URBAN TREE CANOPY

ASSESSMENT

CLARK COUNTY, WASHINGTON
URBAN GROWTH AREAS

MAY | 2025

Funding for this project was provided through an Urban & Community Forestry Grant to the Clark Conservation District, in cooperation with Clark County Public Works and the Washington Department of Natural Resources.

CLARK COUNTY URBAN GROWTH AREAS

URBAN TREE CANOPY ASSESSMENT

> **There are priceless benefits that trees provide across the urban landscape - cooling shade, cleansing our water and air, and moderating the impacts of extreme weather. On a human level, trees give us an immediate connection to the natural world as we note the changing seasons, smile at the return of our avian friends and feel a sense of hope for the future.**
>
> **- SUE MARSHALL, CLARK COUNTY COUNCILOR**

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PREPARED FOR

Clark Conservation District and Clark County Public Works

COMPLETED

May 2025

Cover photo caption: Recreationalists enjoy the benefits of urban tree canopy as they ride their bikes along under mature tree canopies, providing shade on a sunny day. Photo taken by Beth Conyers.

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INTRODUCTION

INTRODUCTION

Clark County is one of the fastest-growing regions in Washington State. It is located on the banks of the Columbia River, just north of the Portland metropolitan area in Oregon. As Clark County's population continues to grow, the region remains rich in natural resources that support fish and wildlife. Among these resources are healthy tree canopies, which provide essential shade for rivers. This shade helps maintain cool water temperatures, benefiting up to five populations of Endangered Species Act-listed salmonids. The environmental resources in Clark County have made this area of Washington State a high priority for salmon recovery, water quality, and water quantity management, ensuring these important natural resources are available for future generations. This includes efforts to protect and restore the urban tree canopy, which provides a multitude of environmental, social, and economic benefits.

PURPOSE

The purpose of this Urban Tree Canopy Assessment is to evaluate the status of the tree canopy in Clark County, Washington, as of 2023, and to assess changes in the tree canopy since 2011. This study also identifies possible planting areas for future plantings to help replenish and to establish the urban tree canopy in areas with the greatest need. This Urban Tree Canopy Assessment serves as the initial step in establishing goals, priorities, policies, and implementation programs to preserve and restore Clark County's tree canopy for the future. This assessment was completed through a partnership between Clark County Public Works and the Clark Conservation District, funded by the Washington State Department of Natural Resources' Urban and Community Forestry Program.

STUDY AREA

The study area includes the eight (8) unincorporated urban growth areas (UGAs) of Vancouver, Camas, Battle Ground, Washougal, Ridgefield, La Center, Yacolt, and Woodland as of May 2025. These unincorporated UGAs are managed by Clark County until they are annexed by the cities. Urban growth areas are zones in Clark County's Comprehensive Plan where denser development and infrastructure can be built over the next 20 years to support population growth. Land outside the UGAs is mostly rural, with larger lots, more open space, farms, and natural areas like forests.

This assessment summarizes the status of urban tree canopy within Clark County UGAs using multiple assessment boundaries including:

1. Watersheds
2. Stream buffers
3. Public and private land ownership
4. Municipal jurisdictions
5. Zoning classifications
6. Census Blocks
7. Census Block Groups

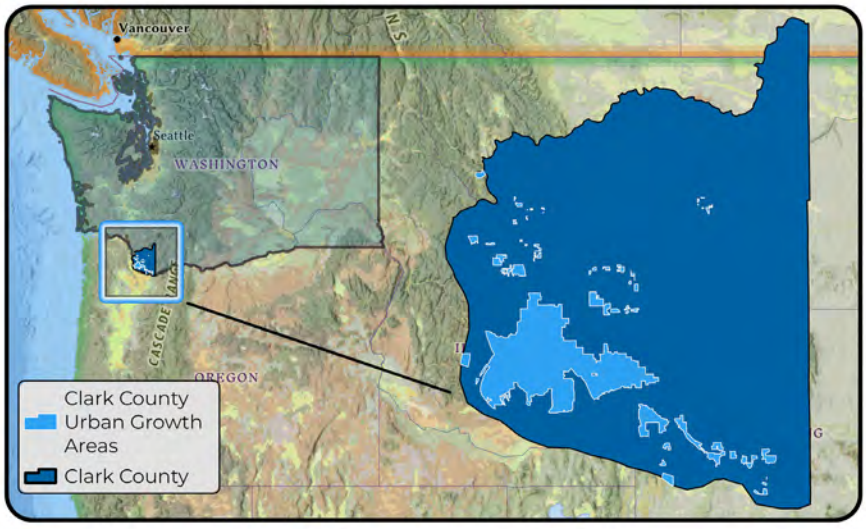


Figure 1. Clark County is in the southwestern part of Washington state, just north of Portland, Oregon, along the Columbia River. This assessment focused on the urban growth areas, covering 61 square miles, which includes 38,972 acres of both surface water and land. The study area is highlighted in light blue.

ASSESSMENT OVERVIEW

Results of this assessment were divided into chapters based on different assessment boundaries. Each chapter presents data on the current tree canopy as of 2023, as well as the changes in tree canopy from 2011 to 2023 for each assessment boundary. The boundaries are listed in order from largest to smallest, starting with the county and concluding with census blocks as defined by the U.S. Census Bureau (2024) on page 23.

This assessment examined the distribution of urban tree canopy within the unincorporated urban growth areas by analyzing several different boundaries. The primary goal was to identify areas with the lowest tree canopy coverage and, therefore, the greatest opportunities for new tree planting. To enhance this analysis, data from the American Community Survey (ACS) were incorporated. This allowed for a comparison of tree canopy opportunities with socioeconomic factors at the census block group level, helping to direct resources to communities with the most need and promote both environmental and social equity. By understanding these patterns, the assessment supported the development of targeted programs and outreach efforts, ensuring that tree planting resources were focused on the highest priority locations.

This assessment utilized i-Tree tools (USDA Forest Service), a tree benefits calculator, to evaluate the benefits and functions of existing canopy incorporating the latest research. **The analysis estimated that Clark County UGAs' current canopy provides approximately $6.98 million annually in avoided infrastructure costs and stores $75.1 million in carbon.**

The Minnehaha neighborhood, located in southwestern Clark County directly north of central Vancouver, was selected as a case study due to its lower urban tree canopy coverage and greater socioeconomic needs compared to other unincorporated neighborhoods in Clark County. Over 250 Minnehaha residents participated in a free tree giveaway program. Additionally, 650 trees were planted in parks, county rights-of-way, and across the neighborhood. The goal of this pilot program was to plant up to 1,000 trees in Minnehaha by 2025. For more information about Minnehaha, see page 28.

Clark County volunteers work with partner organizations to plant new street trees to help increase urban tree canopy.

METHODS OVERVIEW

Urban tree canopies (UTC) are constantly changing. New plantings and natural vegetation growth increases canopy cover, while development, disasters, disease, and pests can diminish tree canopy. Climate change exacerbates these issues by resulting in more frequent and intense natural disasters, altering environmental conditions, and creating new habitats that favor invasive plants, pests, and diseases. This further threatens trees that are already weakened by stress related to climate change.

