation

Flooding is of great concern for the county. Surface runoff **(a)**, was mapped with the Urban Flood Risk Mitigation module of the InVEST tool within the community. Areas with low runoff retention may benefit from increased tree plantings due to the capacity of vegetation acting as riparian buffers filtering runoff and absorbing precipitation into the soil. The urban heat island effect also considerably affects urban communities, and rising temperatures can result in fatalities (particularly among the elderly and those with cardiovascular diseases). The capacity of local vegetation to mitigate rising temperatures **(b)** varies throughout Delaware County's landscape.

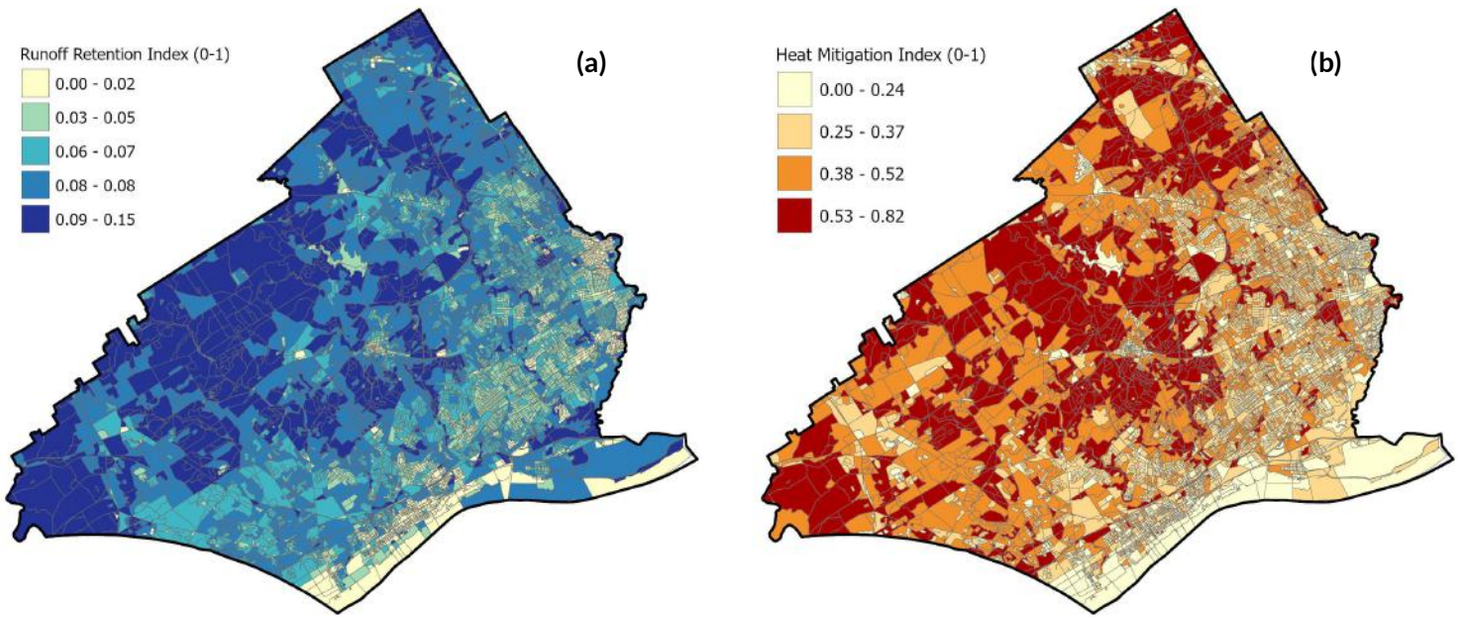


*Figure 7. **(a)** The runoff retention index indicates retention of surface runoff as mapped. The map ranges from zero (indicating low retention of runoff) to one (indicating high retention of runoff). **(b)** The heat mitigation index ranges from zero (low mitigation capacity) to one (high mitigation capacity) and was modeled with InVEST.*

TREE CANOPY METRICS

43% *of Delaware County's land is covered by tree canopy*

Tree canopy and tree canopy change were summarized at various geographical units of analysis, ranging from municipalities to census block group. These tree canopy metrics provide information on the area of Existing and Possible Tree Canopy for each geographical unit as well as Absolute and Relative Percent Tree Canopy Change between 2010 and 2022.

Existing Tree Canopy

Counties commonly have uneven distribution of tree canopy, a pattern that applies to Delaware County. This unequal distribution can be traced back to Delaware County's history of development patterns and open space planning. There are some 0.5 square mile (about 320 acre) hexagons with less than 15% tree canopy and others with nearly 80% tree canopy (Figure 8). Those residents who live and work in areas with more tree coverage (darker green hexagons) benefit disproportionately from the ecosystem services that trees provide. Conversely, the more urbanized regions of the county have lower amounts of tree canopy and therefore receive fewer ecosystem services from trees.

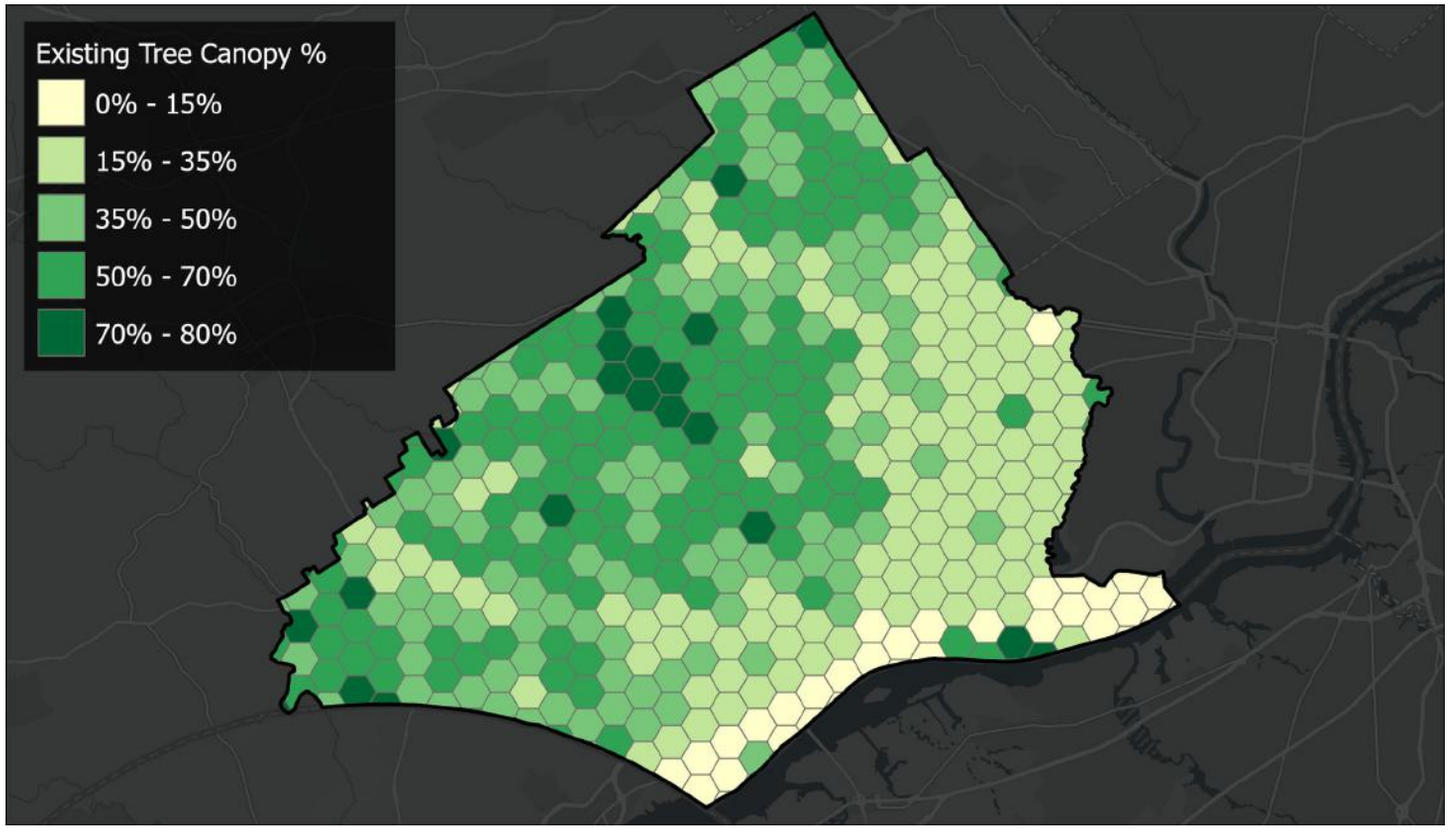


Figure 8. Existing tree canopy percentage for 2022 conditions summarized using 0.5 - sq mi hexagons. For each of the hexagons, the percent tree canopy was calculated by dividing the amount of tree canopy by the land area, which excludes water. Using hexagons as the unit of analysis provides a standard mechanism for visualizing the distribution of tree canopy without the constraints of other geographies that have unequal area (e.g., zip codes).

