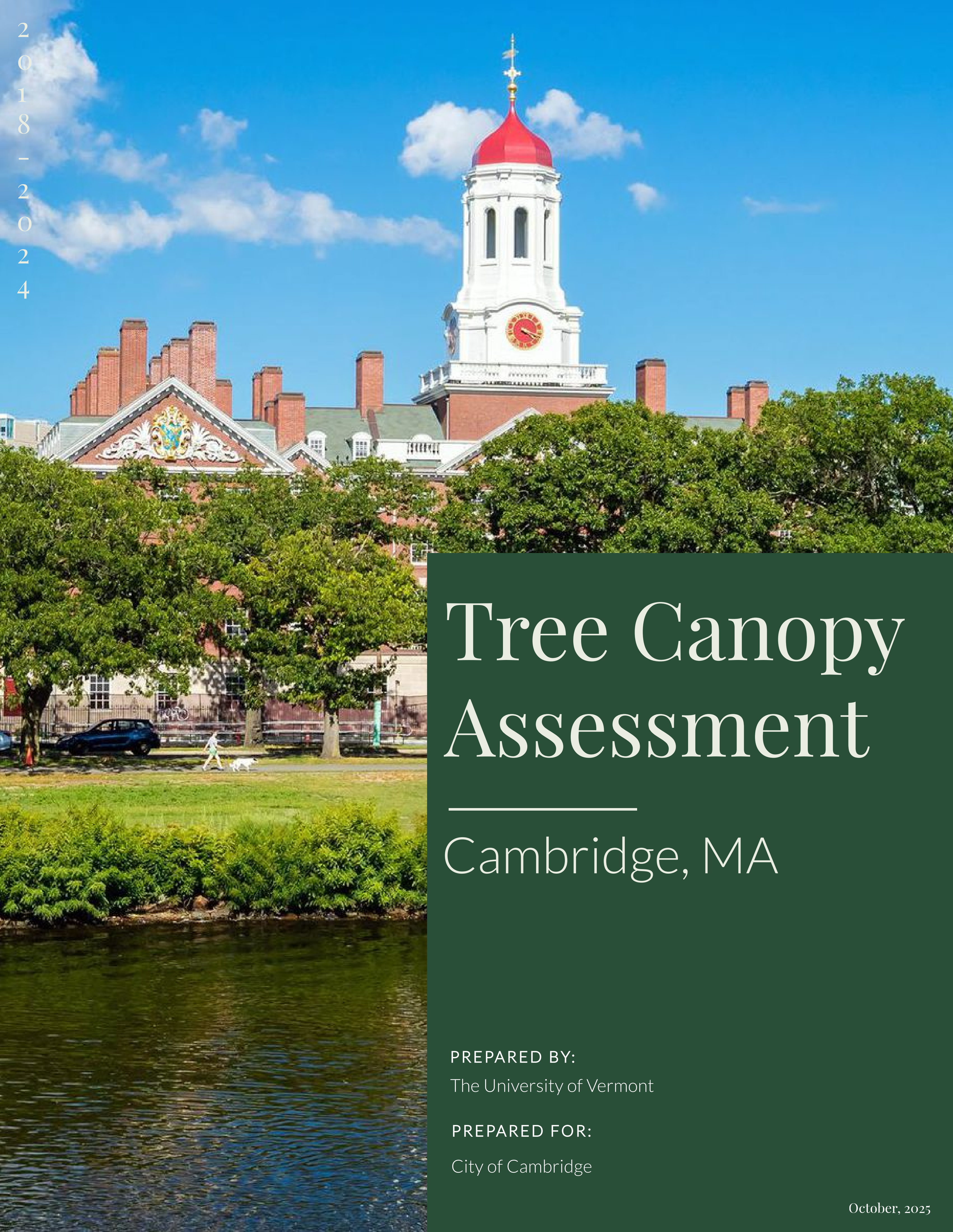


2018–2024

Tree Canopy Assessment

Cambridge, MA

PREPARED BY:

The University of Vermont

PREPARED FOR:

City of Cambridge

October, 2025

THE NEED FOR GREEN

Trees provide essential ecosystem services in Cambridge, like reducing stormwater runoff, cooling the pavement in the summer and providing wildlife habitat. Trees are an indispensable part of the region's infrastructure. Research shows that these green assets can improve social cohesion, reduce crime, and raise property values. A healthy and robust tree canopy is crucial to building a more livable and prosperous town.

As with any community, Cambridge 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 Cambridge's residents 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. Left out of this mapping has been an accounting of the green infrastructure.

The Tree Canopy Assessment protocols were developed by the USDA Forest Service to help communities better understand their green infrastructure through tree canopy mapping and analytics. Tree canopy is the layer of leaves, branches, and stems that provide tree coverage of the ground when viewed from above. 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 trees. Tree Canopy Assessments have been carried out for over 100 communities in North America. This study assessed tree canopy for Cambridge over the 2018 - 2024 period.

2018-2024 TREE CANOPY BY THE NUMBERS

Cambridge is gaining tree canopy. Tree canopy change was computed by mapping the no change, gains, and losses in tree canopy from 2018 - 2024.

30.2%
2024 EXISTING TREE CANOPY

1,239
2024 EXISTING TREE CANOPY ACRES

204
2018 - 2024 ACRES CHANGE

+20%
2018 - 2024 RELATIVE PERCENT CHANGE

Change in tree canopy from 2018 - 2024

2018 Tree Canopy %
25.3%

5.0%
Absolute change in tree canopy

2024 Tree Canopy %
30.2%

20%
Relative change in tree canopy

335
Acres of Gain

130
Acres of Loss

Cambridge was estimated to have 60,350 individual trees in 2024.

Gains in tree canopy are offsetting losses, resulting in a net increase in tree canopy.

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

COMPARISON TO PREVIOUS ASSESSMENTS

Prior Tree Canopy Assessments and Harmonization

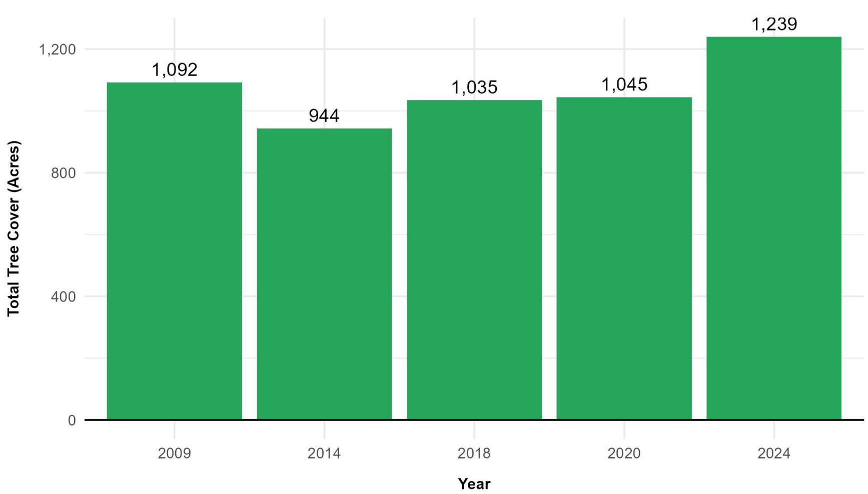
Several tree canopy assessments were conducted for Cambridge prior to this study, covering the periods 2009, 2009–2014, 2014–2018, and 2018-2020. During the 2018–2020 assessment, a harmonization process was undertaken to bring all canopy datasets (2009, 2014, 2018, and 2020) to a common spatial resolution of 0.5 feet. This process also addressed data quality issues, corrected false positives such as canopy detected over buildings, and added young or emerging canopy where applicable. These corrections significantly improved the overall dataset accuracy.

Current Assessment in Relation to Previous Assessments

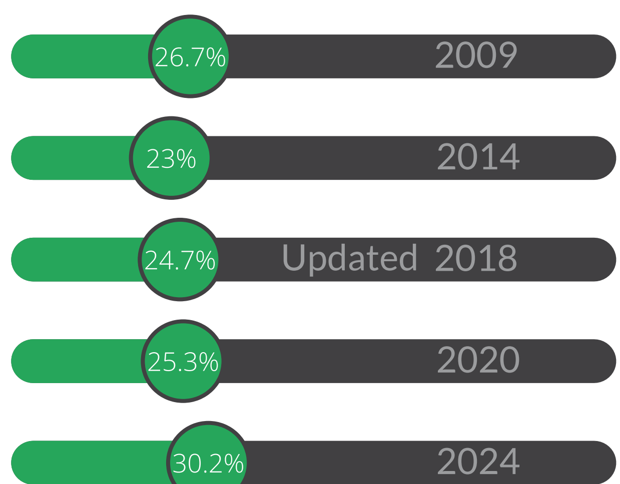
The 2018–2024 assessment was completed independently of earlier work and was not harmonized with previous assessments. However, it maintains the same spatial resolution as past assessments, allowing for a general comparison of tree canopy coverage statistics (see below). Estimates for 2018 differ slightly from the earlier 2018 assessment due to additional manual edits made during the development of the 2018–2024 canopy change map. For example, the 2018 canopy coverage was calculated as 25.3% in the latest assessment, compared to 24.7% in the earlier report, reflecting improvements in methodology and additional manual editing. These updates reflect standard practices in refining earlier data through object-based image analysis and manual editing. As a result, individual tree features in the GIS maps may not align exactly with those in previous assessments, as earlier errors have been corrected.

The following graphs show tree canopy acreage and percentage for each assessment year.

Tree canopy by time period



Total tree canopy area (acres) by time period, 2009–2024.



Percent tree canopy coverage by time period, 2009–2024

FINDINGS

Cambridge's tree canopy increased from 2018 to 2024, with an absolute gain of 5.0%.

There were 335 acres of tree canopy gained and 130 acres of tree canopy lost from 2018 to 2024.

To enhance urban resilience, Cambridge can improve access to trees and the benefits that they provide.

Tree canopy loss is neither evenly distributed nor similar. It varies from removal of individual trees in backyards to clearing of patches of trees for new construction.

Cambridge can improve environmental equity by prioritizing tree plantings in neighborhoods most susceptible to environmental risk.

There were 245 acres of tree canopy in transportation corridors in 2024. This represents a gain of approximately 5% since 2018.

Land use history, urban forestry initiatives, natural processes, and landowner decisions, all play a role in influencing the current state of tree canopy in the City.

The majority of canopy gain were possible thanks to preservation and planting initiatives on residential property, open space, and transportation corridors.

RECOMMENDATIONS

Preserving existing tree canopy is the most effective means for securing future tree canopy, as loss is an event but gain is a process.

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

Having trees with a broad age distribution and a variety of species will ensure that a robust and healthy tree canopy is possible over time.

Community education is essential to maintaining the tree canopy over time. Informed residents who understand the value of trees have played a key role in keeping Cambridge green.

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 citywide ordinances.

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

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

Field data collection efforts should be used to compliment this assessment as information on tree species, size, and health can only be obtained through on-the-ground inventories.

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.

Remotely sensed data 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.

These summaries, in the form of tree canopy metrics, are an exhaustive geospatial database that enables the Existing and Possible Tree Canopy to be analyzed.

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

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

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 investment in high-quality geospatial data, particularly LiDAR. These investments pay dividends for a variety of uses, from 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 Cambridge'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 Cambridge was accounted for.

The high-resolution land cover that forms the foundation of this project was generated from the most recent LiDAR, which was acquired in 2024. 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 Cambridge's tree canopy.

Tree Canopy Mapping

Figure 1. Existing tree canopy overlaid on LiDAR surface model (top) that were derived from the 2024 LiDAR (bottom).

Land Cover Mapping

Figure 2. High-resolution land cover map developed for this project.