Canopy assessments using aerial imagery can measure changes in tree canopy with high accuracy. This assessment follows industry-approved land cover definitions and utilizes a proven approach. The study employed imagery from the USDA's National Agriculture Imagery Program (NAIP) and applied US Forest Service standards, along with machine learning techniques, to analyze land cover in Clark County from 2011 to 2023. The assessment included various land cover types: tree canopy, shrubs, other vegetation, bare soil and dry vegetation, impervious surfaces, and water.

Within these land cover categories, the analysis identified potential planting sites that are suitable for future tree planting. Additionally, the assessment outlined areas that are deemed unsuitable for planting due to ecological or logistical concerns. These unsuitable areas include wetlands, which are crucial for biodiversity and water filtration; recreational fields, which serve community needs for sports and leisure; utility corridors, where infrastructure may hinder tree growth; and stormwater facilities, designed to manage runoff and prevent flooding.

Completion of this assessment enables Clark County stakeholders to develop new programs and priorities for protecting and expanding the urban forest. The key objectives of this Urban Tree Canopy Assessment include:

- Quantify the amount and location of tree canopy and other land cover types.
- Analyze the change in canopy cover from 2011 to 2023.
- Describe the ecosystem services tree canopy provides to the community, the environment, and the local economy.
- Identify areas where tree canopy can be expanded through an assessment of possible planting areas.
- Determine priority areas for tree preservation and planting initiatives based on socioeconomic, environmental, and climate-related factors.
- Provide data to inform future planning and to establish canopy coverage goals.

For more information about the methodology used to complete this assessment, see Appendix A.

Baseball fields and other recreational areas used for sports are examples of land uses that are unsuitable for future tree plantings.

9,866

ACRES OF TREE CANOPY IN UNINCORPORATED URBAN GROWTH AREAS

28%

OF THE TERRESTRIAL LAND AREA WAS COVERED WITH CANOPY IN 2023

Public parks with available open space provide opportunities to plant more trees to increase urban canopy. This also helps reduce maintenance costs by decreasing lawn areas that need regular mowing.

RESULTS OVERVIEW

The unincorporated urban growth areas (UGAs) in Clark County cover a total of 38,972 acres. According to the US Forest Service's UTC assessment protocols, it is best practice to exclude surface water to ensure a more accurate and actionable assessment of urban forest resources and planting opportunities. In line with these guidelines, 3,261 acres of surface water were excluded from the analysis. As a result, the total terrestrial area within the unincorporated urban growth regions of Clark County is 35,711 acres.

As of 2023, tree canopy covers 28% of this terrestrial study area when viewed from above. The remaining 72% of the study area, has been categorized based on its suitability for tree planting. Of this area, 39% is considered unsuitable for planting, including wetlands and recreational fields, while 33% have been identified as suitable for potential future tree planting efforts. For more information on land cover classification, please refer to the Tree Canopy Cover and Potential Planting Areas in County UGAs chapter.

Tree canopy cover in the unincorporated UGAs was evaluated using aerial imagery from 2011 and 2023. Over this twelve-year period, total canopy cover in the UGAs declined by 401 acres, representing a 1.1% net decrease. The assessment provides a snapshot of canopy percent change based on the imagery collected in those years, acknowledging that actual canopy coverage may have fluctuated during the interval. Throughout this report, tree canopy change is expressed as percent net change, calculated by dividing the change in urban tree canopy acres by the total land area.

Tree canopy levels varied across the UGAs, with some areas experiencing gains and others experiencing losses. Increases in urban tree canopy typically resulted from the maturation of existing trees, reforestation of previously vacant land, and community-driven tree planting initiatives. In contrast, areas with significant canopy loss saw removals, likely due to development activities or storm-related impacts. The precise causes of tree canopy loss remain uncertain, highlighting the need for additional site-level investigation and ground-truthing to identify the underlying factors driving these changes within the UGAs in Clark County. Regular reassessment of canopy cover is essential to effectively track changes over time and to inform adjustments to urban forestry strategies and programs.

28%
URBAN TREE CANOPY

33%
POSSIBLE PLANTING AREA

-1.1%
TREE CANOPY CHANGE

Figure 2. Based on an analysis of 2023 and 2011 high-resolution imagery.

PROJECT

METHODOLOGY

MAPPING LAND COVER IN WASHINGTON

This assessment used high-resolution (60-centimeter) multi-spectral imagery from the USDA's National Agriculture Imagery Program (NAIP) collected in 2023 to classify six land cover types: tree canopy, shrubs, bare soil and dry vegetation, water, impervious surfaces, and other vegetation. EarthDefine applied advanced machine learning techniques to extract these land cover features from the imagery.

For historical comparison, 1-meter NAIP imagery from 2011 was used to map tree canopy and assess changes over time. For more details on methodology, see Appendix A.

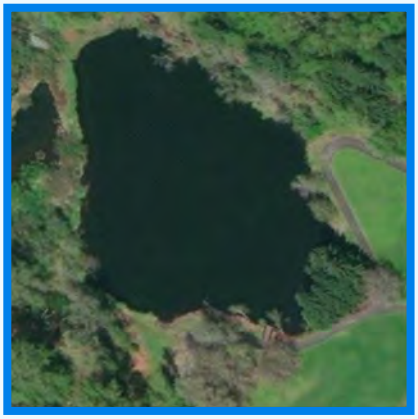
TREE CANOPY
leaves, branches, and stems generally greater than 10-15' tall

SHRUBS
woody plants with multiple stems arising from the base, generally less than 10' tall

OTHER VEGETATION
healthy grasses, herbaceous plants, open pastures and turf grass

BARE SOIL AND DRY VEGETATION
exposed earth, sand, or dead/ dormant grasses

IMPERVIOUS SURFACES
roads, sidewalks, parking lots, buildings, and other paved areas



WATER
rivers, lakes, ponds, reservoirs, and wetlands

Figure 3. This study identified six (6) unique land cover classes within the 2023 assessment imagery: tree canopy, shrubs, other vegetation, bare soil and dry vegetation, impervious surfaces, and water.

IDENTIFYING POSSIBLE PLANTING AREAS

In addition to quantifying current tree canopy cover, areas suitable for planting trees (referred to as possible planting area or plantable space) were identified as opportunities to increase tree canopy cover. These areas absent from tree canopy cover were classified as either suitable for planting or unsuitable for planting. Unsuitable areas for tree planting, such as recreation fields, utility corridors, wetlands, etc., were manually delineated from the possible planting assessment and identified as Unsuitable Impervious, Unsuitable Vegetation, Unsuitable Wetland, Unsuitable Soil and Water.

Areas suitable for planting have been identified, but planting trees in Clark County require careful planning to consider existing infrastructure and specific site conditions. Conducting thorough site assessments is vital for evaluating the feasibility of planting and ensuring long-term success. It is important to follow the "right tree, right place" principle, which emphasizes selecting the appropriate species, sizes, and locations. This approach ultimately increases the success rate of the trees and helps reduce maintenance demands for the program and its partners.

Figure 4. The study identified vegetated areas where tree plantings would be feasible but are undesirable based on their current usage. An example includes recreational areas, such as this baseball field (left), which is delineated as “Unsuitable,” highlighted in yellow (right).

Tree planting events help bring community members and neighbors together for a great cause.