Possible New Tree Canopy

There is available space in Delaware County to plant more trees. In this assessment, any areas with no trees, buildings, roads, or bodies of water are considered Possible-Vegetation and represent locations in which trees could theoretically be established without having to remove hard surfaces. Many factors go into deciding where a tree can be planted with the necessary conditions to flourish, including land use, landscape conditions, social attitudes towards trees, and financial considerations. Examples include golf courses and recreational fields. While there is open space to plant trees, there is a direct conflict in use; thus, the Possible-Vegetation category should serve as a guide for further field analysis, not a prescription of where to plant trees. With 35,799 acres of land (comprising 30.5% of the county's land base) falling into the Possible-Vegetation category, there remain significant opportunities for planting trees and preserving canopy that will improve the county's total tree canopy in the long term.

In Delaware County's most densely urbanized areas, significantly increasing the tree canopy will be difficult; nevertheless, it remains vitally important to strive for canopy gains. In the county's residential areas, healthy natural regeneration of the existing tree canopy and planting new trees will be important. There is often a "plant and forget" cycle in residential areas, where trees are generally planted when homes are built, without the follow-up to replace trees as they decline to establish the next generation of canopy.

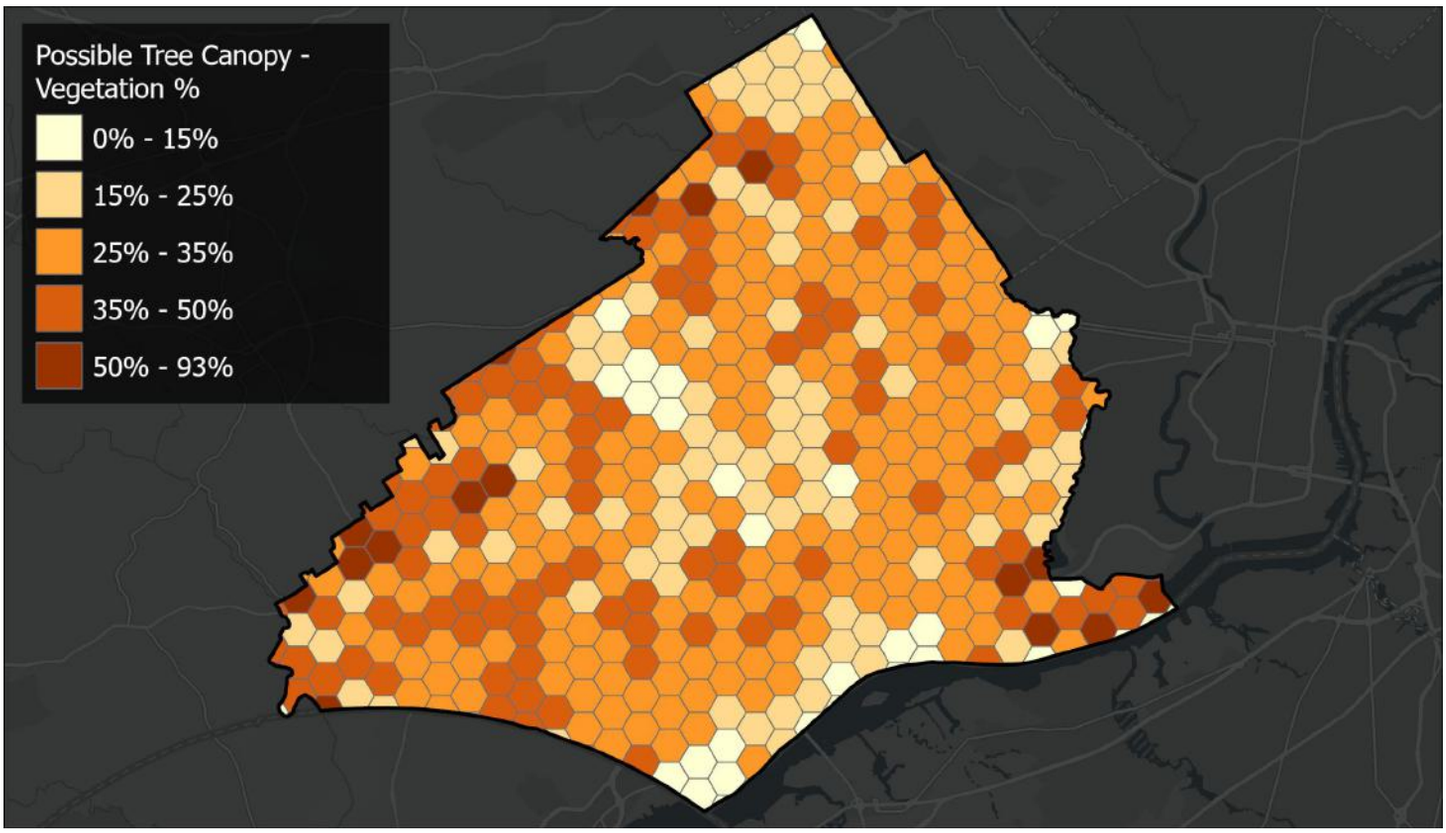


Figure 9. Possible Tree Canopy consisting of non-treed vegetated surfaces summarized by 0.5 - sq mi hexagons. These vegetated surfaces that are not currently covered by tree canopy represent areas where it is biophysically feasible to establish new tree canopy. It may be financially challenging or socially undesirable to establish new tree canopy on much of this land. Examples include golf courses, recreational and agricultural fields. Maps of the Possible Tree Canopy can assist in strategic planning, but decisions on where to plant trees should be made based on field verification. Surface, underground, and above surface factors ranging from sidewalks to utilities can affect the suitability of a site for tree canopy planting.

Canopy Change Distribution — Absolute % Change

Delaware County has experienced a net decrease in tree canopy, but the story of change is more nuanced, with a mix of loss and gain. All areas of the county experienced both gains and losses of tree canopy, though some areas saw a net increase and others a net decrease. Removal and die off of mature trees resulted in the loss of large patches of tree canopy. Mature trees with large crowns contribute substantially to tree canopy and take decades to grow, so their loss creates large, localized declines in tree canopy. Even though there was evidence of tree loss throughout Delaware County, planting efforts, preservation programs, and natural growth helped offset losses and stem decline. Established trees will continue to contribute to gains as their canopies expand over the course of their lives. Trees, when properly cared for, can mitigate environmental risks challenges such as flooding, air quality, and urban heat island. This makes tree canopy an important part of a the county's infrastructure.

The trajectory of Delaware County's tree canopy in the future is uncertain. There are both environmental and anthropogenic risks facing canopy cover. Invasive species and disease can pose a serious threat if not identified and controlled early. The resilience of tree canopy to natural events such as storms can vary depending on the environment. In conserved areas, tree canopy can return through natural growth, but in urbanized areas, trees lost to storms will need to be replanted. In addition to natural risks, human actions such as tree removal also play a role. Climate change may cause trees to grow more quickly but could also result in inhospitable conditions for native species. Anthropogenic factors also include preservation and conservation efforts and the strength of tree ordinances. Managing these risks and solutions will be key to achieving sustained canopy growth.