LANDCOVER

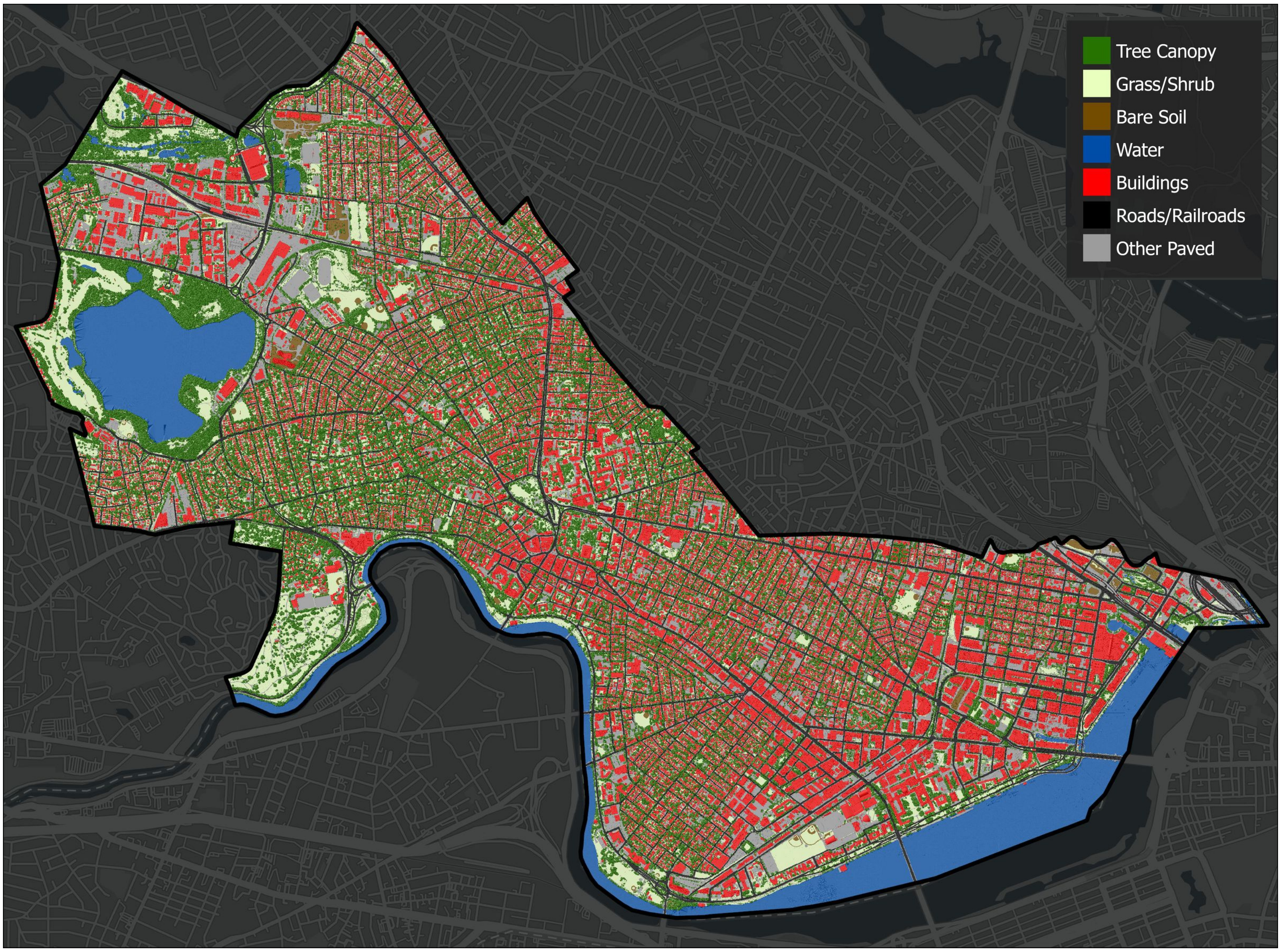


Figure 3. The new 2024 landcover for Cambridge *was used in this assessment to quantify existing tree canopy, possible tree canopy - vegetated, possible tree canopy - impervious, and not suitable. The following terminology is used throughout this report.*

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 the two time periods.

Relative % Change - the magnitude of change in tree canopy based on the amount of tree canopy in 2018.

Absolute % Change - the percentage point change between the two time periods.

TREE COUNT

60,350+ Individual Trees

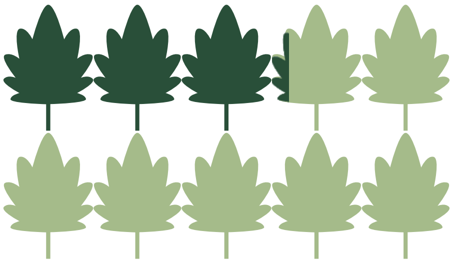
Cambridge has over 60,350 individual trees, an estimate that was derived from the 2024 LiDAR data.

Tree Crowns & Centroids

Trees, particularly individual ones located in parks, on streets, on college greens, and on residential lands, require attention, care, and maintenance to thrive. In addition to quantifying the tree canopy acreage and percent coverage, this study produced an estimate of the number of individual trees in Cambridge. This analysis was performed using the 2024 LiDAR data. While not a replacement for field-based inventories, LiDAR provides a unique advantage in that all of Cambridge's trees can be counted regardless of ownership or locations that are challenging to access. With Cambridge having an estimated over 60,350 trees, tree maintenance and care will ensure that these critical green infrastructure assets thrive in a challenging urban environment.

Figure 4. Tree centroids (dots) and tree crowns (circles) mapped from the 2024 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.

TREE CANOPY METRICS



30.2%

of Cambridge'*s land is covered by tree canopy*

Tree canopy and tree canopy change were summarized at various geographical units of analysis, ranging from neighborhoods to land use. 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 2018 and 2024

Existing Tree Canopy

Cities commonly have uneven distribution of tree canopy, a pattern that applies to Cambridge. There are some 10-acre hexagons with no tree canopy and others with over 98% tree canopy (Figure 5). This unequal distribution can be traced back to Cambridge's history of development patterns and open space planning. Those residents who live and work in more treed areas (darker green hexagons) benefit disproportionately from the ecosystem services that trees provide. Conversely, the more densely developed regions of the Cambridge have lower amounts of tree canopy and therefore receive fewer ecosystem services from trees.

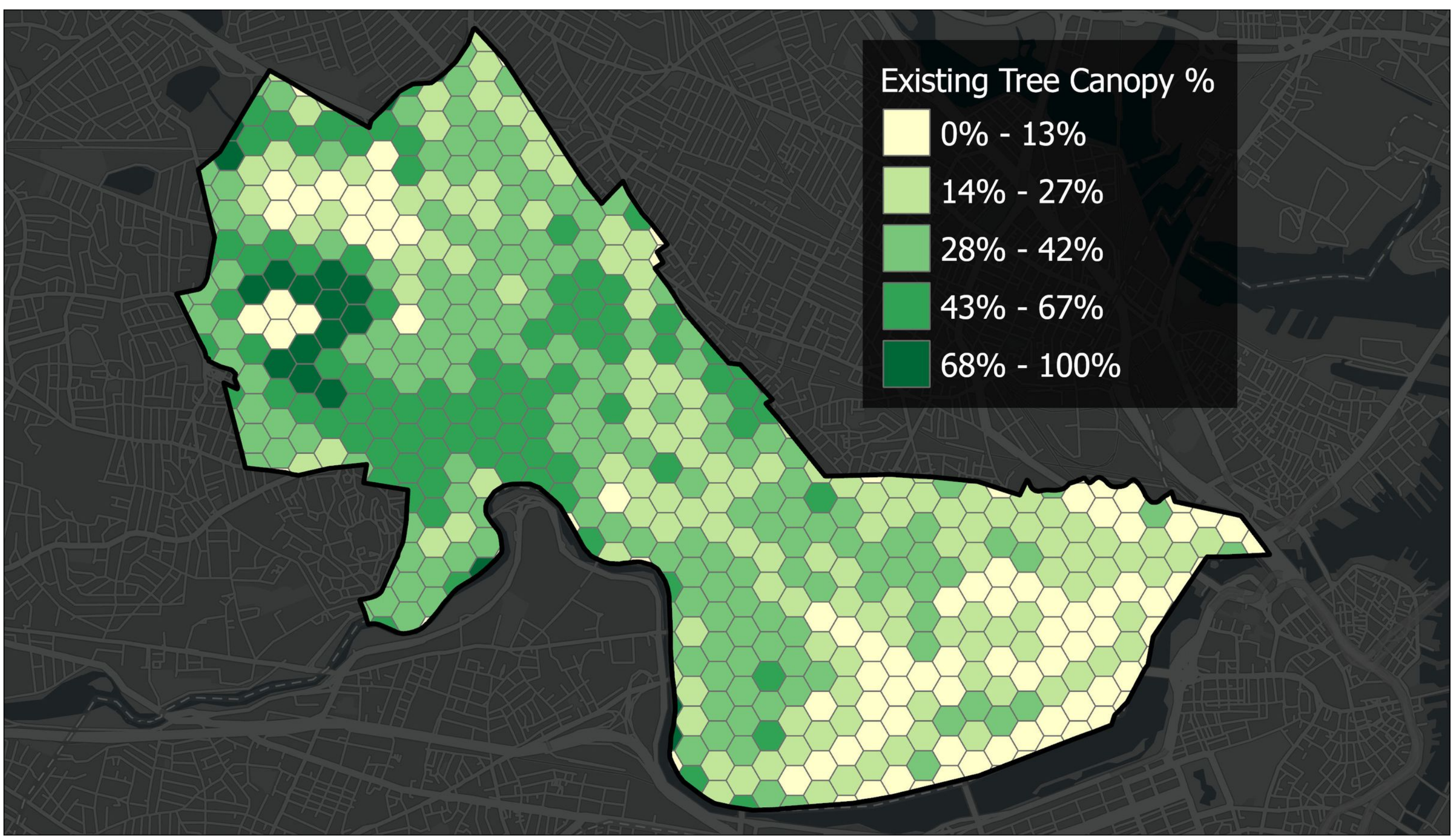


Figure 5. Existing tree canopy percentage for 2024 conditions summarized using 10-acre hexagons. For each of the hexagons, the percent tree canopy was calculated by dividing the amount of tree canopy by the land area, which excludes water. Using hexagons as the unit of analysis provides a standard mechanism 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 Cambridge 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 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 536 acres of land (comprising 13% of the Cambridge's land base) falling into the Possible-Vegetation category, there remain some opportunities for planting trees and expanding canopy that will improve the Cambridge's total tree canopy in the long term.

In Cambridge's most densely developed areas, expanding the tree canopy will be challenging; nevertheless, canopy growth remains important, as these areas are heavily used and visited by many people, who stand to benefit from the shade, cooling, and overall well-being that trees provide. In the City's residential neighborhoods and campus areas, promoting regeneration and planting new trees will play a key role in sustaining and enhancing the canopy.