STATE OF THE CANOPY AND KEY FINDINGS

CLARK COUNTY'S LAND COVER

The US Forest Service's Urban Tree Canopy (UTC) assessment protocols are widely recognized for recommending the exclusion of water bodies to provide an accurate and actionable evaluation of urban forest resources and planting potential. Water bodies are excluded from the land area calculations because they are typically unsuitable for planting new trees without significant modifications. However, the total land cover findings and percentages presented below include water bodies to illustrate the distribution of all land cover classes—both aquatic and terrestrial—throughout the study area.

When examining all land cover types in the Urban Growth Areas (UGAs):

- Non-canopy vegetation, like grass and small bushes, covers the largest portion at 32% of the area.
- Impervious surfaces—such as buildings, roads, and parking lots—make up 30%.
- The tree canopy overhanging pervious surfaces covers 24% of the area, plus an additional 1% where trees overhang paved surfaces. Altogether, tree canopies cover 25% (9,866 acres) of the total area.
- Bare soil and shrub/scrub vegetation each cover 2% of the area.

Table 1. Land cover classes in the urban growth areas of Clark County (percentages based on the total area including water bodies).

Land Cover Class	Acres	% of Total
Non-Canopy Vegetation (Grass/Small Bushes)	12,619	32%
Impervious Surfaces	11,621	30%
Tree Canopy Over Pervious Surfaces	9,427	24%
Water	3,261	8%
Bare Soil/Dry Vegetation	944	2%
Shrubs	659	2%
Tree Canopy Over Impervious Surfaces	439	1%

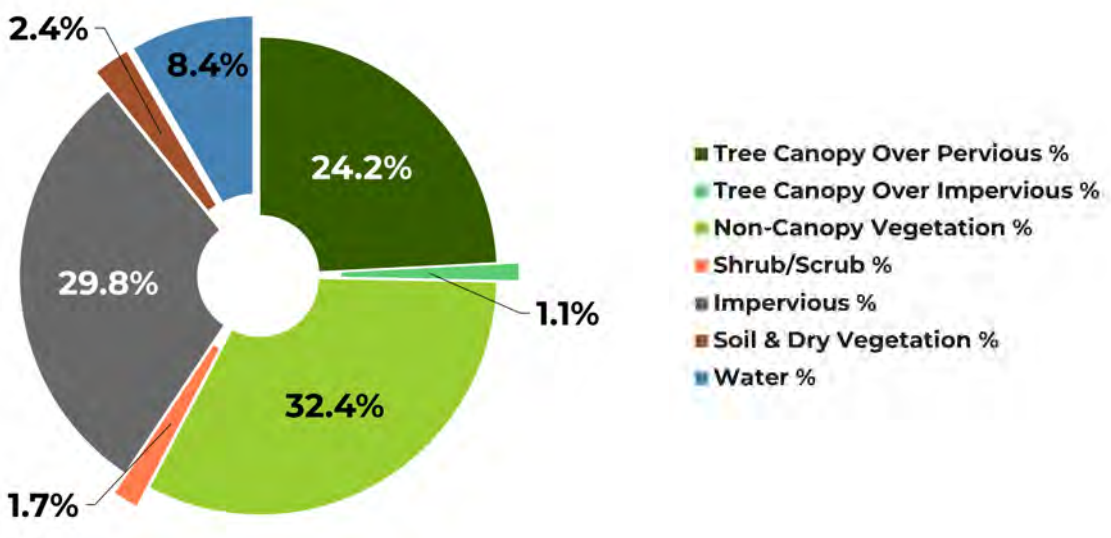


Figure 5. Distribution of land cover classes in the urban growth areas of Clark County, Washington (percentages based on the total area including water bodies).

LAND COVER CLASSIFICATIONS IN THE URBAN GROWTH AREAS OF CLARK COUNTY

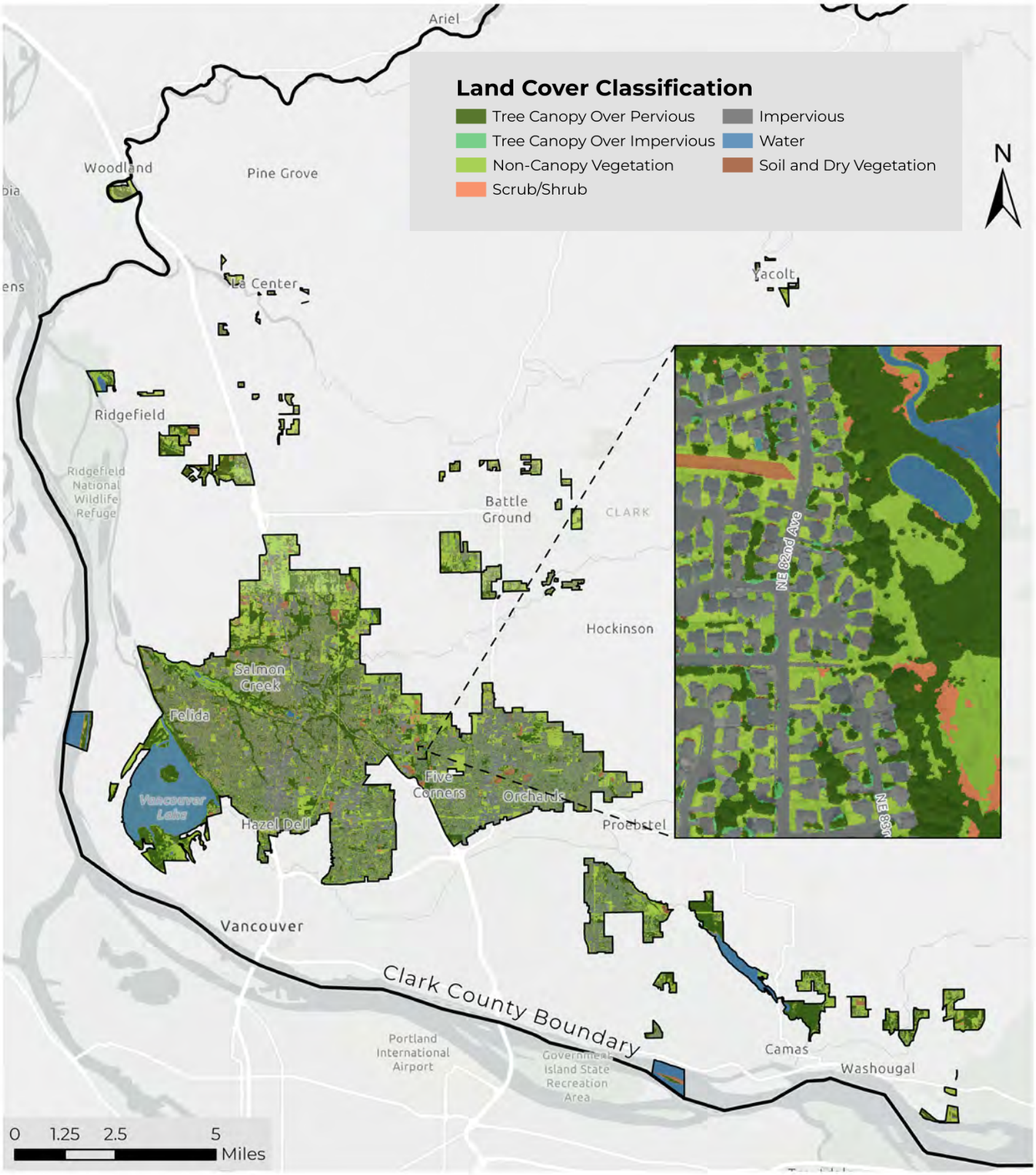
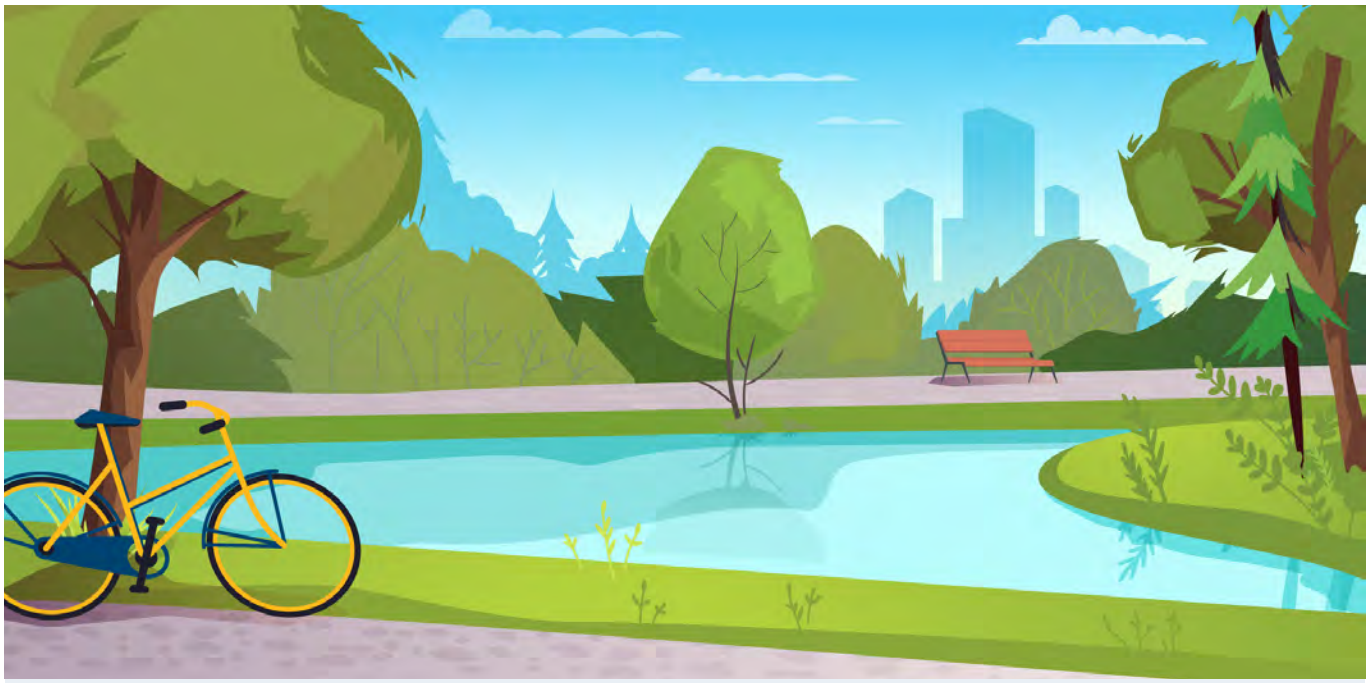