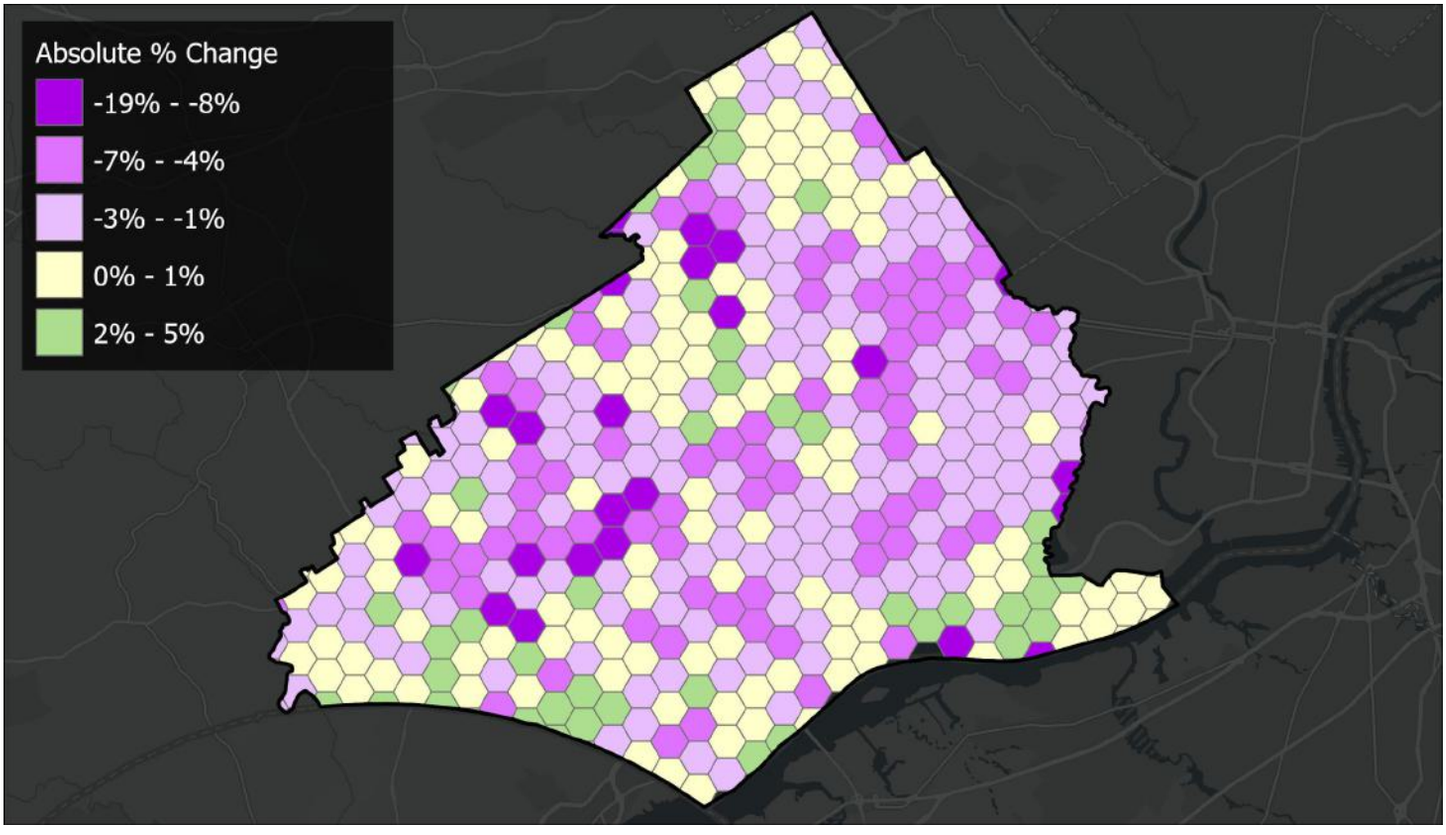


Figure 10: Tree canopy change summarized by 0.5 - sq mi hexagons. Darker greens indicate greater gain, while darker purple reflects higher amounts of loss.

Canopy Change Distribution - Relative % Change

The magnitude of tree canopy change across Delaware County can be measured by the relative tree canopy change over the 2010 - 2022 period. The relative change is calculated by taking the tree canopy area in 2010, subtracting the tree canopy area in 2022, then dividing this number by the area of tree canopy in 2010. Areas with the greatest change indicate that the canopy is markedly different in 2022 as compared to 2010. In some of the commercial and urbanized areas with little tree canopy in 2010, the growth of street trees resulted in a sizeable relative gain. Conversely, the removal of trees as a result of construction in sparsely treed areas resulted in substantial relative reductions in tree canopy.

The greatest relative gains in tree canopy were in locations where new plantings were carried out on areas with little tree canopy to begin with. Just as forest patches provide valuable ecosystem services, such as wildlife habitat, so do individual trees. In areas with low tree canopy, an individual tree can have an outsized impact through ecosystem services such as providing a refuge from the sun while watching a baseball game, shading cars in a parking lot or helping to reduce homeowner air conditioning costs. Though growing conditions in Right-of-Way (ROW) areas can be tough, they are a tool to increase canopy in low coverage, often impervious surface dominated areas. Natural growth can provide gains in areas with robust canopy, but in areas with low canopy, such as commercial spaces, tree plantings are an important part a long-term plan to increase tree canopy and resulting ecosystem services.

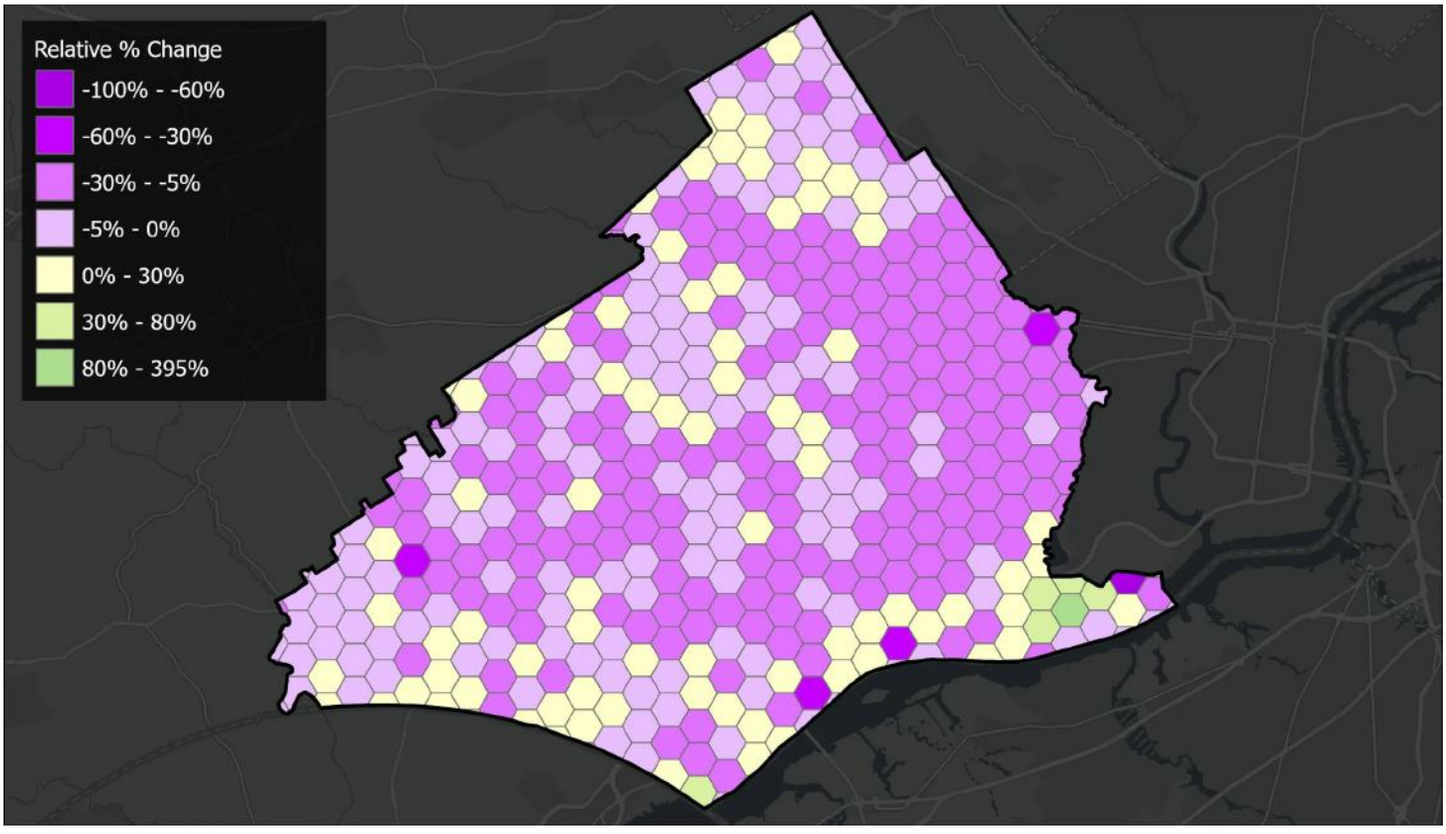


Figure 11: Tree canopy change metrics summarized by 0.5 - sq m hexagons. Relative tree canopy is calculated by using the formula (2010-2022)/2022. Colors are categorized by data quantiles. Darker greens indicate greater relative gain, while darker purple reflects a higher magnitude of loss.