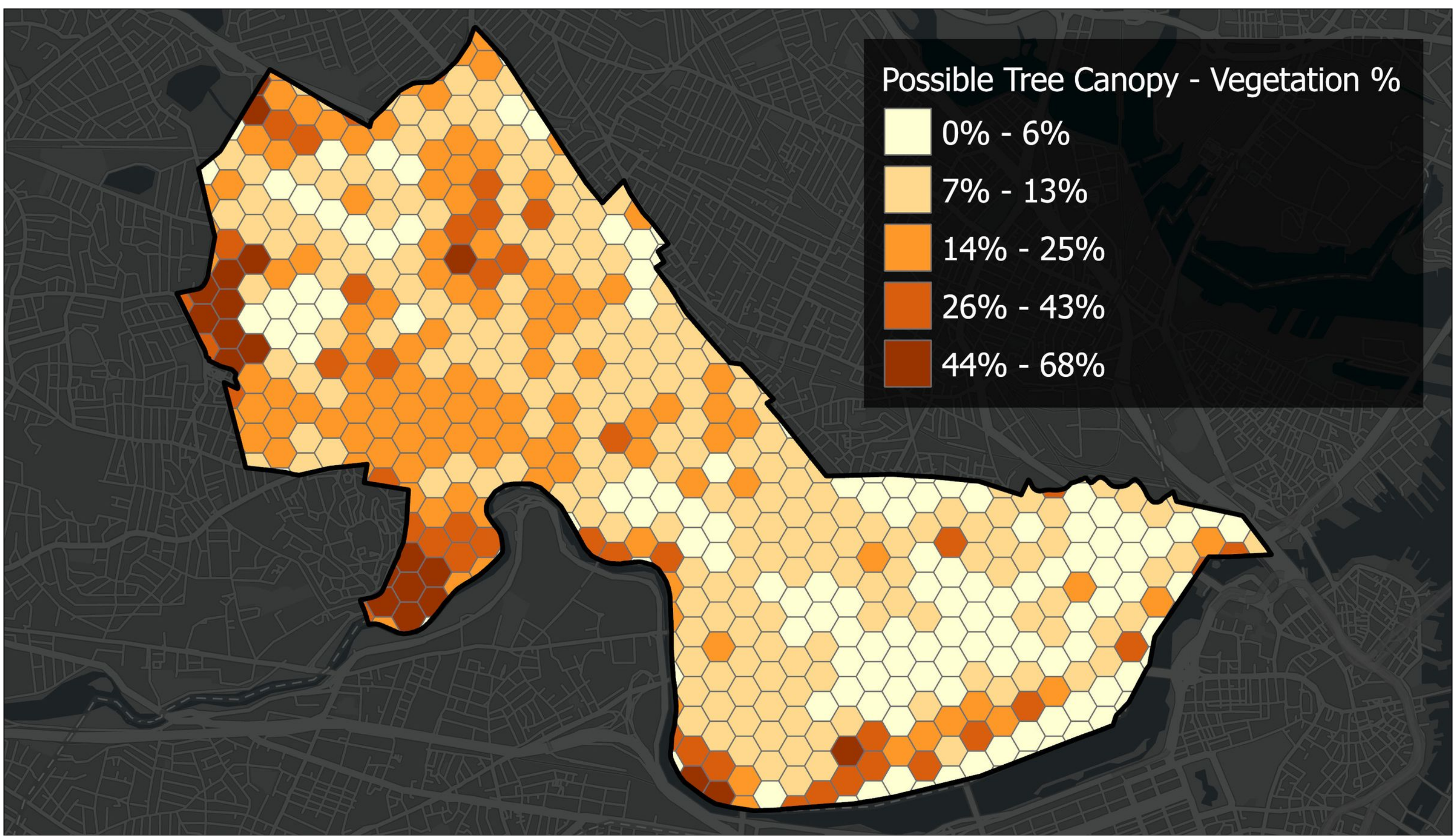


Figure 6. Possible Tree Canopy consisting of non-treed vegetated surfaces summarized by 10-acre hexagons. These vegetated surfaces that are not currently covered by tree canopy represent areas where it is biophysically feasible to establish new tree canopy. It may be financially challenging or socially undesirable to establish new tree canopy on much of this land. Examples include recreational fields and turfs. 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

Cambridge has experienced a net increase of 5% in tree canopy overall, but the pattern of change is more nuanced, marked by a mix of both loss and gain. Every area of the City saw some degree of canopy loss and gain. The removal and natural die-off of mature trees led to the loss of large canopy patches. Mature trees with wide crowns contribute significantly to overall canopy and take decades to replace. Their loss results in substantial and localized declines. Generally, planting efforts, preservation programs, and natural growth have helped offset those losses and support overall canopy expansion. Tree canopy tends to build upon itself, as most trees increase in size annually. When properly maintained, trees play a critical role in mitigating environmental challenges associated with urban areas, such as flooding, poor air quality, and the urban heat island effect. This makes tree canopy a vital component of Cambridge's green infrastructure.

Cambridge's canopy growth between 2018-2024 is encouraging, but the City's tree canopy faces a range of environmental and human-driven risks. Invasive species, if not identified and managed early, could pose a serious threat to canopy health. Natural events such as storms have mixed effects—while canopy may regenerate naturally in conserved areas, trees lost in urbanized settings typically require replanting. Climate change adds further complexity: it may accelerate tree growth in some cases, while also creating inhospitable conditions for certain native species. On the human side, outcomes will depend heavily on the strength of preservation efforts, conservation initiatives, and local tree ordinances. Effectively managing these risks will be essential to ensuring long-term, sustainable canopy growth in Cambridge.

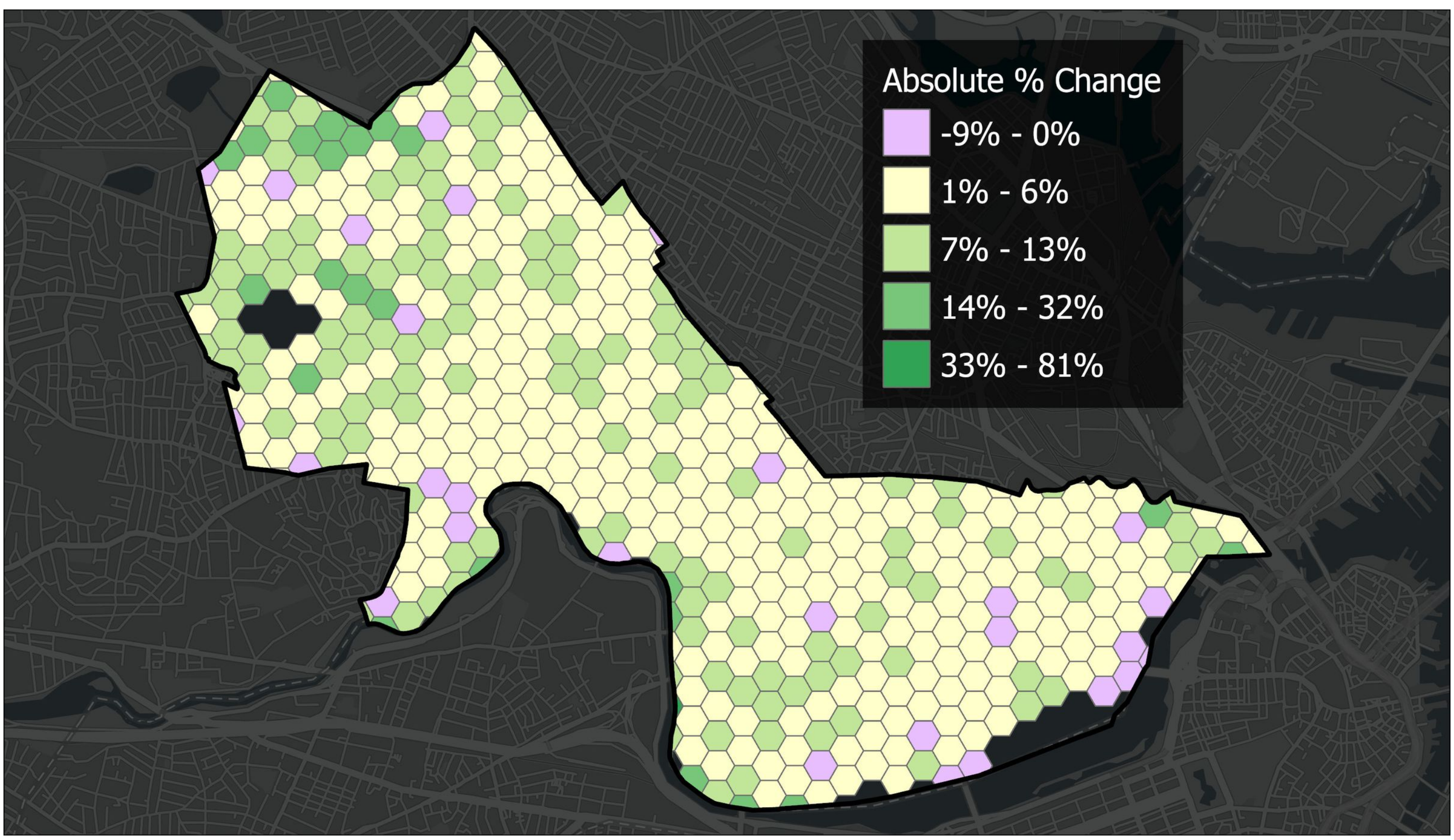


Figure 7. Tree canopy change summarized by 10-acre hexagons. Darker greens indicate greater gain, while purple reflects canopy loss.

Canopy Change Distribution - Relative % Change

The magnitude of tree canopy change across Cambridge can be measured by the relative tree canopy change over the 2018 - 2024 period. The relative change is calculated by taking the tree canopy area in 2018, subtracting the tree canopy area in 2024, then dividing this number by the area of tree canopy in 2018. Areas with the greatest change indicate that the canopy is markedly different in 2024 as compared to 2018. In some of the commercial and urbanized areas with little tree canopy in 2018, 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 gain in tree canopy were in locations where new plantings were carried out on areas with little tree canopy to begin with (south-east and north-west Cambridge). 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 the Right of Way (ROW) can be tough, they are a tool to increase canopy in low coverage, often impervious surface dominated areas. Natural growth can provide gain 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.

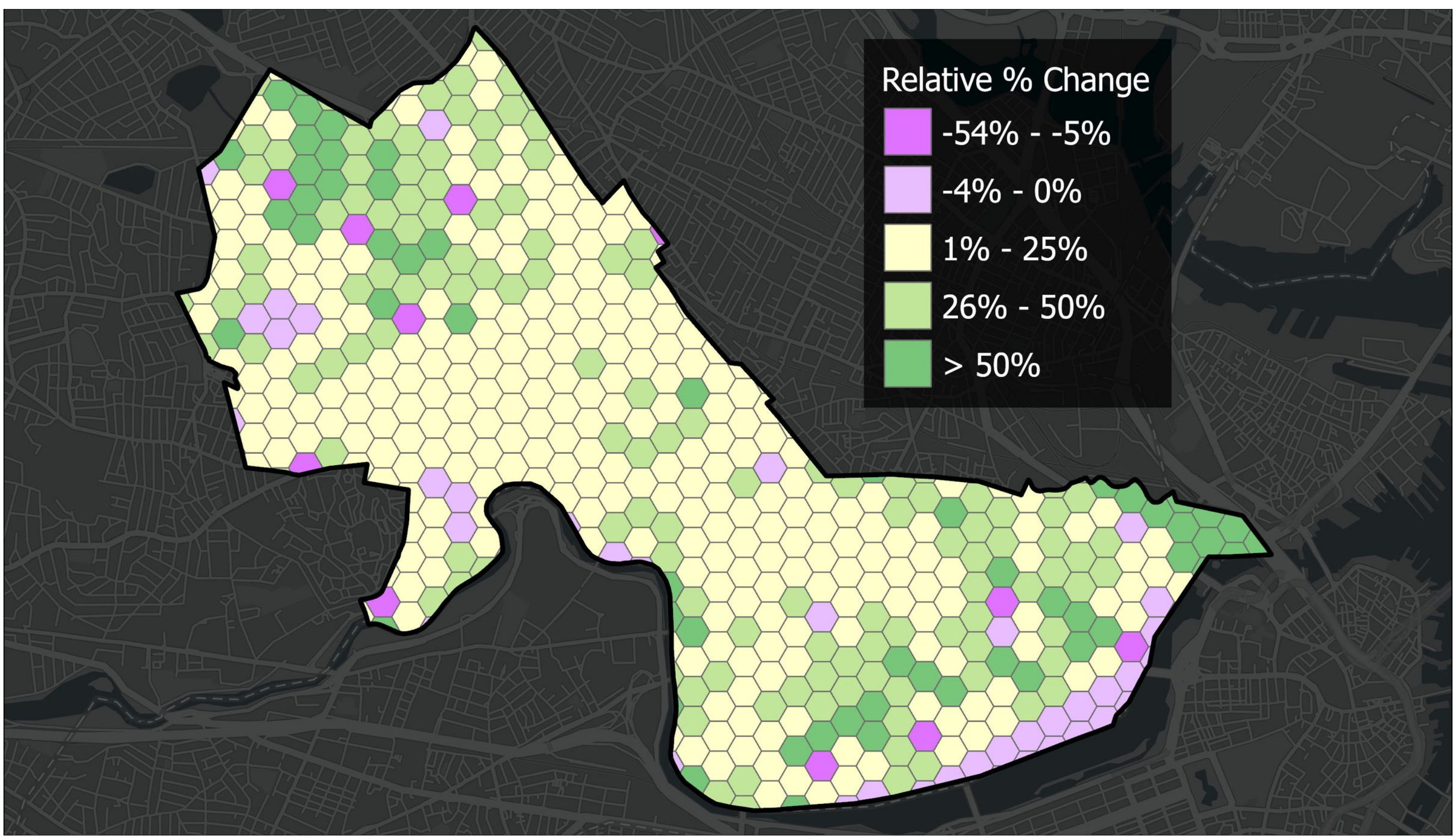


Figure 8. Tree canopy change metrics summarized by 10-acre hexagons. Relative tree canopy is calculated by using the formula (2018-2024)/2024. Colors are categorized by data quantiles. Darker greens indicate greater relative gain, while darker purple reflects a higher magnitude of loss.