Figure 6. Land cover classification results.



TREE CANOPY AND IMPERVIOUS SURFACES

Tree canopy covers 28% of the unincorporated urban growth areas (UGAs), which is equal to 9,866 acres. This assessment divided tree canopy into subcategories based on whether the canopy overhangs pervious or impervious surfaces. Tree canopy over impervious surfaces provides many advantages in urban areas, including localized cooling and increased interception of rainfall to reduce stormwater runoff.

Most of the tree canopy (96% of the 9,866 canopy acres) overhangs pervious surfaces, while the remaining 4% overhangs impervious surfaces. Increasing tree canopy over paved areas like streets, sidewalks, and parking lots helps reduce urban heat, stormwater runoff, and pollution. It also protects hardscapes from deteriorating, lowering maintenance costs. Strengthening ordinances to require tree planting in and around these areas can enhance these benefits. Targeted canopy expansion supports environmental resilience while balancing priorities like safety, accessibility, and infrastructure needs.

TREE CANOPY CHANGE

In 2011, the UGAs had 10,267 acres of tree canopy, which covered 29% of the total area. However, by 2023, this amount had decreased to 9,866 acres. This represents a loss of 401 acres and a reduction in tree cover to 28% over the twelve-year period.

This loss can be quantified in two ways:

- **Net change:** The net change shows that there were 401 fewer acres of canopy in 2023, representing a 1.1% decrease in tree cover relative to the total land area.
- **Relative change:** Relative change compares the amount of canopy lost to the amount present in 2011. Losing 401 acres out of 10,267 acres indicates that the tree canopy decreased by approximately 4% from its initial level.

This documents reports the net change percentages to align with the metrics presented in Clark County's TreePlotter CANOPY tool (https://pg-cloud.com/clarkcountywashington/). While these figures provide a general overview of canopy trends in the region, they do not capture variations at the neighborhood level. Local factors, such as urban development, changes in land use, and environmental policies, can lead to significant differences in tree canopy coverage from one area to another. This highlights the importance of conducting more localized assessments to fully understand the ecological impacts and conservation needs.

TREE CANOPY COVER AND POTENTIAL PLANTING AREAS IN COUNTY UGAS

After excluding 3,261 acres of surface water, the terrestrial areas in the unincorporated urban growth regions of Clark County total 35,711 acres. In 2023, 28% of this land was covered by tree canopy. An additional 33%, or 11,741 acres, was available for tree planting. The remaining 39% of the land was considered unsuitable for tree planting. This includes 11,621 acres of impervious surfaces and 2,482 acres that cannot support tree growth due to poor soil, recreational fields, utility corridors, or wetlands.

Note that the 28% urban tree canopy metric is different from the earlier 25% metric discussed in the Clark County Land Cover chapter (page 7). The initial 25% figure was calculated using the total area, which includes surface water. It was determined by dividing 9,866 canopy acres by 38,972 total acres (9,866 / 38,972 = 25%). **The remainder of this assessment will focus specifically on tree canopy as a percentage of terrestrial land areas only, excluding water. This method aligns with the US Forest Service standards for tree canopy assessments**. For the entire study area, the percentage of UTC was calculated by dividing 9,866 canopy acres by 35,711 land acres, resulting in 28%.

Table 2. Tree canopy potential (existing, possible, and unsuitable) in the urban growth areas of Clark County (percentages based on the land area excluding water bodies).