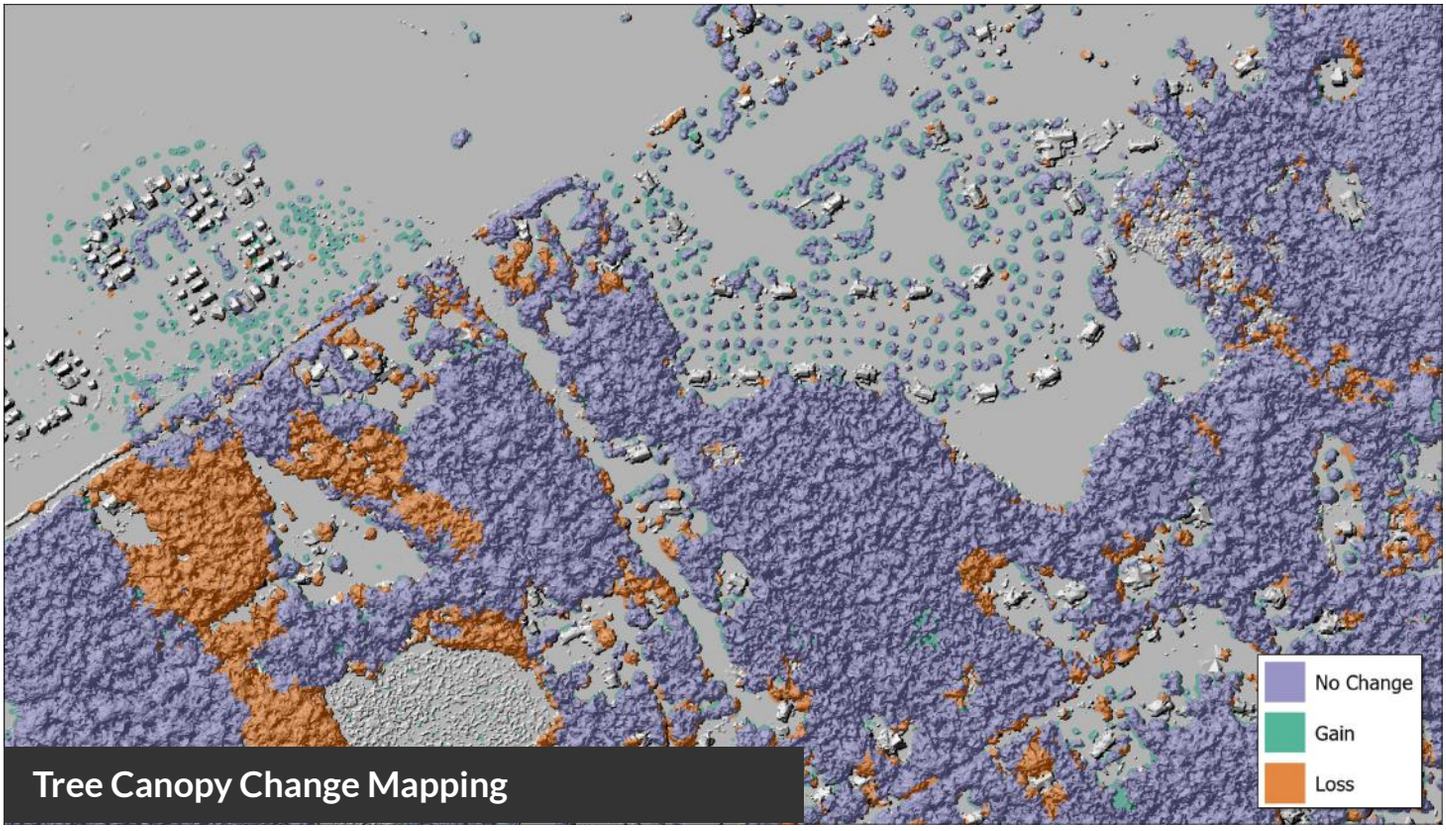


Figure 12: Tree canopy change mapping for the area surrounding Spring Lawn Rd in Concord Township overlaid on 2008 LiDAR. This area experienced a mix of gain and loss.