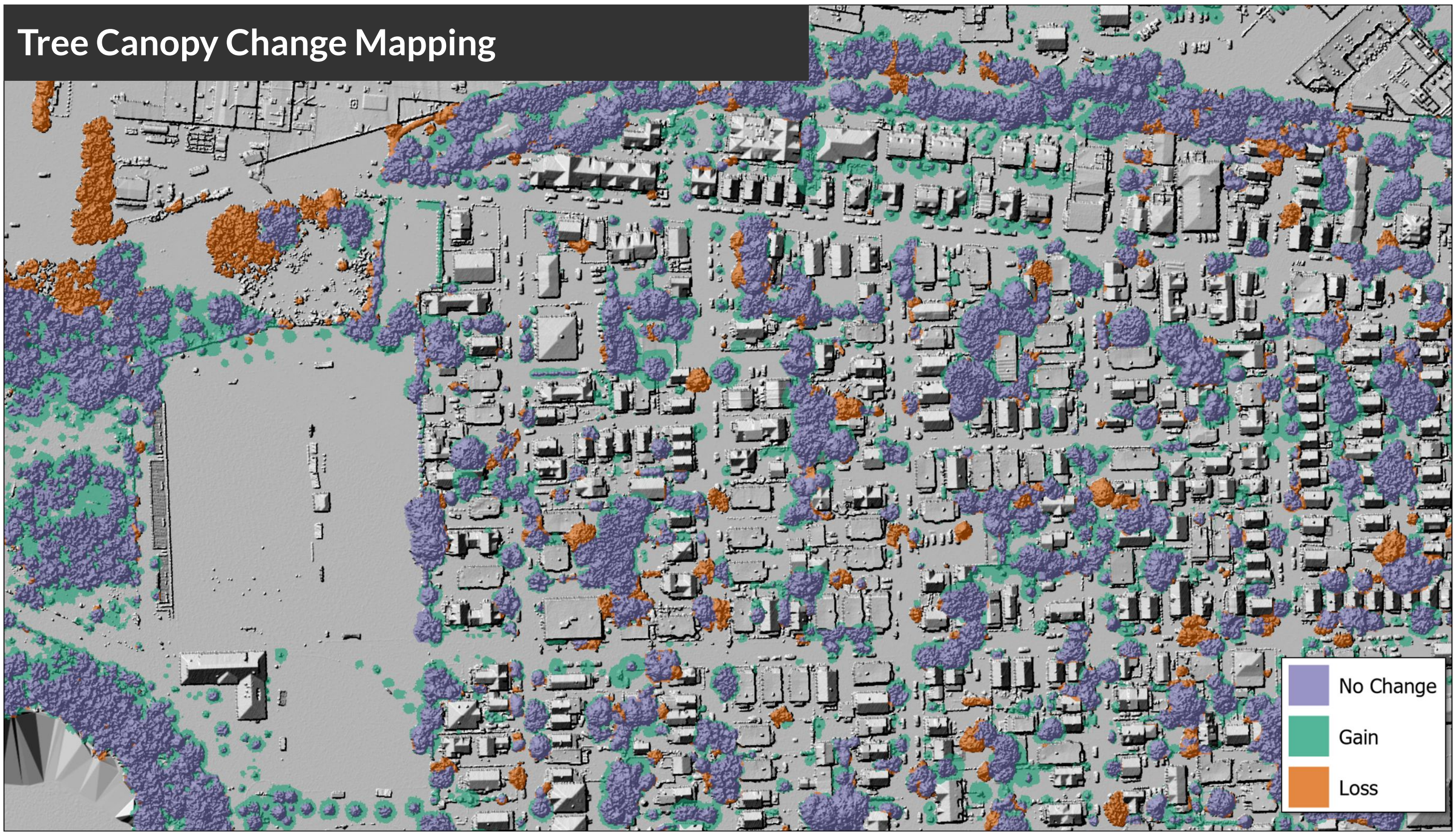


Figure 9. Tree canopy change mapping for the area around Russel Field in North Cambridge overlaid on 2018 LiDAR. This area experienced a mix of gain (green) from regeneration and new tree plantings (green) and loss (orange) resulting from trees removed during construction.

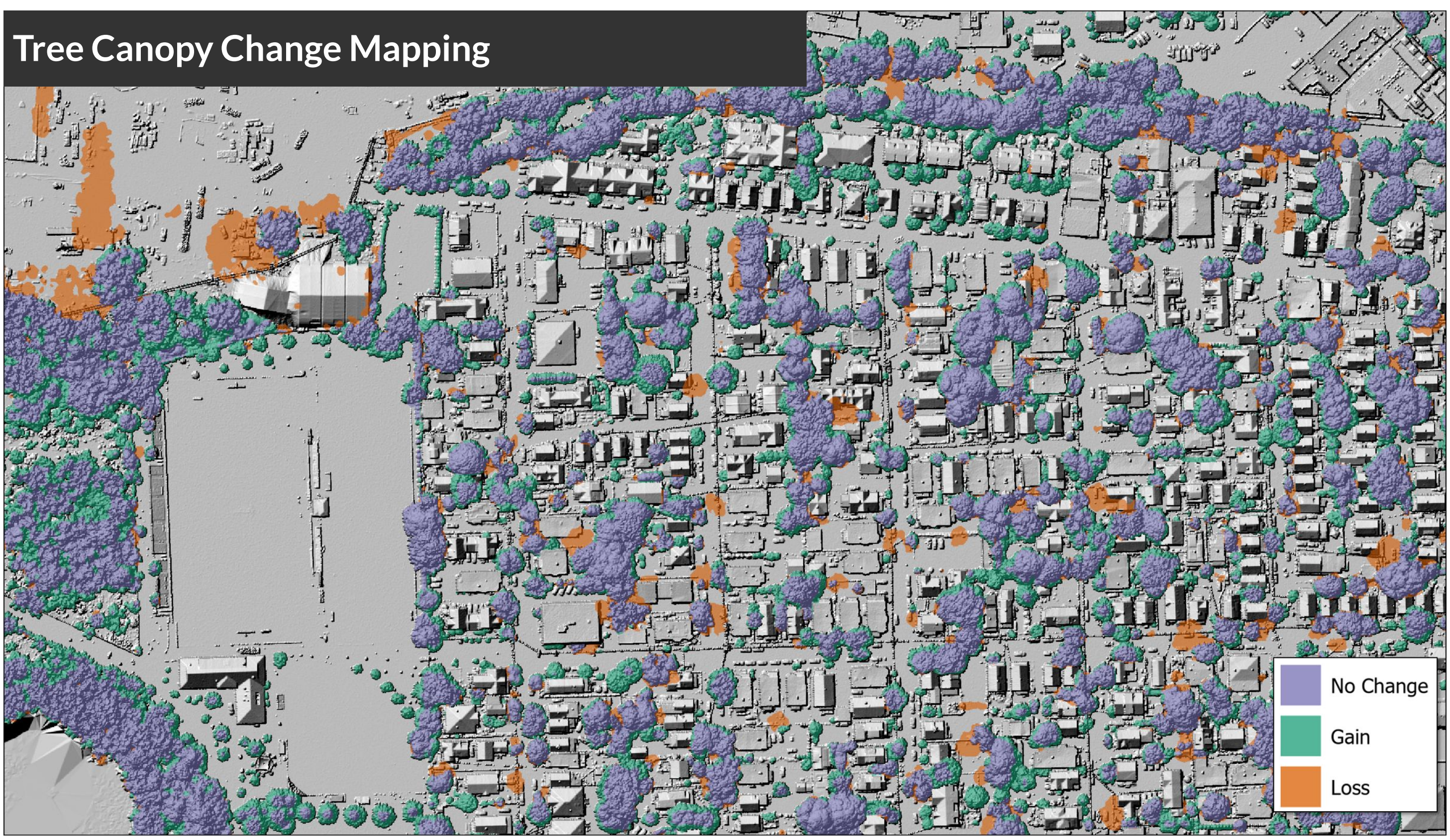


Figure 10. Tree canopy change for the same area surrounding *overlaid on the 2024 LiDAR. The areas of gain appear rough now that tree canopy is present, and the areas of loss appear smooth due to the absence of tree canopy.*

PATTERNS OF CHANGE

Numerous factors contribute to the range of tree canopy change patterns of Cambridge. These include 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.

Residential Canopy Regeneration

Tree canopy gain

Residential Area

New Construction

Tree canopy increased between 2019 and 2024 in Cambridge's residential neighborhoods, thanks to replanting efforts and natural regeneration. A common challenge is the "plant and forget" cycle—trees are often planted during initial construction, but there is little follow-up to care for or replace them as they age or decline. This limits the development of the next generation of canopy. In more established neighborhoods, trees continue to grow and contribute to canopy cover, but factors such as aging, disease, invasive species, storm damage, and changing landowner preferences all contribute to tree removals. Without consistent replanting, canopy losses may eventually outpace gains, threatening the long-term sustainability of Cambridge's urban forest.