UTC Potential Class	Acres	% of Total
Existing Canopy	9,866	28%
Possible Planting Area	11,741	33%
Total Unsuitable (Impervious, Soil, Wetlands, and Vegetation)	14,103	39%

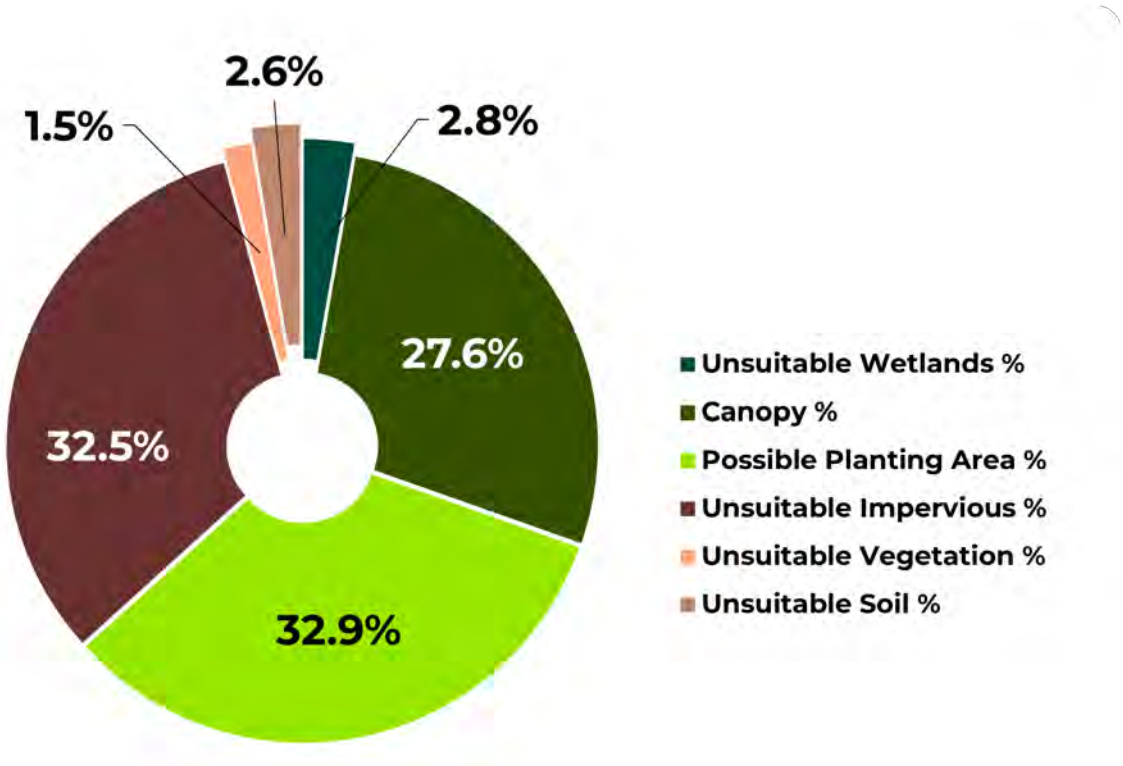


Figure 7. Distribution of UTC, possible planting area, and unsuitable areas in the unincorporated urban growth areas (percentages based on the land area excluding water bodies).

URBAN GROWTH AREA TREE CANOPY POTENTIAL CLASSIFICATION

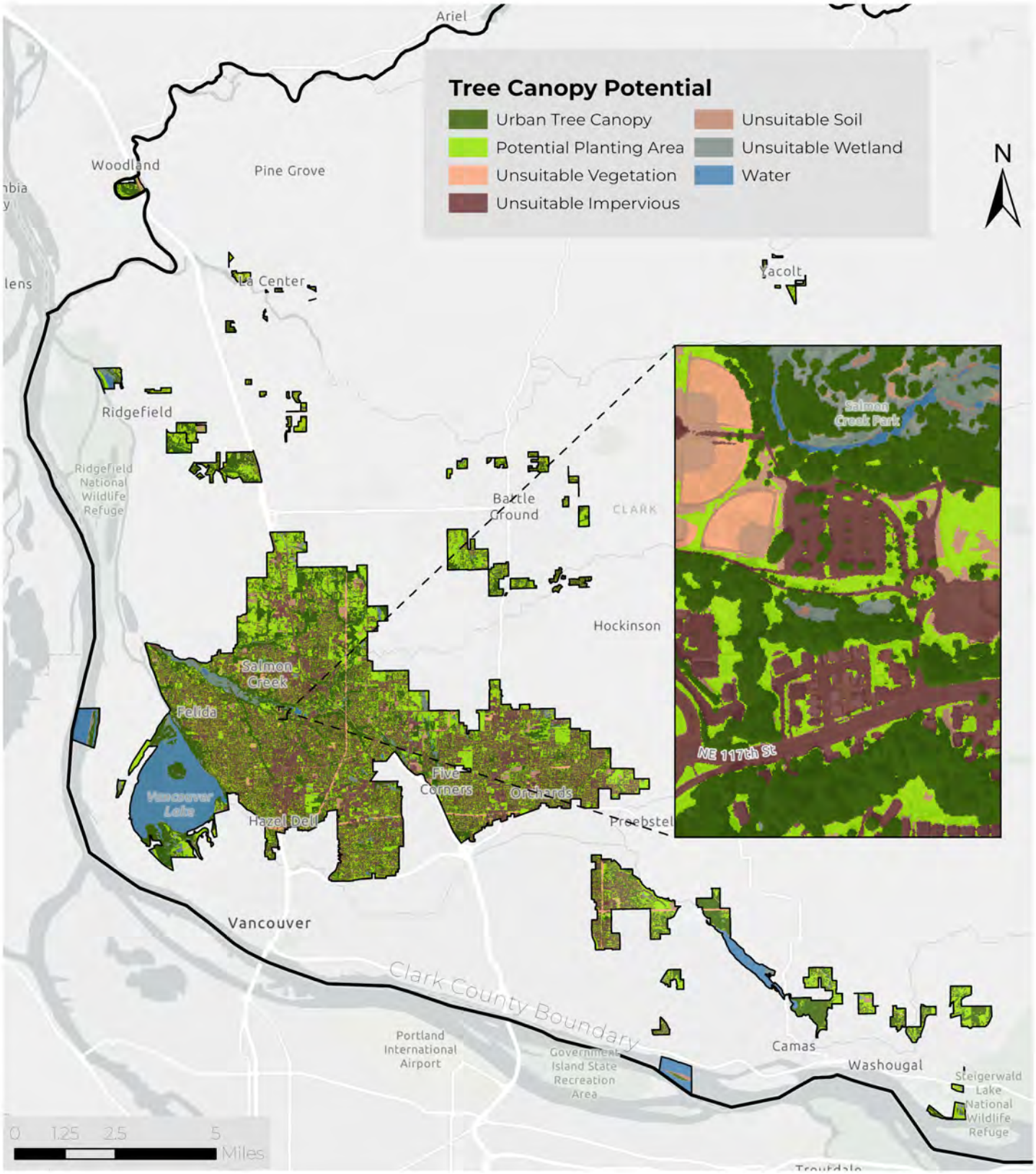


Figure 8. Classification of urban tree canopy, possible planting area, and areas unsuitable for canopy expansion within the unincorporated urban growth areas.

TREE CANOPY COVER IN

WATERSHEDS & STREAM BUFFERS

To provide a more detailed understanding of how tree canopy cover differs across the UGAs, the following section examines canopy distribution at the watershed level, with special attention to areas within 200 feet of streams, known as shoreline riparian zones. These zones are a high priority for protection and restoration because trees in these areas help manage stormwater runoff, filter pollutants and sediments, reduce flooding, and improve local water quality. Land cover metrics were evaluated within five primary watersheds intersecting the UGAs, as well as within the 200-foot buffer along rivers and streams. The assessment used the HUC-12 watershed scale and excluded watersheds covering less than 1% of the total UGA land area to focus on those with the most significant land area and planting opportunities.