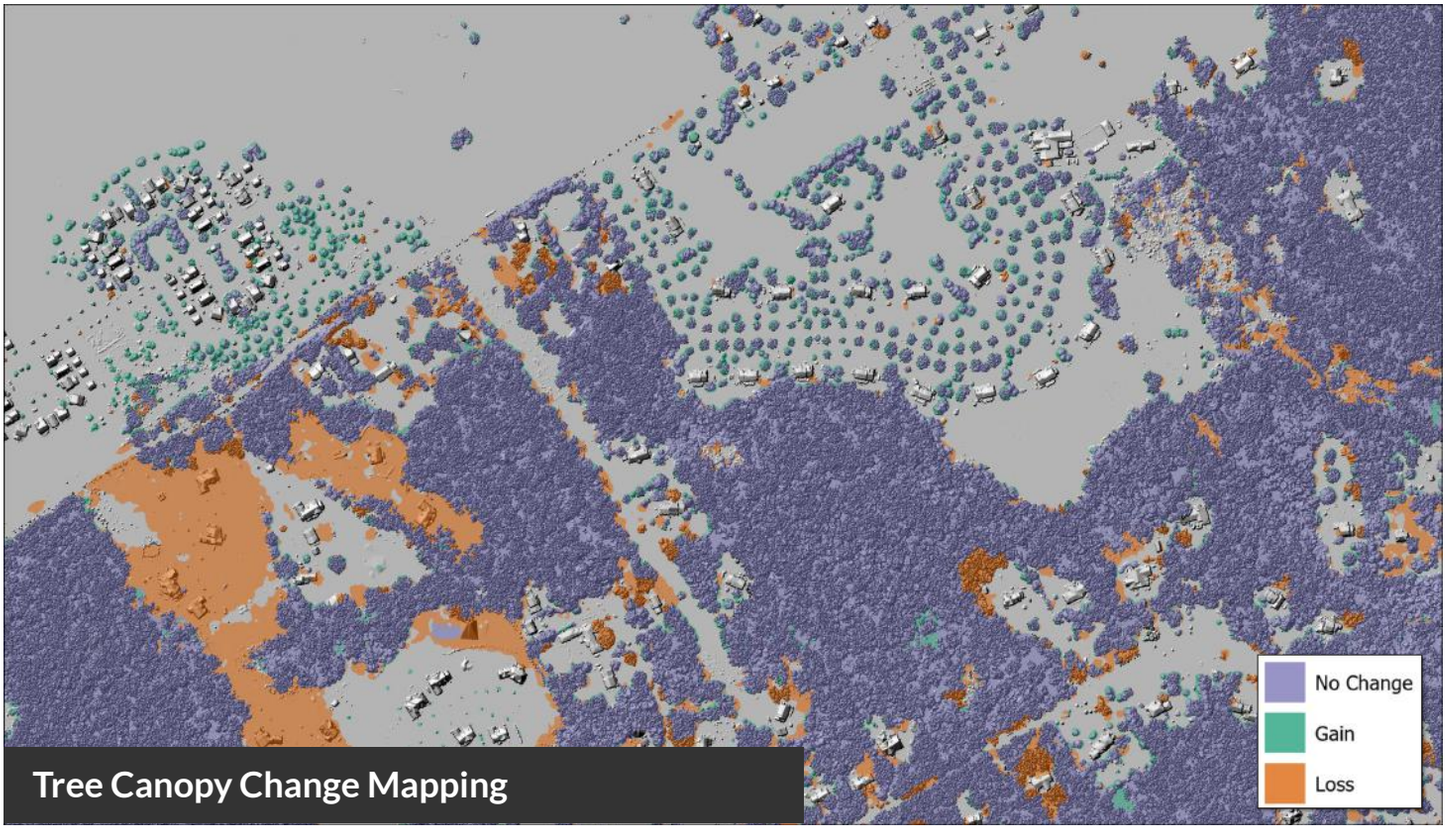


Figure 13: Tree canopy change for the same area above but overlaid on the 2015 LiDAR. The areas of gain appear rough now that tree canopy is present, and the areas of loss appear smooth due to the absence of tree canopy. Note that due to the offset between LiDAR and imagery acquisition, tree canopy lost between LiDAR collection in 2015 and imagery collection in 2022 will still appear rough because it was present when the LiDAR was acquired, though absent by 2022.

PATTERNS OF CHANGE

Numerous factors contribute to the wide range of tree canopy change patterns of Delaware County. These include zoning, land use history, urban density, and landowner decisions. The examples that follow illustrate how these factors influence canopy change. Examining patterns and processes over the past decade can provide insights into how the canopy may change in the future.

Land Use Changes

Urban forest patches provide essential ecosystem services relating to wildlife habitat and reduced runoff their removal is a concern. Forest patches can be removed in a matter of days and take decades to regenerate.

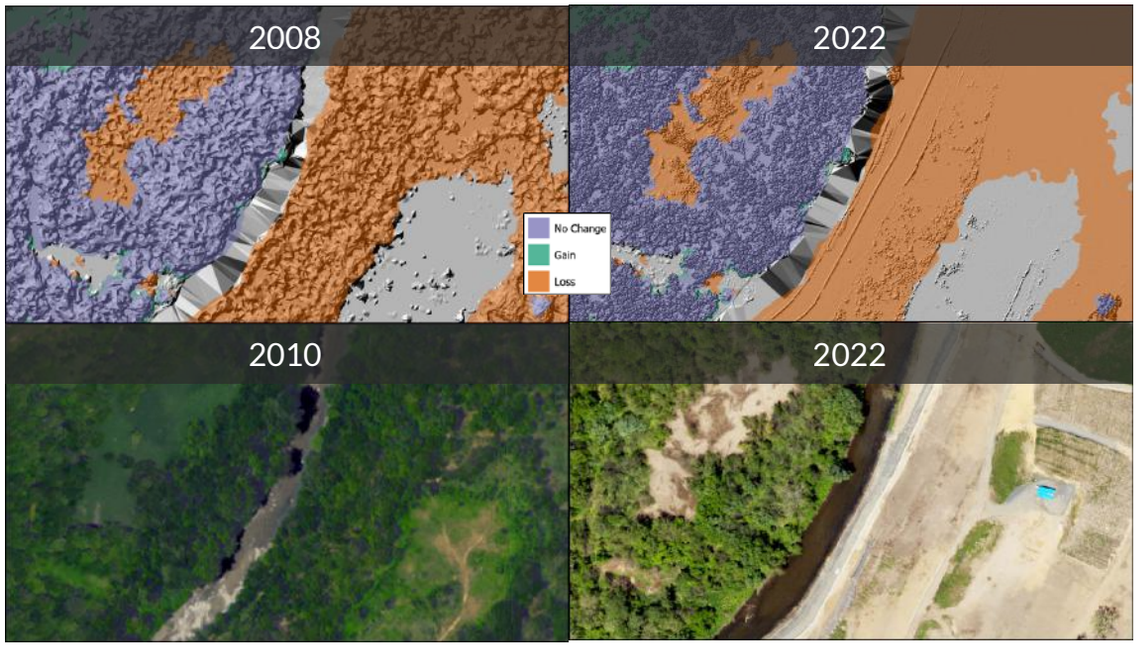


Figure 14. Large forest patch removal for construction around Darby Creek in Darby Township resulted in an overall decrease in canopy coverage.

Forest Patch Loss

Riparian Area

New Construction

Natural Succession Drives Growth

Tree planting and natural succession add canopy slowly but important processes for increasing tree canopy.

Figure 15. Growth of already existing canopy was the largest driver of Delaware County's tree canopy gains as can be seen in the natural growth in a forest patch by Spring Valley Rd in Concord Township.

Tree canopy gain

Forest Patch

Natural Sucession

Planting Efforts

Development is a natural part of a community's lifecycle but care should be taken to balance development needs with the essential ecosystem services that forest patches provide. Trees are often removed to provide space for new construction but development projects that prioritize greening and new plantings can help offset these losses. The trees in this development were likely present in 2010, but their canopies were not detectable by imagery data. Their rapid growth is evident in the 2022 imagery data.

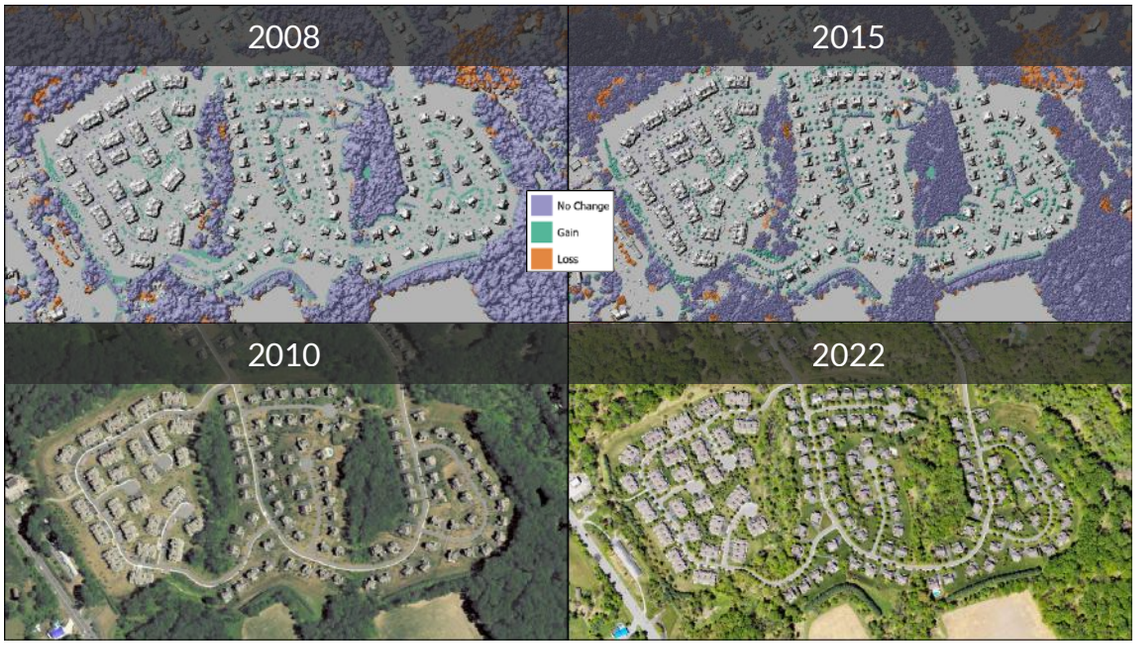


Figure 16. Tree plantings can coincide with development as can be seen in the growth of planted trees around Cherry Farm Ln in Thornbury Township.

Tree canopy gain

Neighborhood

Tree Planting

Residents are Key

Trees continue to grow and contribute canopy in more established neighborhoods, but age, disease, invasive species, storms, and changing landowner preferences all contribute to removals. As a result, losses may outpace gains over time if replacement trees are not planted.

Figure 17. Natural succession off-set tree canopy losses, resulting in a slight net increase (gain) in tree canopy around Ruskin Ln in Upper Darby Township.