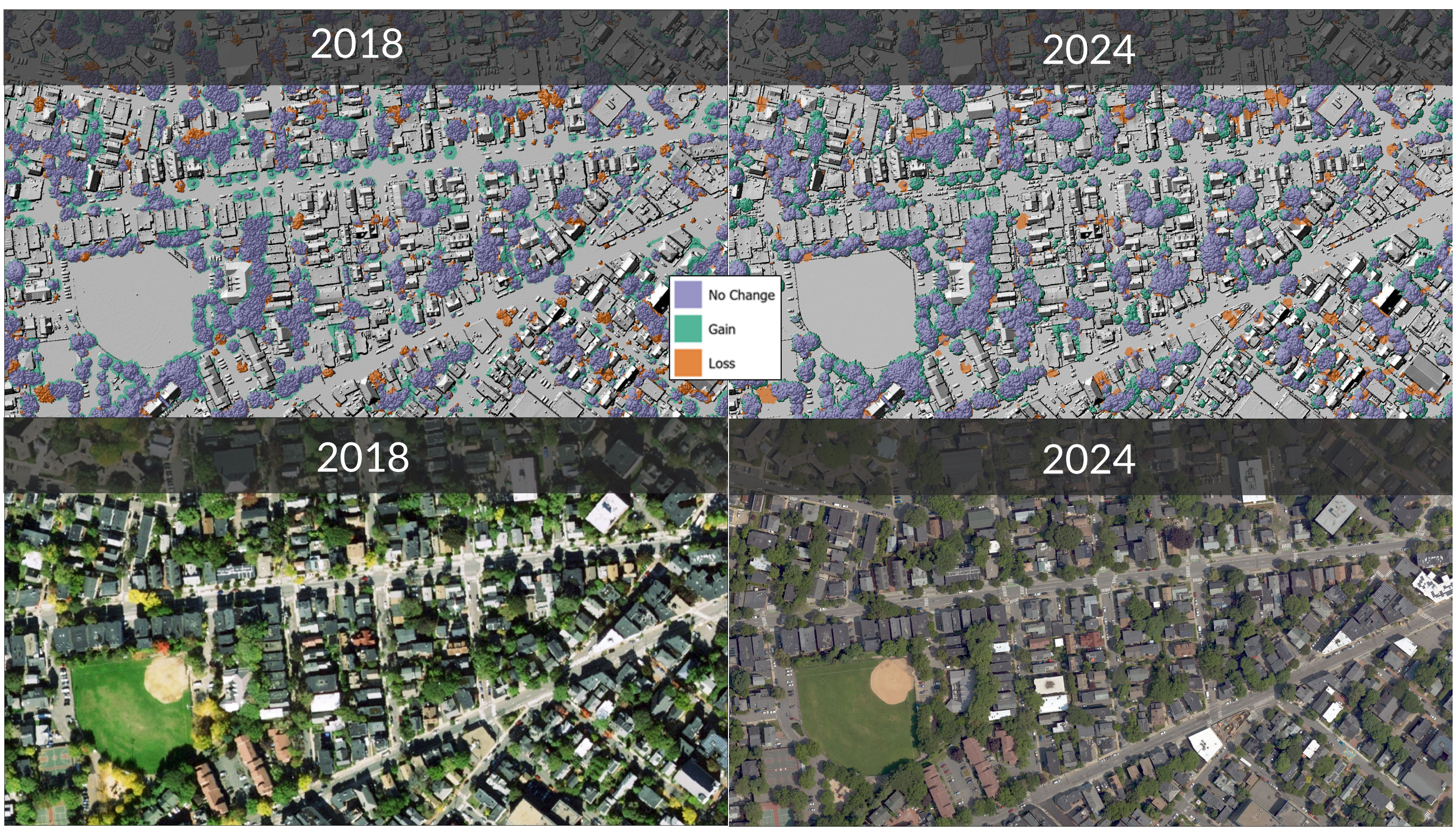


Figure 11. Natural growth and new plantings near Western Ave. in the vicinity of the Riverside and Cambridgeport neighborhoods, resulted in tree canopy gain in the area.

Canopy losses with New Development

While housing developments can be necessary, it is important to balance these needs with the critical ecosystem services provided by trees. Incorporating greening measures and new plantings into development projects can help mitigate the impacts of construction. Although tree planting and natural succession are gradual processes, they play a key role in sustaining and expanding the urban tree canopy over time.

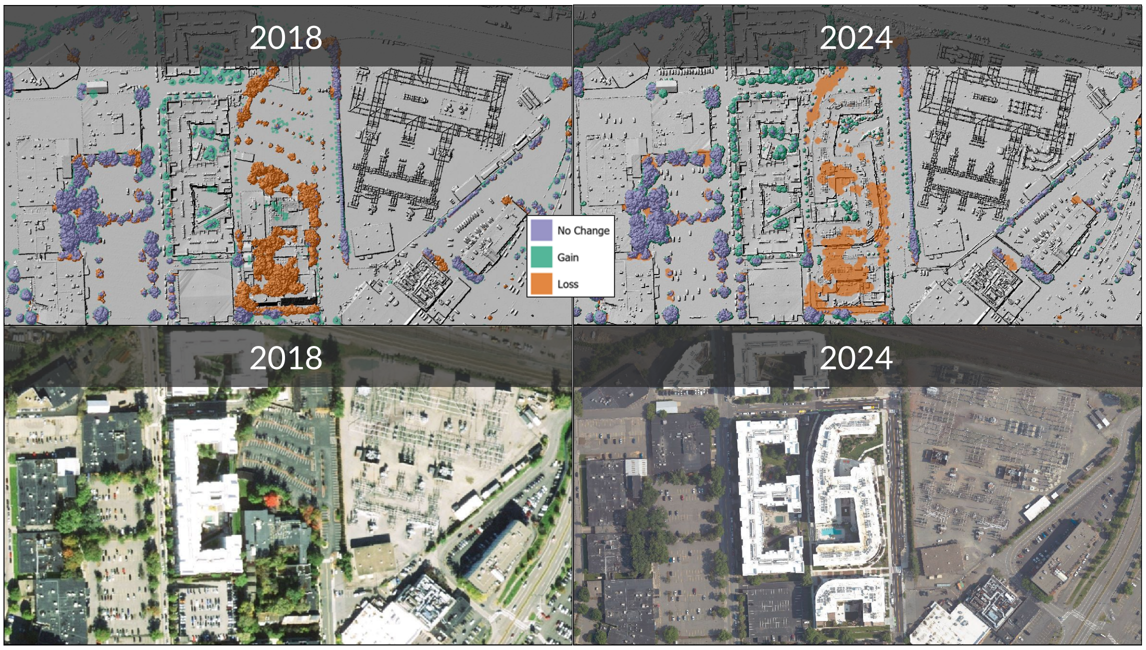


Figure 12. Tree canopy removal stemming from the construction of a apartment complex off Wheeler St.

Forest Patch Loss

Residential Area

New Construction

Growth in Commercial & Industrial Areas

Industrial and commercial areas tend to have far less tree canopy than other land uses, this is true in Cambridge. While tree canopy coverage in these areas is low, Cambridge's industrial and commercial areas saw increases in tree canopy over the 2018-2024 period. Tree plantings and growth can have an outsized impact in these areas since trees can help reduce the urban heat island and stormwater runoff, problems to which these impervious surface-dominated areas are especially vulnerable.

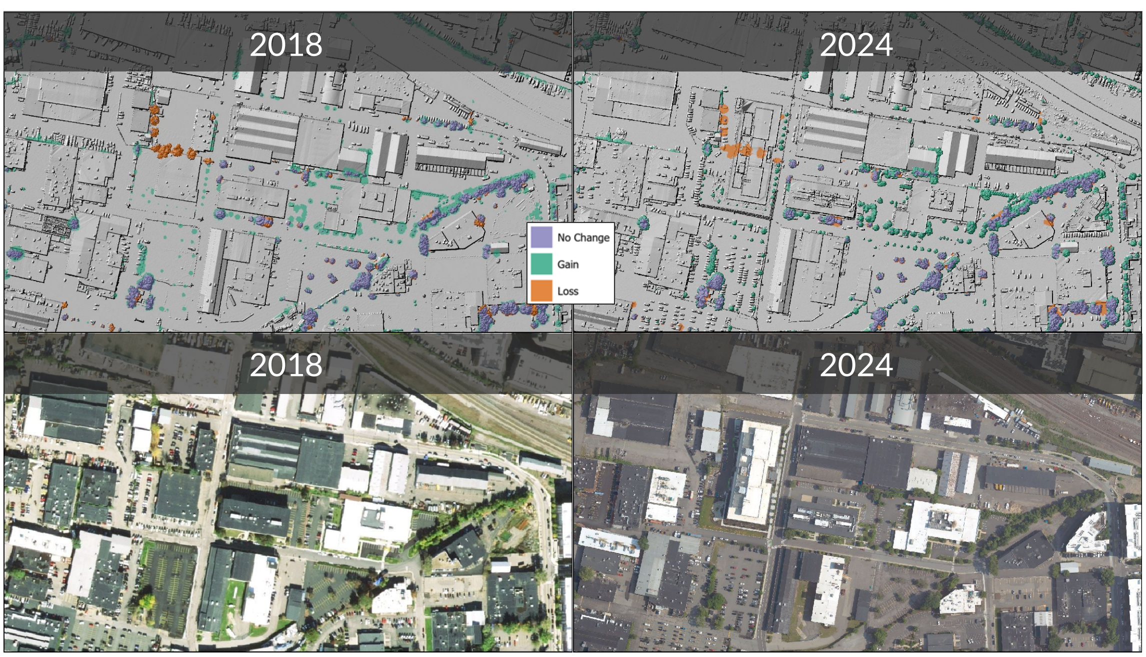


Figure 13. Growth of street trees helped mitigate losses and contribute to tree canopy gains around Smith Pl.

Mix of Loss and Gains

Commercial and Industrial Area

High Impervious Cover

Neighborhood boundaries are a useful way to describe tree canopy patterns and compare different parts of Cambridge. Differences in canopy cover reflect the City's land use history and changes in the built environment. Between 2018 and 2024, all neighborhoods experienced both gains and losses in tree canopy. However, thanks to replanting efforts and natural canopy regeneration, overall gains outpaced losses, leading to a net increase across all neighborhoods and citywide.

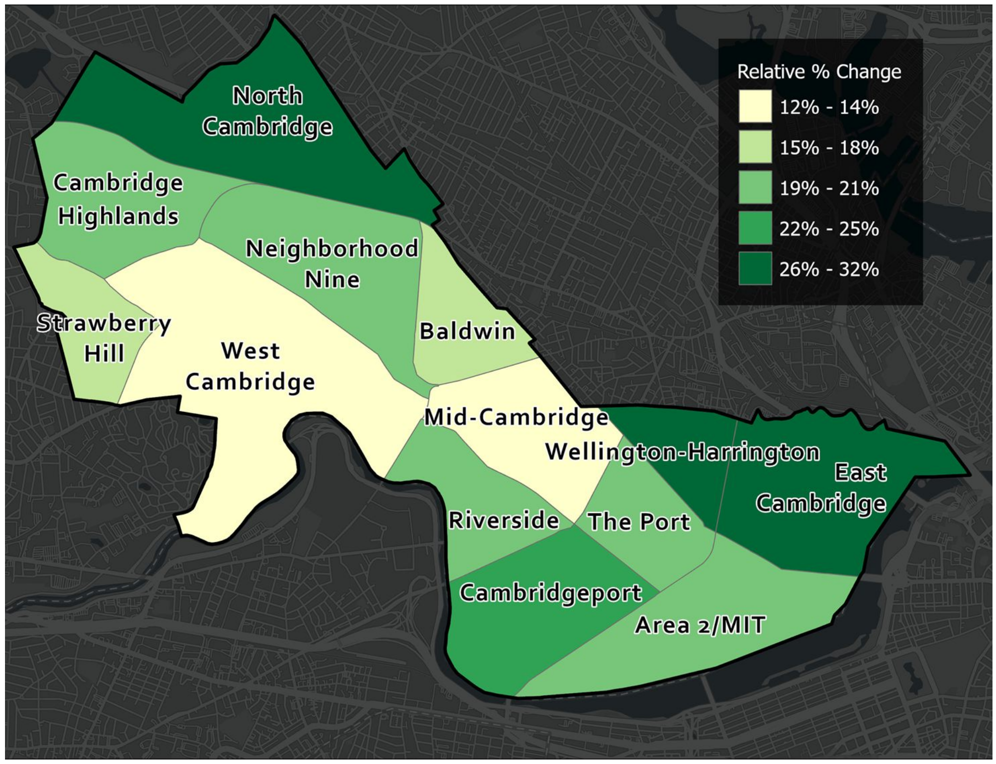


Figure 14. Existing tree canopy percentage for 2024 conditions summarized by neighborhoods.

The West Cambridge neighborhood has the highest tree canopy coverage, with over 40%. In contrast, East Cambridge has the lowest coverage at 15.5%, yet it experienced the second-highest relative increase (31.4%) in canopy from 2018 to 2024, following Wellington-Harrington, which saw a 31.8% increase Figure 15. North Cambridge recorded the third-highest relative increase (29.6%) and gained nearly 172 acres of canopy, much of it concentrated around the Alewife Brook Reservation.