After removing the five smallest watersheds from the total, Lower Salmon Creek is the largest watershed in the UGAs, making up 50% of the total land area and supporting 45% of the urban tree canopy across the study area. Lake River, which drains into the Columbia River, is the next largest, representing 19% of the total area and 23% of the total tree canopy. Lacamas Creek and Burnt Bridge Creek comprised 12% and 11% of the land area, respectively, with tree canopy percentages of 29% and 21%. Burnt Bridge Creek had the lowest canopy cover among the major watersheds, at 6% below the UGA-wide average of 28%. In contrast, Gee Creek, which covers 5% of the total land area, has a relatively high canopy cover of 35%.

Lower Salmon Creek has the greatest potential for new plantings, with over 5,500 acres (32%) of its area identified as possible planting space. Lacamas Creek and Burnt Bridge Creek also offer substantial opportunities, with 35% and 31% of their areas available for planting respectively. Both had lower-than-average canopy cover compared to other watersheds, presenting significant opportunities for canopy enhancement. Burnt Bridge Creek has the highest impervious surface coverage (43%) among all watersheds, making it a key area for targeted planting to address stormwater runoff and urban heat island effects.

The 200-foot stream buffer covers 6% of the total UGA land area and contains a dense tree canopy. On average, tree canopy covers 56% of these buffer zones, which is much higher than the average for entire watersheds. Only 20% of stream buffer areas are available for new planting, underscoring the importance of conserving existing canopy in riparian zones rather than focusing solely on restoration.

Table 3. Distribution of land area, urban tree canopy, potential planting areas, changes in tree canopy, and impervious surfaces for watersheds and stream buffers. *The five major watersheds comprise 97% of the total land area. The remaining 3% is found in watersheds that each cover less than 1% of the total UGA land area. This emphasis highlights the watersheds with the largest land area and the best opportunities for planting.

Watersheds & 200-ft Stream Buffers	Land Area Distribution %	Land Area (Acres)	Urban Tree Canopy %	Possible Planting Area %	UTC Change % (2011 - 2023)	Impervious Surface %
Lower Salmon Creek	50%	17,513	24%	32%	-1.1%	37%
Lake River	19%	6,596	34%	30%	-0.6%	21%
Lacamas Creek	12%	4,118	29%	35%	-2.5%	29%
Burnt Bridge Creek	11%	3,873	21%	31%	-1.4%	43%
Gee Creek	5%	1,590	35%	44%	1.1%	12%
Watersheds Totals & Averages	**97%***	33,691	**27%**	**32%**	-1.1%	**31%**
Stream Buffer	**6%**	2,218	**56%**	**20%**	1.9%	**6%**

TREE CANOPY COVER BY WATERSHED

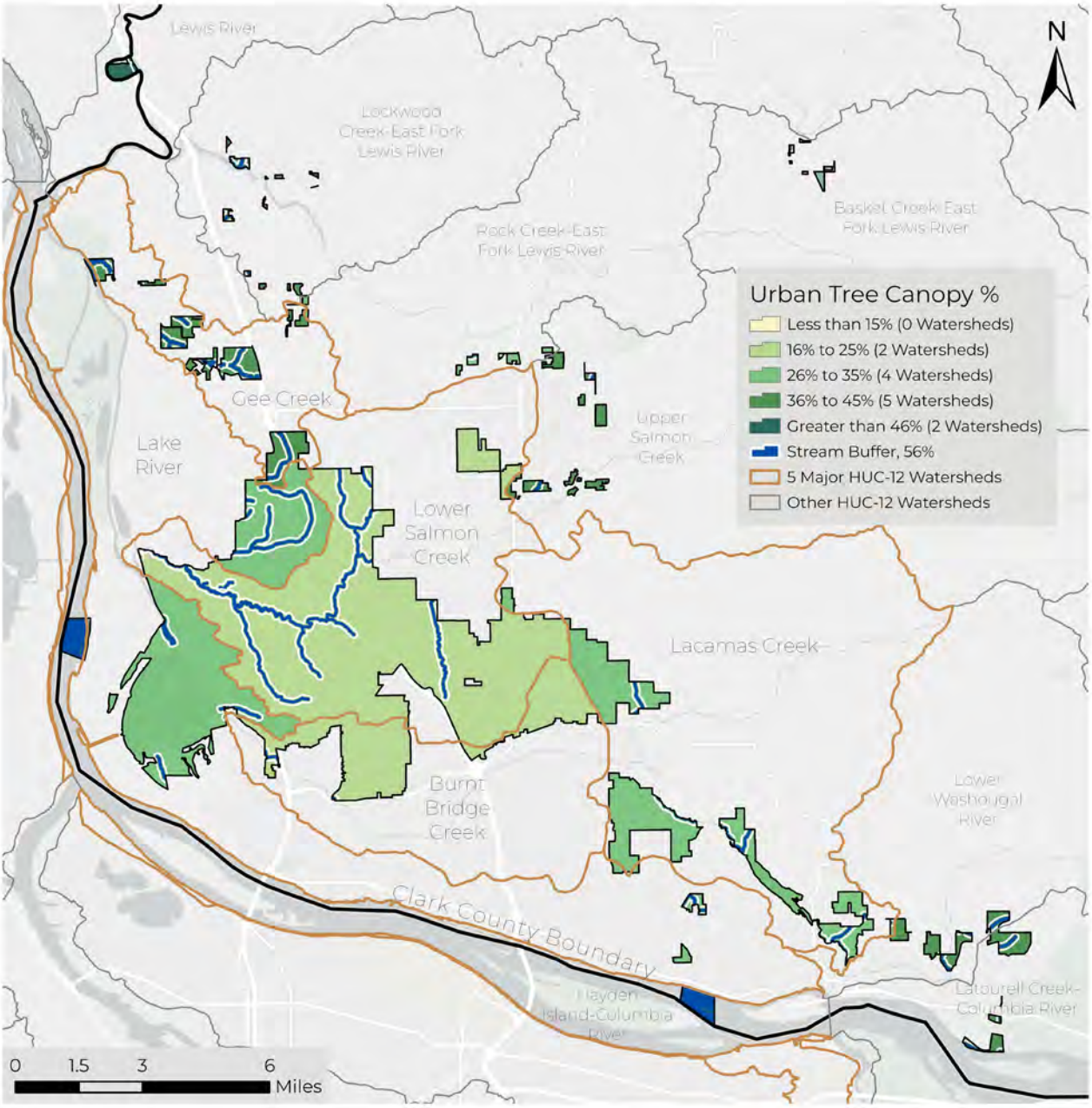


Figure 10. The percentage of canopy cover in the watershed is displayed, along with a UGA-wide stream buffer highlighted in blue.

The largest watershed, Lower Salmon Creek, covers 50% of the total land area and 45% of the tree canopy across all watersheds. Planting trees in these headwaters, with over 5,500 acres available for tree planting, presents a significant opportunity to support salmon recovery and stream health.

TREE CANOPY CHANGE IN WATERSHEDS AND STREAM BUFFERS

Between 2011 and 2023, four of the five major watersheds in the study area experienced a net decline in tree canopy. Lower Salmon Creek recorded the largest loss, with a reduction of 187 acres of tree canopy, followed by Lacamas Creek with a loss of 105 acres. Burnt Bridge Creek and Lake River also showed declines, losing 54 acres and 40 acres, respectively.

Gee Creek was the only major watershed to gain tree canopy, adding 17 acres over the twelve-year period, which reflects a 1.1% net increase. Overall, these five major watersheds experienced a collective net loss of 368 acres.