Mix of Loss and Gains

Residential Area

Natural Sucession

Municipalities

Municipal boundaries are a useful way to summarize tree canopy and draw comparisons between parts of the county. The differences in canopy between Delaware County's municipalities is the result of land use history, changes to the built environment, local ordinances, and conservation efforts. The county's urban forests span all regions with varying coverage depending on the physical characteristics of municipality. Municipalities with large parks and open space or those that have lower density development tend to have more canopy, while municipalities that are denser with commercial or industrial use tend to have less tree canopy. The presence of tree canopy in each municipality impacts resident's access to all the benefits that come with urban forests. Tree canopy coverage as a percent of land area ranged from 5.5% in Marcus Hook Borough to 71% in Rose Valley Borough. Middletown Township had the largest total area of tree canopy with approximately 4,860 acres, making up 9.6% of total tree canopy by area in Delaware County. Middletown was followed by Radnor Township with 4,570 acres or 9% of the county's total tree canopy area.

All municipalities in the county experienced both gain and loss of tree canopy within their boundaries, but overall losses outpaced gains for all but Tinicum Township. Despite much of the land being occupied by Philadelphia International Airport, Tinicum Township saw a net increase of 21 acres in tree canopy between 2010 and 2022.

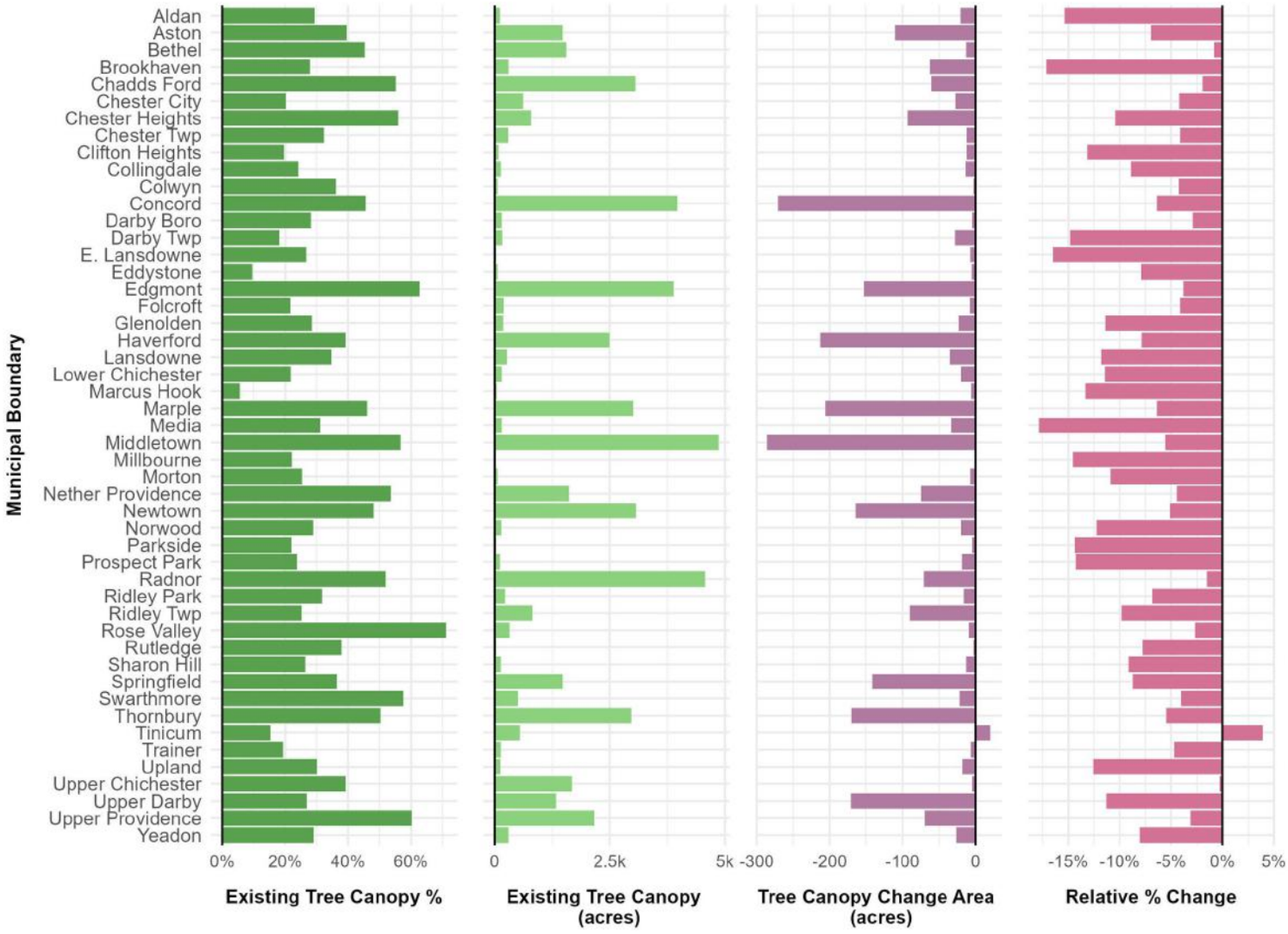


Figure 18. Tree canopy and change metrics summarized by municipality.

TREE HEIGHT DISTRIBUTION

Tree height is a useful proxy for tree age. Diverse height structure indicates a healthy and varied tree age distribution. Even-aged urban tree canopy results when trees were planted around the same time and can lead to a sudden and widespread loss in canopy when many mature trees reach the end of their lifespan at the same time. Age diversity supports a more resilient canopy over time, ensuring that that not all trees reach maturity at the same time. Delaware County's trees have an average height of 67 ft. Trees between 0 and 25ft in height make up 15.6% of the county's trees. These trees likely represent young trees and recent plantings that have grown large enough to register as tree canopy. Trees between 25 and 50ft tall make up 17% of the county's canopy, followed by 24.2% 50-75ft range, 24.2% in the 75-100ft range, and 19% above 100ft tall. Mature trees have a greater capacity to offer ecosystem services to urban residents. Loss of taller, more mature trees results in loss of those benefits and potential impacts to the overall canopy cover. It will be important to preserve trees in the 50-100 foot height range, while planting a variety of new trees to continue the lifecycle. Proper care and monitoring will help to develop the next generation of trees that reach maturity and balance the distribution. Having trees with a broad age distribution, as well as a variety of species, will ensure that a robust and healthy tree canopy is possible over time. Specific information on individual trees is collected via on-the-ground field inventories and was not captured in this assessment.

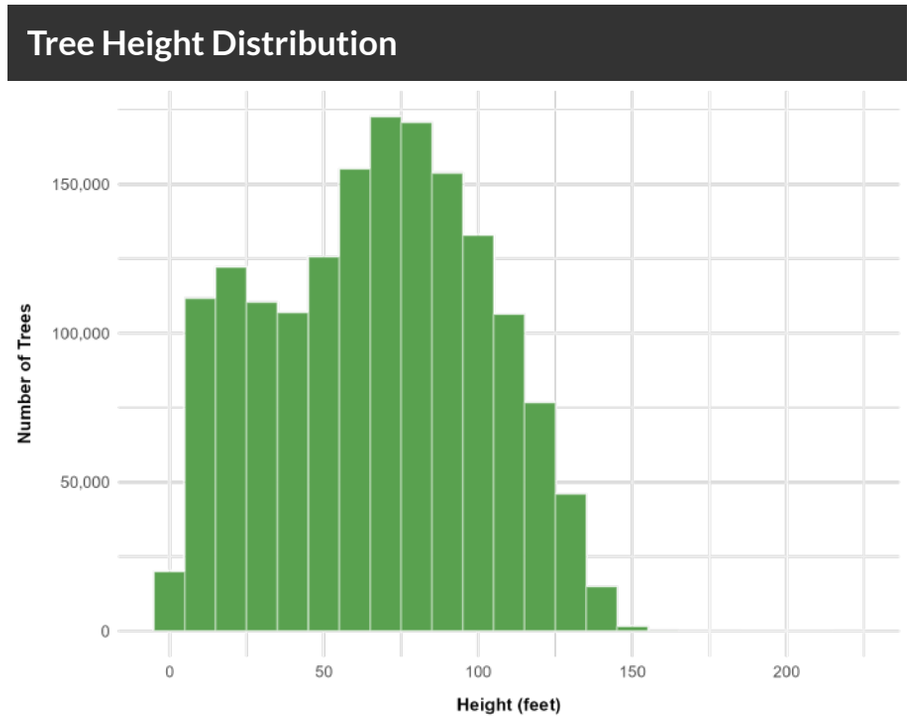


Figure 19. Histogram of the tree canopy height displaying the number of trees in each 10-foot bin.