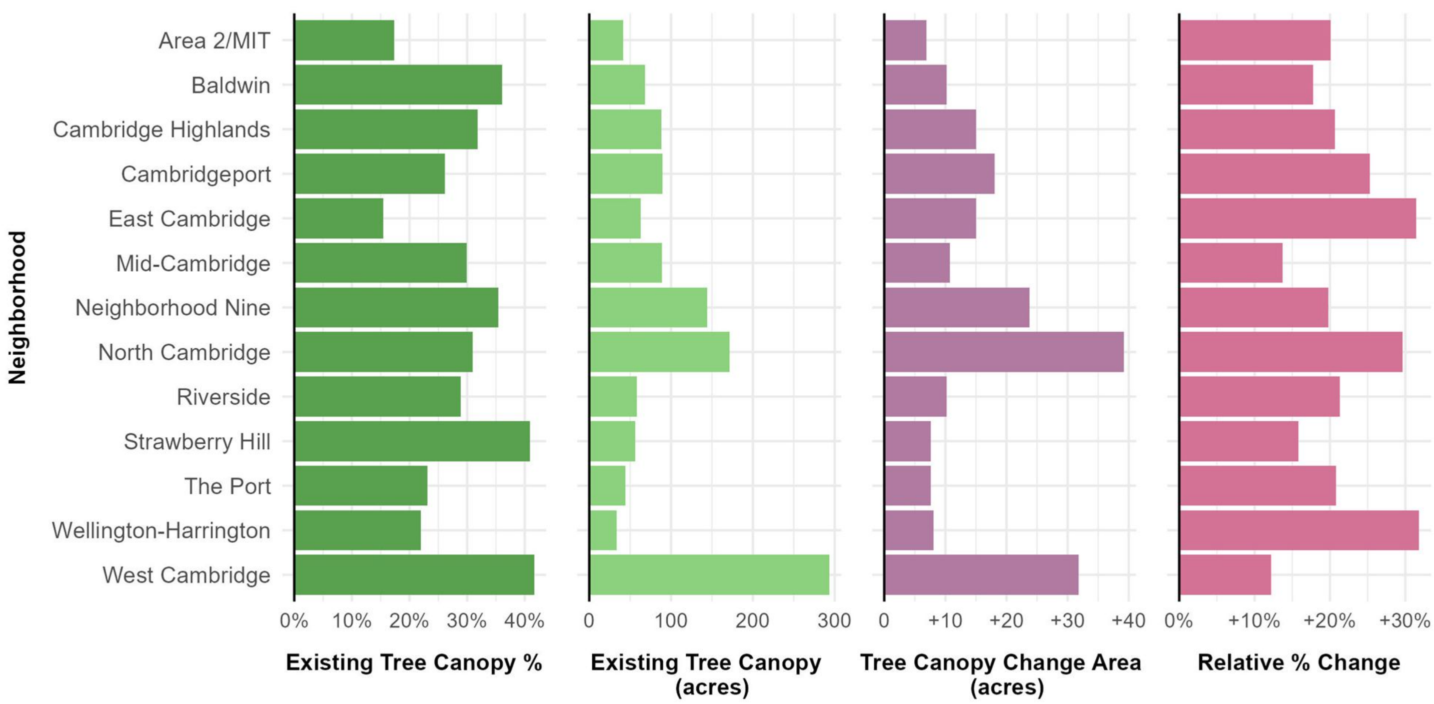


Figure 15: Tree canopy and change metrics summarized by neighborhoods.

Land use refers to how people use land. For example, for residential, commercial, or agricultural purposes. It differs from land cover, which describes physical features on the landscape, such as trees, buildings, water, or pavement. For instance, residential areas may include a mix of trees, buildings, and other land cover types. Land use plays a key role in determining both the amount of existing tree canopy and the potential space for new canopy growth. Some land uses may offer greater opportunities for planting new trees, while others may be more constrained due to impervious surfaces or competing infrastructure needs.

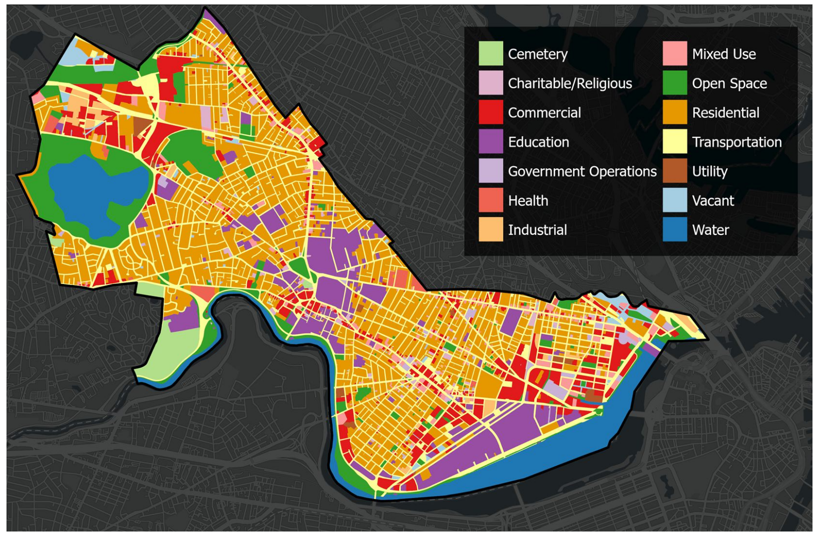


Figure 16. Lan Use by which tree canopy metrics were summarized.

Residential land accounts for the largest share of tree canopy in Cambridge, with over 500 acres. This is followed by land used for transportation and open space, which together contribute nearly 500 acres of canopy. Among all land use categories, open space saw the greatest absolute increase in canopy, with an 11% gain.

Canopy gains in open space and transportation areas suggest that the City's investment in urban forestry is producing measurable benefits. Transportation areas experienced an approximate 5% increase in canopy cover. However, street trees in these areas often face challenging growing conditions due to their proximity to roads. Factors such as road salt, soil compaction, limited root space, clearance pruning, and vehicle impacts can hinder both the establishment and long-term growth of trees. Despite these challenges, trees along streets can serve as visual cues that help calm traffic, improve air quality, mitigate heat, and may be strategically incorporated into high-traffic corridors and commercial districts.

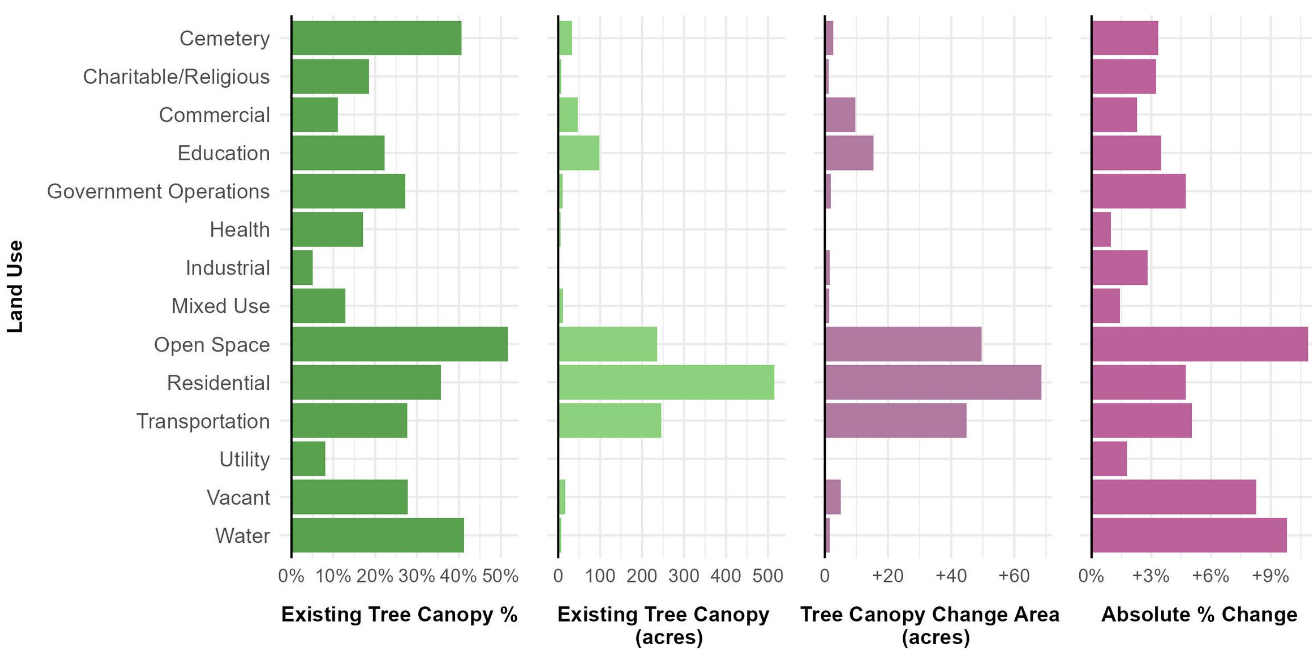


Figure 17: Tree canopy and change metrics summarized by Land Use.

There is space in Cambridge where additional trees could be planted. Areas identified in this assessment as "Possible Vegetation" refer to places without existing trees, buildings, pavement, or water, where canopy could potentially be added without major site alterations (see page 11).

Land use plays a critical role in determining where tree planting is most feasible. In Cambridge, there is possible vegetated space for canopy expansion across several land use types, particularly within Charitable/Religious, Educational, Open Space, and Residential land uses. These areas present opportunities for further exploration and collaboration. Partnerships with community groups, organizations, and residents may help support tree planting and long-term care efforts.

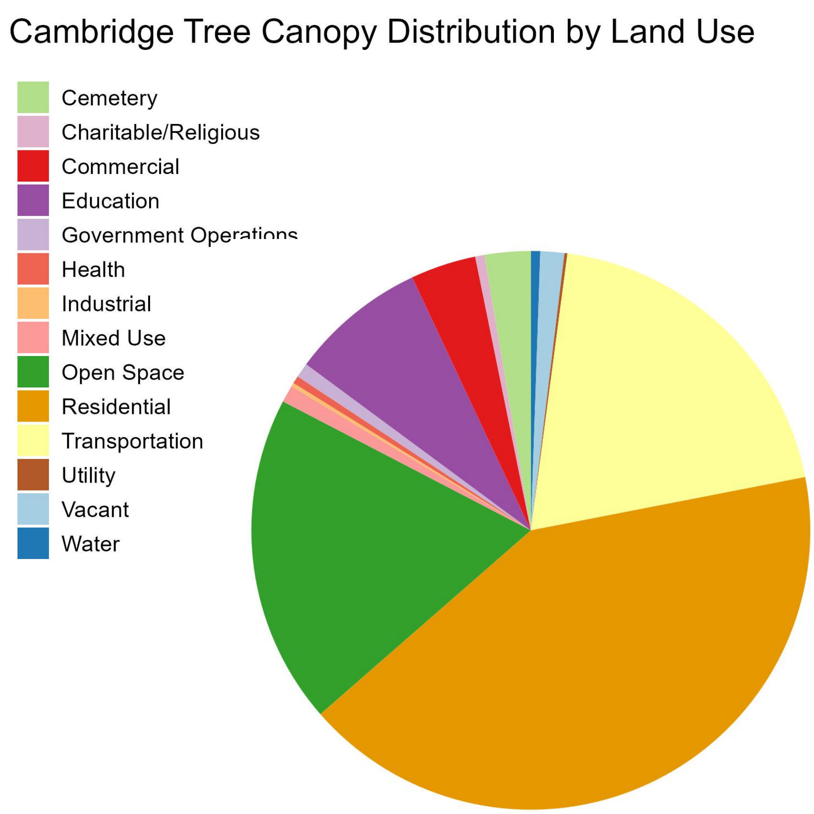


Figure 18. Cambridge Tree Canopy Distribution by Land Use.