In contrast to the general watershed trend, the 200-foot stream buffer showed a positive change, with canopy cover increasing from 54% in 2011 to 56% in 2023—a net gain of 42 acres, or a 1.9% increase. This improvement is likely due to natural regeneration, the growth of existing trees, and the effectiveness of local restoration efforts and regulatory protections in riparian zones. The continued protection and restoration of mature trees in these stream buffers are critical for maintaining water quality, regulating stream temperatures, and supporting vital aquatic and terrestrial habitats.

Enhancing stormwater management and improving water quality in the UGAs will have positive impacts on the native species inhabiting local streams and the Columbia River.

Volunteers celebrate planting trees together. Trees often provide social benefits by improving community wellbeing.

TREE CANOPY COVER BY

PROPERTY OWNERSHIP

Private and public properties in Clark County present distinct opportunities and require different approaches for tree planting and maintenance. This assessment focuses on two types of property ownership: private properties—mainly residential parcels within the urban growth area—and public properties, which include rights-of-way, county-owned parcels, city-owned parcels, parks, schools, and federal or state properties. Since the study area excludes incorporated areas, there are relatively few city-owned properties.

Private properties comprise most of the land in unincorporated urban growth areas (UGAs), covering a total of 7,504 acres of urban tree canopy. Three-quarters (76%) of the tree canopy across the UGAs is found on private land (represented in light green in Figure 11).

In contrast, public parcels contribute 2,362 acres of tree canopy, which represents about a quarter of the total tree canopy in the UGAs, as shown in dark green in Figure 11. While private properties cover a larger area of tree canopy due to their greater overall land size, public lands tend to have a higher density of tree canopy. This is because public lands often include larger tracts of undeveloped forested areas. As of 2023, 45% of public land was covered by tree canopy, compared to only 25% on private properties. This difference highlights the effects of conservation, preservation, and restoration efforts on public lands.

Private properties account for most potential planting areas, representing 87% (10,164 acres) of all possible planting sites within the UGAs, as indicated in light green in Figure 12. This opportunity emphasizes the importance of engaging private landowners in tree-planting and preservation initiatives. Approximately 33% of private land is suitable for tree canopy planting, although these properties also have a higher impervious surface coverage of 33%. Strategic plantings near homes, sidewalks, and driveways can enhance urban green space, especially when residents are actively involved.

In contrast, public property makes up only 13% of the total plantable space in the study area. Nevertheless, utilizing the 1,578 acres of public land available for tree planting can offer numerous benefits creating inviting public spaces that encourage outdoor activity and foster social interaction in the community.

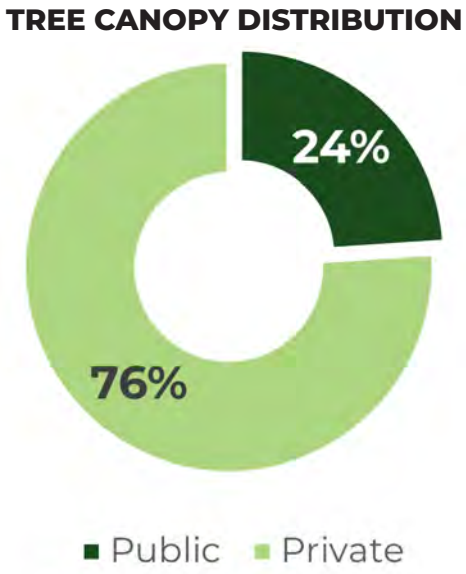


Figure 11. This graphic shows how tree canopy is split between public and private properties. Dark green represents public land, and light green shows private land.

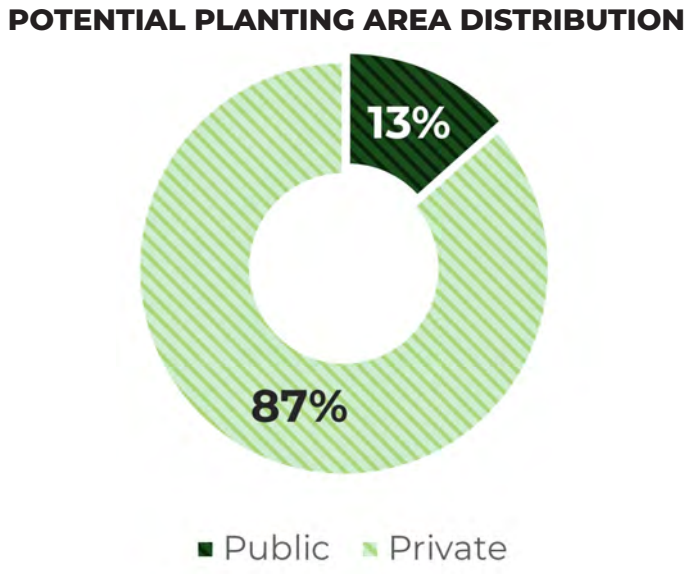


Figure 12. This graphic shows how plantable space is distributed between public and private properties. Dark green represents public land, and light green shows private land.