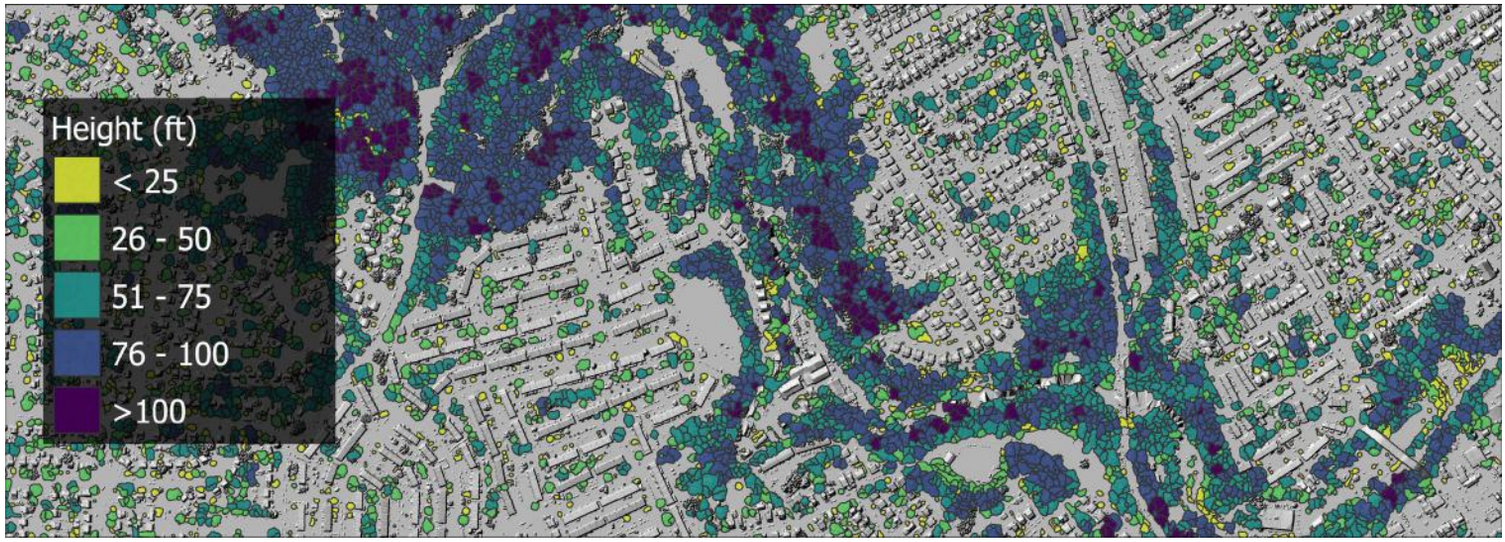


Figure 20. Example of the height classification in Upper Darby Township with darker colors representing taller canopy. Delaware County's tree canopy was segmented into polygons approximating individual trees. Each of these polygons was then attributed with the height from the 2015 LiDAR.

FOREST PATCH SIZE

Along with the size, distribution, and diversity of urban forests, structure is another key factor to consider in management decisions. Urban forests are made up of patches of tree canopy interspersed throughout the landscape. This project used an algorithm to divide Delaware County's tree canopy into polygons of forest patches surrounded by other, non-forested, land cover types. These polygons were then sorted five forest patch size classes based on Jenks Natural Breaks where the smallest class represents individual trees.

Forest patches, large and small, serve important roles in landscapes. Small patches and individual trees can provide access to natural areas and associated benefits in populated areas and can serve as stepping stones for wildlife traveling between larger forest patches. It is critical to maintain large patches of forest since they are necessary for certain ecosystem services that smaller patches cannot provide. In addition to producing amplified benefits like pollution mitigation and cooling, large forest patches can accommodate species with larger home ranges and species that rely on interior forest. This supports biodiversity by providing habitat for a wider variety of species than small patches alone can support.

The largest share of the county's tree canopy exists in Small patches, with the total area of that size class adding up to 27,106 acres (Figure 22). This was followed by Medium patches (7,490 acres). Large patches contributed 6,200 acres, slightly less area than Very Large patches with 6,458 acres. Isolated Trees made up the smallest total area of the five size categories covering a total of 3,244 acres throughout the county.

Forest Patch Size Classes

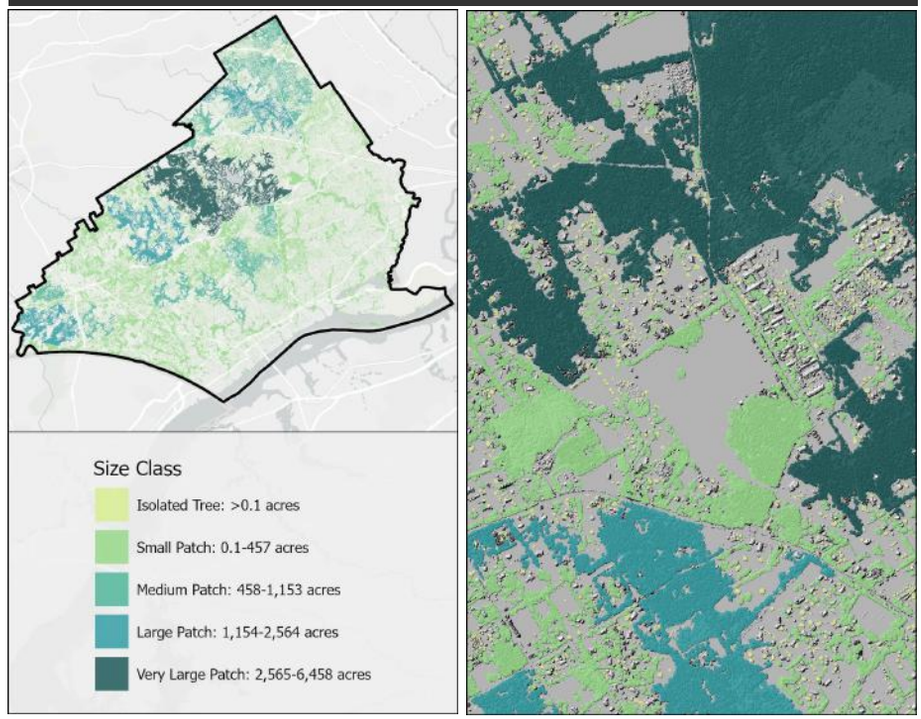


Figure 21. Overview of Delaware County's forest patches by size (left). Example close-up of forest patch size classification in Edgmont Township (right).

Forest Patch Total Area

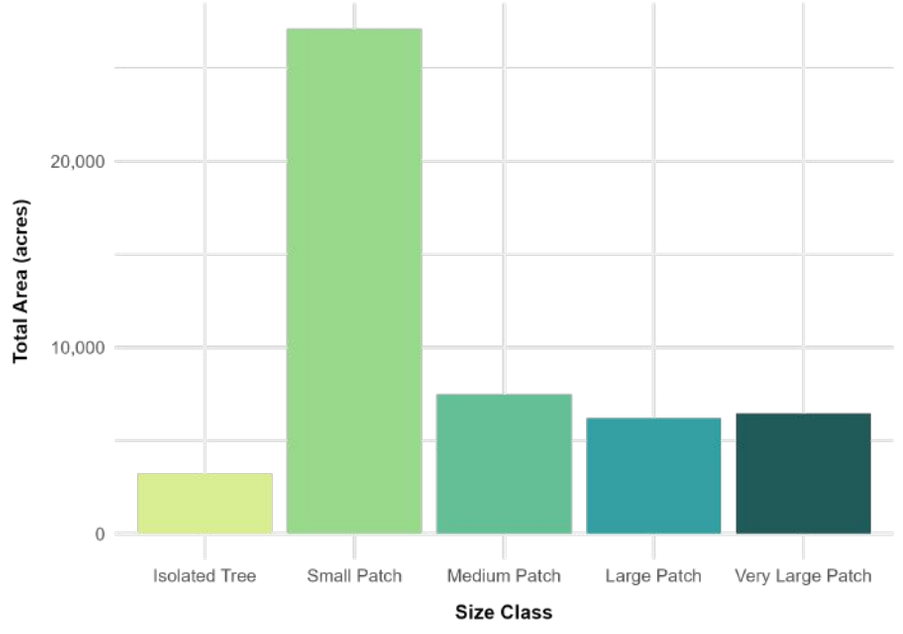


Figure 22. Total area of each forest patch size class.