Figure 19. Possible Tree Canopy metrics summarized by Land Use.

TREE HEIGHT DISTRIBUTION

Tree height can serve as a useful proxy for tree age. A diverse height structure suggests a healthy, varied age distribution. In contrast, an even-aged tree canopy, often the result of trees being planted around the same time, can lead to widespread canopy loss when many trees reach the end of their lifespan simultaneously. Age diversity supports a more resilient canopy, ensuring that not all trees reach maturity at the same time. In Cambridge, the most common tree height is between 20 and 25 feet, with the number of trees decreasing as height increases beyond 25 feet (Figure 20). A small number of trees exceed 100 feet in height, and there are also some trees in the 5–10 foot range. Trees shorter than 8 feet were not included in this assessment.

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 ensuring succession by 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. A balanced age and height structure is essential for a resilient and sustainable urban forest.

Tree Height Distribution

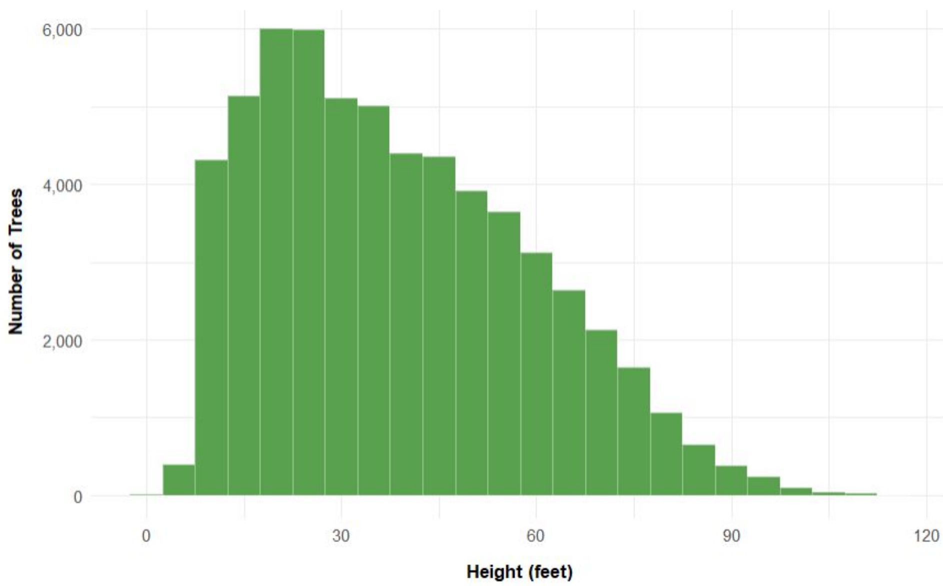


Figure 20. Histogram of the tree canopy height displaying the number of trees in each 5-foot bin.

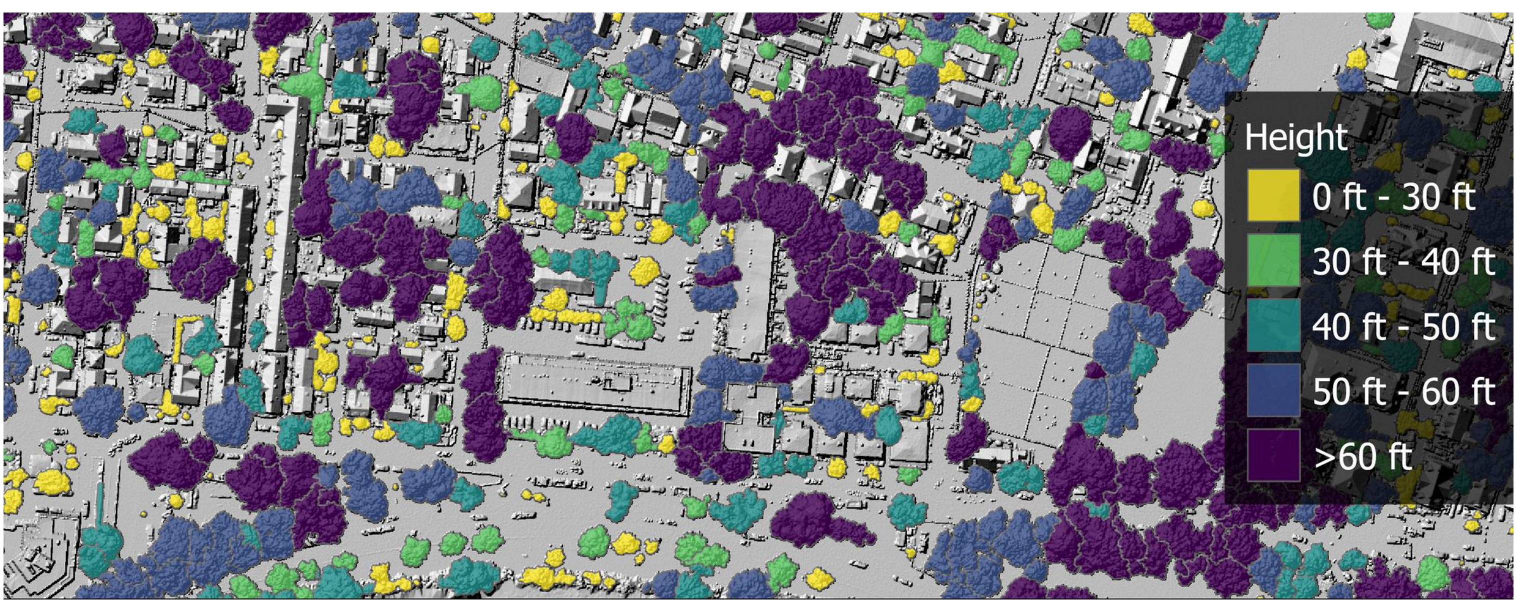


Figure 21. Example of the height classification with purple representing taller canopy. Cambridge's tree canopy was segmented into polygons approximating individual trees. Each of these polygons was then attributed with the height value from the 2024 LiDAR.

TREE CANOPY HEIGHT CHANGE

In addition to examining the spatial distribution of tree canopy gains and losses, it is valuable to assess how these changes vary by tree height class, which serves as a proxy for tree age, maturity, and ecological function. Figure 22 illustrates canopy change across different height classes using LiDAR data from 2019 and 2024. It is important to note that areas of gain (green) loss (orange) and no change (purple) reflect shifts in canopy area within each height class, not changes in the height of individual trees over time. Canopy loss is categorized by 2019 tree height, while canopy gain and areas of no change (purple) are based on 2024 tree height data.

The largest increases in canopy area occurred in the 10–20 ft (80 acres) and 20–30 ft (84 acres) height classes, reflecting the rapid growth of young or recently planted trees. Canopy gains were less prominent in taller height classes, which is consistent with the slower growth rates of mature trees. The most significant canopy losses were observed in the mid-height ranges, with 35 acres lost in the 40–50 ft range and 27 acres lost in the 50–60 ft range. While some of this loss may reflect trees growing into the next height class, the total amount of gain in the subsequent height ranges was lower than the loss in the original class, suggesting that much of the loss is due to the removal or decline of mature trees.

This analysis does not include data on individual tree species, trunk diameter, or health (information typically gathered through field-based inventories). Incorporating this type of data into planning efforts would support more targeted urban forest management strategies such as species diversification and risk mitigation.

Figure 22. The tree canopy was segmented into polygons approximating individual trees. Each of these polygons was then attributed with the height from both the 2019 and 2024 LiDAR data. The height from the 2019 LiDAR was used to understand loss (orange), whereas the height from the 2024 LiDAR was used to understand the gains (green) and no change (purple).

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 Cambridge's tree canopy into five forest patch classes based on their morphology.

Forest patches, large and small, serve important roles in urban landscapes. Small patches and individual trees can provide access to natural areas and associated benefits in urban settings and can serve as stepping stones for wildlife traveling between larger forest patches. Large forest patches are particularly important to protect and maintain because they are necessary for certain ecosystem services that smaller patches cannot provide. In addition to producing outsized benefits like pollution mitigation and cooling, large forest patches can offer habitat for species with larger home ranges and those 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 Cambridge's tree canopy exists in small patches, which collectively cover nearly 600 acres (Figure 24). The second largest group was isolated trees, which account for over 250 acres. The largest contiguous patches of forest are primarily located in the northwestern areas of the city, including Very Large patches of approximately 200 acres.

A balanced urban forest should include both widespread small canopy patches and large contiguous patches. Strategies to protect large patches, connect fragmented canopy, and expand tree planting in areas dominated by isolated trees can strengthen ecological resilience and improve environmental equity across Cambridge.

Forest Patch Size Classes

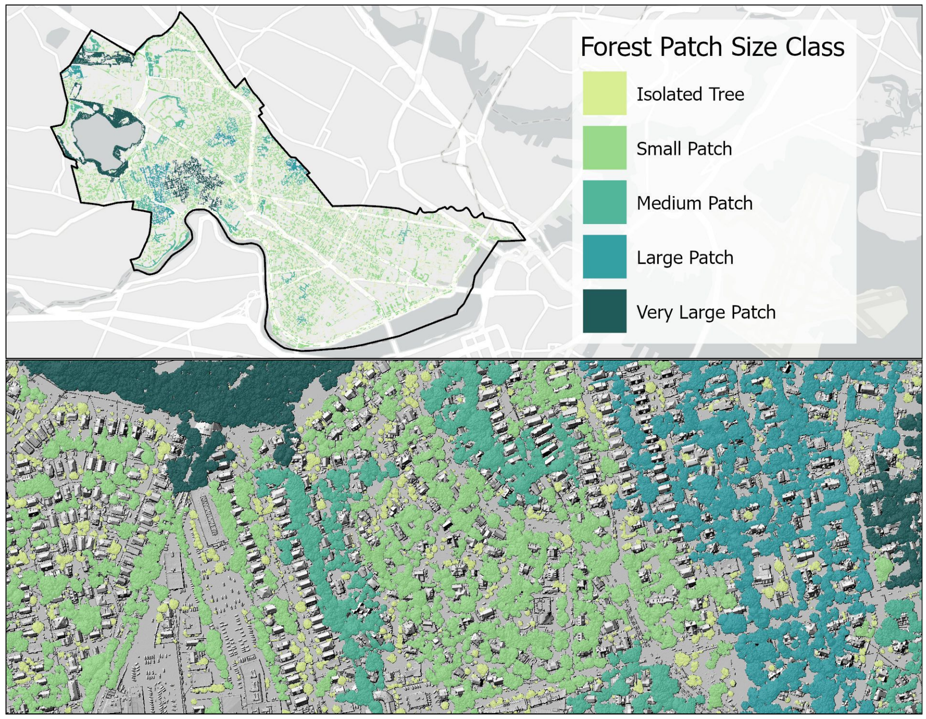


Figure 23. Overview of Cambridge's forest patches by size (top). Example close-up of forest patch size classification (bottom). Forest patches are groups of trees surrounded by other, non-forested, land cover types.

Forest Patch Total Area

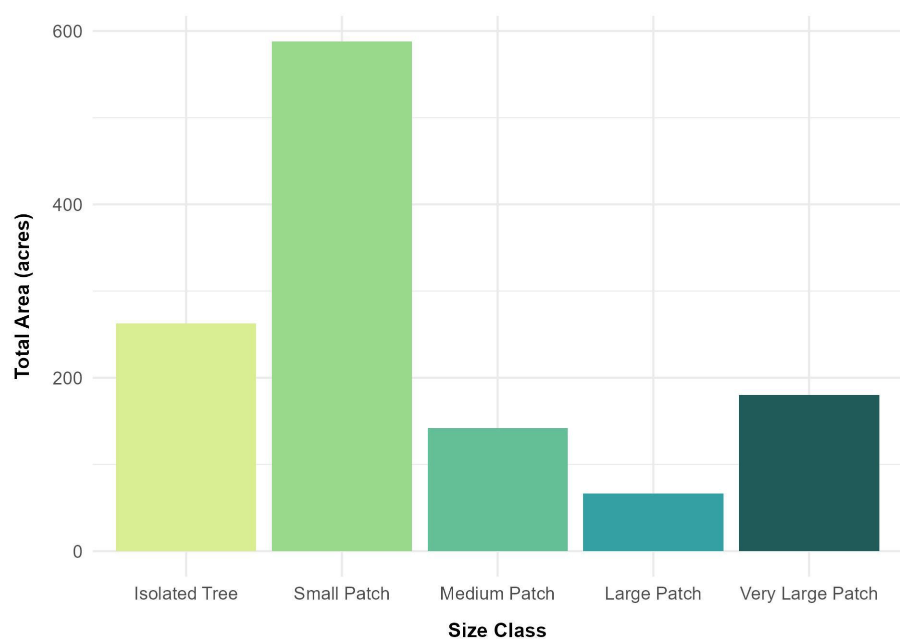


Figure 24. Total area of each forest patch size class.

EQUITY & ENVIRONMENTAL JUSTICE

Environmental Equity & Urban Resilience

Like many cities across the United States, Cambridge faces environmental risks and urban challenges. When properly maintained, trees can play a vital role in promoting sustainability and strengthening the City's resilience. However, resilience relies not only on infrastructure and nature-based solutions but also on the community's preparedness and ability to access these resources.

To enhance urban resilience, Cambridge can prioritize neighborhoods with limited access to tree canopy. Tree planting efforts can also be informed by the distribution of demographic groups that are more vulnerable to environmental risks, including historically marginalized populations such as racial and ethnic minorities and residents living in poverty.

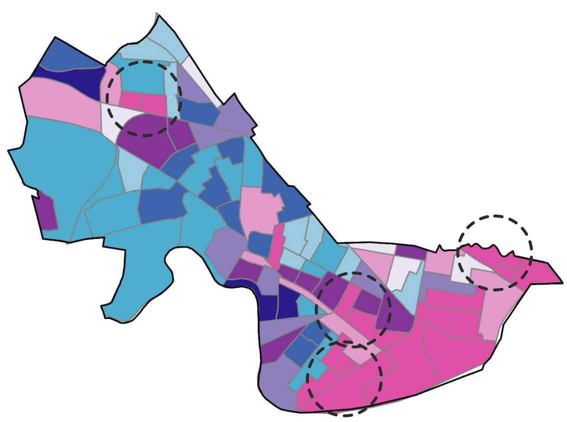
In Cambridge, census block groups with a higher proportion of Non-White residents (darker pink top map) and limited tree canopy (light blue top map) closely align with areas where poverty is more prevalent (darker pink bottom map) and canopy is similarly sparse (light blue bottom map). These populations, often overlapping (dashed line), are likely more exposed to environmental challenges due to the absence of trees that help mitigate such risks through the provision of ecological benefits.

SUSCEPTIBILITY AND INEQUITY

CERTAIN DEMOGRAPHICS* ARE MORE VULNERABLE TO ENVIRONMENTAL CHALLENGES

*Other examples of demographics (not included in this analysis) 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)

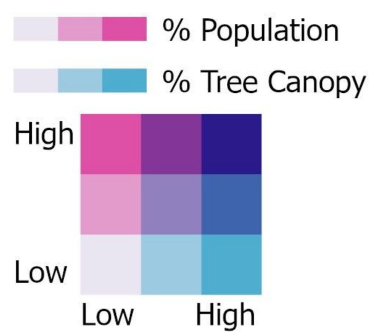


Figure 24. These maps show percent existing tree canopy cover in relation to two demographic groups that are often interrelated and typically within the most susceptible groups against environmental challenges. Shades of blue indicate tree canopy percentage by block group, with the darkest shade indicating 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 Cambridge. Using both the Urban Flood Risk Mitigation and the Urban Cooling modules of the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) tool, areas that are more at risk of flooding and high temperatures were identified based on 2024 existing tree canopy. The resulting 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 and extreme heat are significant concerns for Cambridge. Surface runoff (a) and heat mitigation (b) were mapped using the Urban Flood Risk Mitigation module of the InVEST tool. Areas in the north and southeast parts of the City show very low runoff retention. These low-retention zones (indicated in dark blue) could benefit from increased tree planting, as vegetation can act as a riparian buffer—filtering runoff and allowing more precipitation to be absorbed into the soil.

Cambridge is also impacted by the urban heat island effect. Research shows that rising temperatures can increase health risks, particularly for older adults and individuals with cardiovascular conditions. Vegetation helps reduce heat, but its cooling capacity varies across the city. Areas shown in dark red retain more heat and feel significantly warmer. Planting trees in these zones can provide shade and cooling, helping to reduce heat exposure.

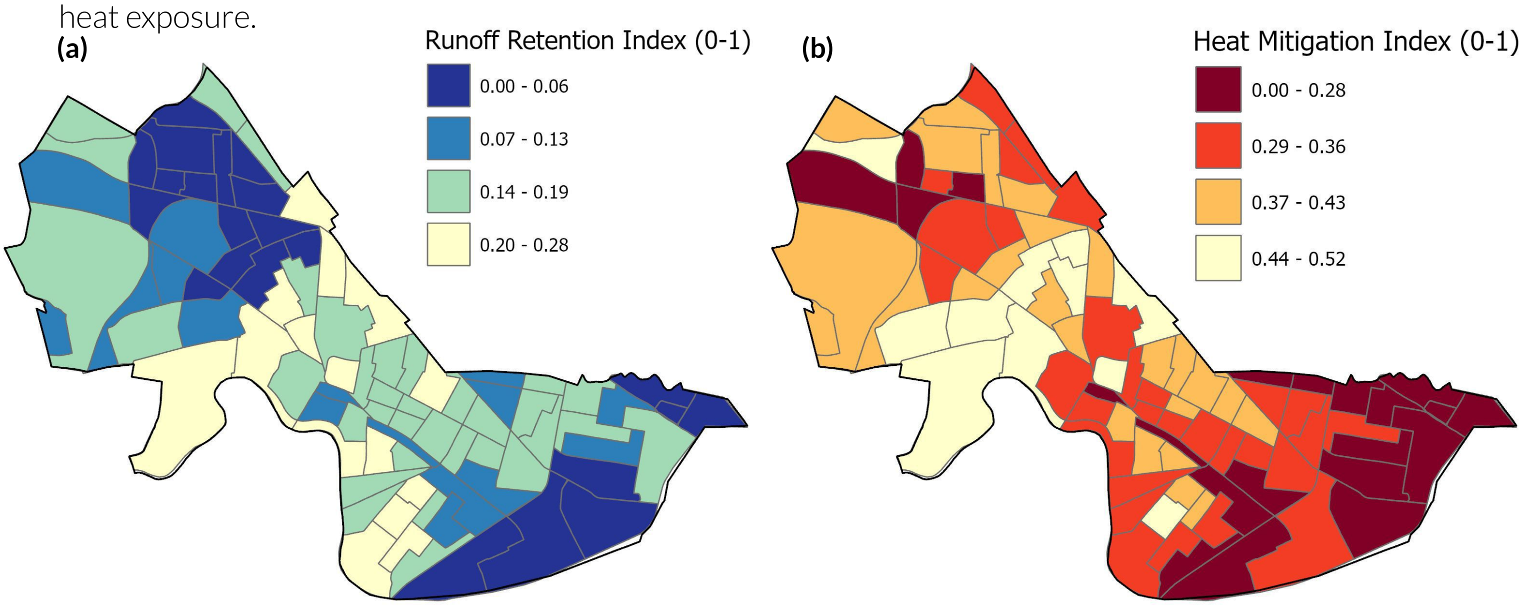


*Figure 25. **(a)** The runoff retention index indicates retention of surface runoff as mapped. The map ranges from zero (indicating low retention of runoff) to one (indicating high retention of runoff). Darker blue indicate low runoff retention capacity and can benefit from more trees. **(b)** The heat mitigation index ranges from zero (low mitigation capacity) to one (high mitigation capacity) and was modeled with InVEST. Darker red indicate low urban cooling capacity and feel hotter.*

Conclusion: Sustaining and Growing Cambridge'sTree Canopy

The tree canopy assessment reveals that between 2018 and 2024, Cambridge experienced both gains and losses in canopy cover, with overall gains outpacing losses. Citywide, tree canopy increased by approximately 5%. Targeted plantings and tree preservation, particularly along transportation corridors and in parks, contributed to this growth, even under the challenging conditions of the public right-of-way. These efforts demonstrate the potential of strategic planting to deliver meaningful ecological and social benefits, especially in underserved neighborhoods with high levels of impervious surface. Residential properties experienced the most canopy growth, underscoring the vital role of private landowners in maintaining and expanding the urban forest. Preserving large trees, while planting a diverse mix of younger species, will be essential to sustaining a healthy, resilient canopy with balanced age and species diversity.

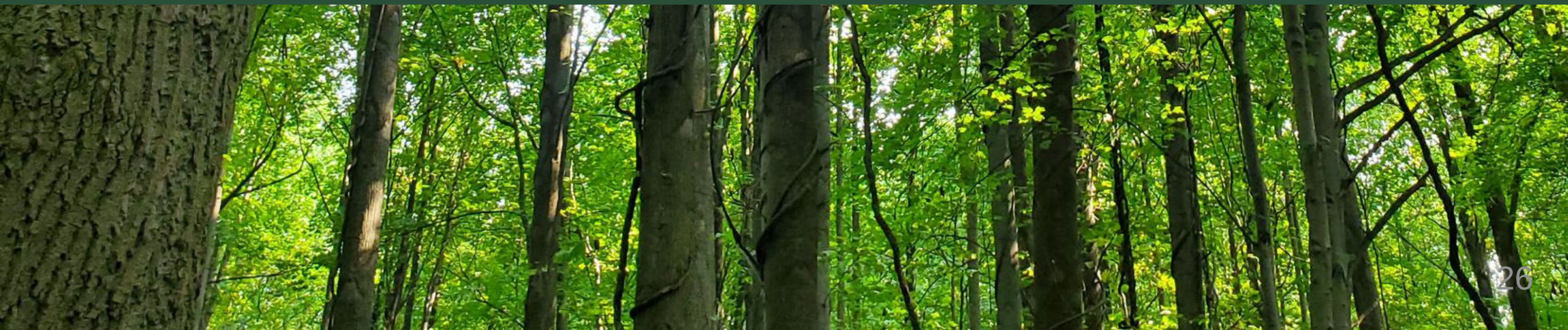
Long-term success will require continued community education and engagement. When residents understand the value of trees and how to care for them, they become active partners in protecting their local environment. By combining informed public participation with data-driven planning, regular maintenance, and equity-focused investment, Cambridge can protect, enhance, and grow its urban canopy for generations to come.

Putting Tree Canopy Data to Work

Tree canopy assessments have been successfully used to inform local planning and environmental strategies. In areas facing challenges like urban heat, flooding, and disparities in access to green space, issues Cambridge 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 localized goals to increase canopy cover. In Cambridge, this assessment can similarly guide equitable tree planting efforts, support community engagement around the importance and care 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 data for tree canopy, canopy change, land cover, and related metrics, all publicly available through the City of Cambridge. The maps and analyses presented here represent a subset of a larger collection. A larger set of maps and graphs is available from the City.



This assessment was carried out by the University of Vermont Spatial Analysis Lab in collaboration with the Cambridge of Cambridge, MA. The methods and tools used for this assessment were developed in partnership with the USDA Forest Service. The source data used for the mapping came from the City of Cambridge, Middlesex County, the State of Massachusetts, and the USDA. The project was funded by the City of Cambridge. Additional support for this project was provided by the Gund Institute for Environment at the University of Vermont. Computations were performed on the Vermont Advanced Computing Core supported in part by NSF award No. OAC-1827314.

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