TREE CANOPY BY THE NUMBERS

43%
2022 EXISTING TREE CANOPY

50,473
2022 EXISTING TREE CANOPY ACRES

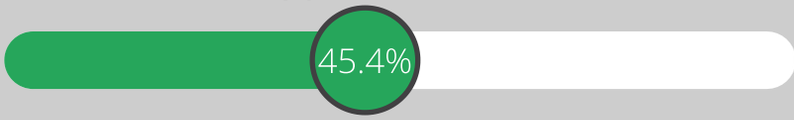
-2,825
2010 - 2022 CANOPY CHANGE IN ACRES

-5.3%
2010 - 2022 RELATIVE PERCENT CHANGE

Delaware County has lost tree canopy. Tree canopy change was computed by mapping the no change, gains, and losses in tree canopy from 2010 - 2022.

Change in tree canopy from 2010 - 2022

2010 Tree Canopy %



2022 Tree Canopy %

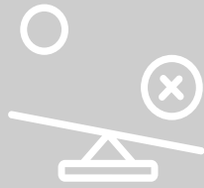
-2.4%
Absolute change in tree canopy

-2,825
Net change in tree canopy acres

4,285
Acres of Gain

7,110
Acres of Loss

Of the 117,399 total acres of land in the study area, 50,473 are covered by tree canopy.



Losses in tree canopy are outpacing gains, resulting in a net decrease in tree canopy.

Growth of existing tree canopy is the biggest contributor to tree canopy gains.

RECOMMENDATIONS

Preserve existing tree canopy as this is the most effective means for securing future tree canopy. Loss is an event but gain is a process.

Plant new trees in areas where tree canopy is low or in locations where there has been tree canopy removed will also help the county grow canopy.

Ensure a broad age distribution and a variety of tree species to help maintain a robust and healthy tree canopy over time.

Engage residents in community education. Residents who are knowledgeable about the value of trees will help the county stay green for years to come.

Integrate the tree canopy change assessment data into planning decisions at all levels of government from individual park improvements, to comprehensive planning and zoning initiatives, to county-wide ordinances.

Reassess the tree canopy at 3-5 year intervals to monitor change and make strategic management decisions.

Continue to invest in high-quality, high-resolution LiDAR and imagery data to support these tree canopy assessments and other mapping needs.

Complement this assessment with field data collection. Information on tree species, size, and health can only be obtained through on-the-ground inventories.

Conclusion: Sustaining and Growing Delaware County's Tree Canopy

The tree canopy assessment reveals that between 2010 and 2022, all municipalities in Delaware County experienced both gains and losses in canopy cover, with overall losses generally outpacing gains. Tinicum Township was a notable exception, achieving a net increase of 21 acres despite its urbanized setting. Encouragingly, relative gains were seen in areas that initially had low canopy coverage. Targeted plantings, particularly of street trees and in commercial zones, contributed to canopy gain, even under challenging growing conditions. These efforts demonstrate the potential of strategic tree planting to deliver significant ecological and social benefits to underserved and impervious surface-dominated neighborhoods.

At the same time, the loss of tall, mature trees, especially those in the 50–100 foot range, has reduced the canopy's ability to deliver its full range of ecosystem services. Preserving these large trees, while planting a diverse mix of younger species, is essential to maintaining a healthy, resilient canopy with a balanced age and species structure.

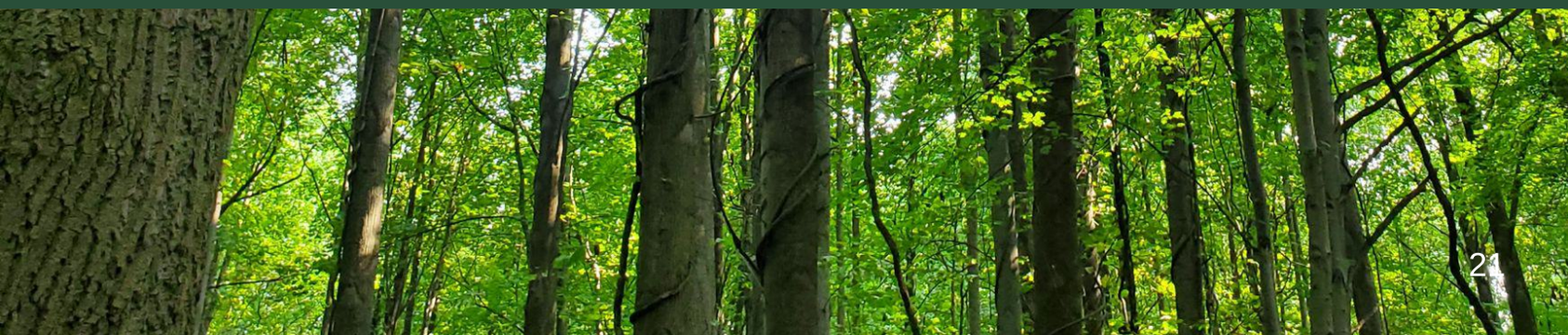
Long-term success will also require ongoing community education and engagement. When residents understand the value of trees and how to care for them, they become active partners in sustaining their local environment. By combining informed public involvement with data-driven planning, regular maintenance, and equity-focused investment, Delaware County can protect, enhance, and expand its tree canopy.

Putting Tree Canopy Data to Work

Tree canopy assessments have been successfully used by other communities to inform local planning and environmental strategies. In areas facing challenges like urban heat, flooding, and uneven access to green space, issues Delaware County also experiences, these assessments have helped prioritize tree planting in neighborhoods with low canopy and vulnerable populations. Many municipalities have used the data to update tree protection policies, secure funding for planting and maintenance programs, and set clear goals to increase canopy cover. In Delaware County, such an assessment can similarly guide equitable tree planting efforts, support community engagement around the importance of trees, and help local governments balance development with conservation.

Accessing the full Tree Canopy GIS Data, Maps and Metrics

This report is accompanied by GIS layers detailing tree canopy, canopy change, land cover, and related metrics, all publicly available through Delaware County. The maps and analyses presented here represent a subset of a larger collection. A comprehensive set of maps and graphs is available from the County.



KEY TERMS

Tree Canopy

Tree canopy is the layer of leaves, branches, and stems that provide tree coverage of the ground when viewed from above.

Geospatial Data

Information that includes a spatial component, referring to a specific location on the Earth's surface.

LiDAR

LiDAR is an acronym for Light Detection and Ranging. It is an optical remote sensing technology that uses light pulses to measure ranges (distances) to construct three-dimensional models of features on the Earth's surface.

Remotely Sensed Data

Information gathered using sensors, usually on satellites or planes, that detect electromagnetic radiation.

Environmental Risks

Potential hazards stemming from the built environment, natural events, or interactions between the two, such as pollution exposure, floodsing or excess heat.

Urban Heat Island

An effect where cities and urban areas tend to be measurably warmer than surrounding rural areas due to high proportions of human made impervious surfaces such as concrete and asphalyt, and lower concentrations of natural vegetation.

Forest Patch Morphology

Morphology refers to the forests structure and arrangement of trees. Forest patches are groups of trees surrounded by other, non-forested, land cover types.

Tree Centroid

The estimated location of the central point of each tree, derived using LiDAR data.

Absolute Percent Change

The percentage point change between the two time periods (2010-2022).

Relative Percent Change

The magnitude of change in tree canopy based on the amount of tree canopy in 2010.

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