PROPERTY OWNERSHIP IN THE UGAS OF CLARK COUNTY

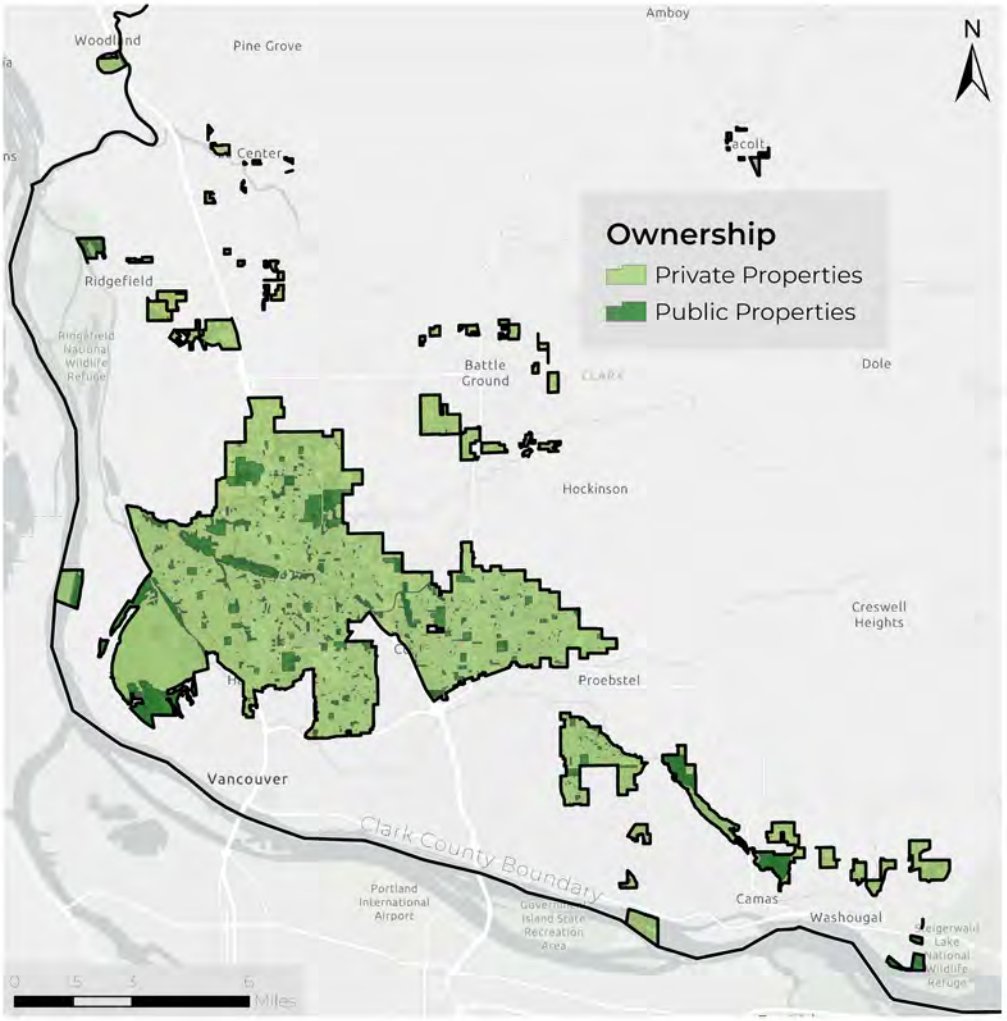


Figure 13. Depiction of private and public properties in the unincorporated UGAs of Clark County. Private properties are marked in light green, and public properties are marked in dark green.

Public Properties

Represents 15% of total land area (5,299 acres)

Canopy covers 45% of public land (2,362 acres), accounting for 24% of the total canopy in the unincorporated UGAs of Clark County

Plantable areas make up 30% of public land (1,578 acres), representing 13% of total PPA seen within the study area

10% of public land is covered with impervious surfaces (562 acres)

Private Properties

Represents 85% of total land area (30,412 acres)

Canopy covers 25% of private land (7,504 acres), accounting for 76% of the total canopy in the unincorporated UGAs of Clark County

Plantable areas make up 33% of private land (10,164 acres), representing 87% of total PPA

33% of private land is covered with impervious surfaces (11,060 acres)

TREE CANOPY CHANGE BY PROPERTY OWNERSHIP

Over the twelve-year assessment period from 2011 to 2023, changes in tree canopy coverage were observed on both public and private lands. Private properties, which encompass a substantial proportion of the UGAs, experienced a notable loss of 569 acres of tree canopy. This decline resulted in a decrease in their overall tree canopy cover from 27% to 25%. This reduction may be attributed to various factors, including urban development.

In contrast, public properties saw an increase in their tree canopy coverage. Over the same period, the canopy cover on public lands increased from 41% to 45%, reflecting an addition of 168 acres of trees. This growth could be linked to intentional reforestation efforts, improved urban forestry programs, and community initiatives aimed at enhancing green spaces within public domains.

TREE CANOPY CHANGE (2011 - 2023)

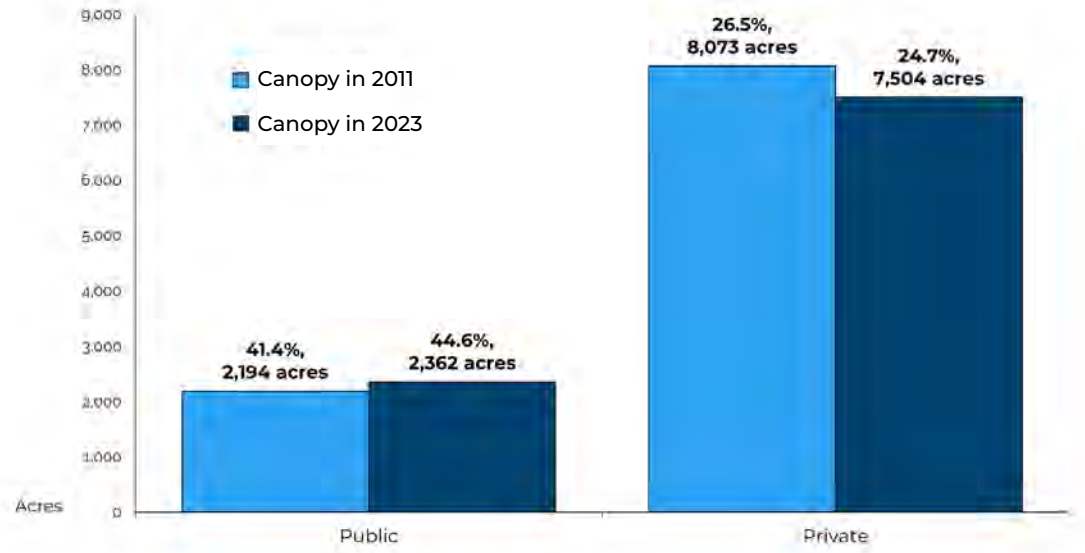


Figure 14. Canopy area in acres by property ownership for 2023 and 2011. The figure compares total canopy coverage on public and private lands for each year, highlighting changes in UTC distribution over time.

Most of the UGAs consists of private property, which currently has a lower-than-average tree cover of 24.7%.

There has been a noticeable decline of trees on private property, but there's good news—over 10,000 acres of land that could be planted with new trees is available. This presents a great opportunity to help increase tree cover in the areas where residents live and play.

TREE CANOPY COVER BY

MUNICIPAL URBAN GROWTH AREAS

Tree canopy was assessed for the urban growth areas of eight municipalities that overlap with unincorporated Clark County: Battle Ground, Camas, La Center, Ridgefield, Vancouver, Washougal, Woodland, and Yacolt. It is important to note that this assessment focused solely on the unincorporated county portion of the UGAs, rather than the entire jurisdictions of the cities. Rural areas outside of the UGAs were not assessed.

The Vancouver UGA makes up the largest share of all UGAs in the county, covering 87% of their total land area. It also contains the majority of tree canopy across UGAs, contributing 79% of the total canopy cover. However, within the Vancouver UGA itself, only 25% of the land area is covered by tree canopy. This urban growth area was the only one that had tree canopy coverage below the UGA-wide average of 28%. However, 83% of the possible planting areas in the UGAs are located within Vancouver's UGA

Ridgefield, La Center, Woodland, and Camas all had tree canopy cover exceeding 40% within their respective unincorporated urban growth areas. The Camas UGA had the densest tree canopy, with 62% of its area covered. Although the Camas UGA represented only 3% of the total study area, it contributed to 7% of the overall canopy distribution within the County UGAs, totaling 666 acres. This makes Camas the second-largest contributor to tree canopy cover in the urban growth areas, following Vancouver.

Camas and Vancouver have the highest tree canopy acreage among the areas studied; however, both cities, along with Woodland, have less plantable space compared to the UGA-wide average of 33%. Although Camas significantly contributes to the overall canopy, it offers limited opportunities for planting. Vancouver faces challenges due to 11,143 acres of impervious surfaces, making it the only UGA where these surfaces exceed the tree canopy cover.

For increasing canopy cover, Yacolt had the highest percentage of land available for planting, with 55% of its UGA accessible for new trees, though this represents only 55 acres. The Battle Ground UGA also had over 50% of its land available, providing more than 600 acres of plantable space. However, the most significant opportunity for expanding the canopy lies within Vancouver's UGA, which has nearly 10,000 acres available for planting.

The Vancouver urban growth area is a great place to target tree maintenance and preservation efforts due to its large land area, lower-than-average canopy cover, and higher-than-average impervious surface.

TREE CANOPY COVER BY MUNICIPAL URBAN GROWTH AREAS

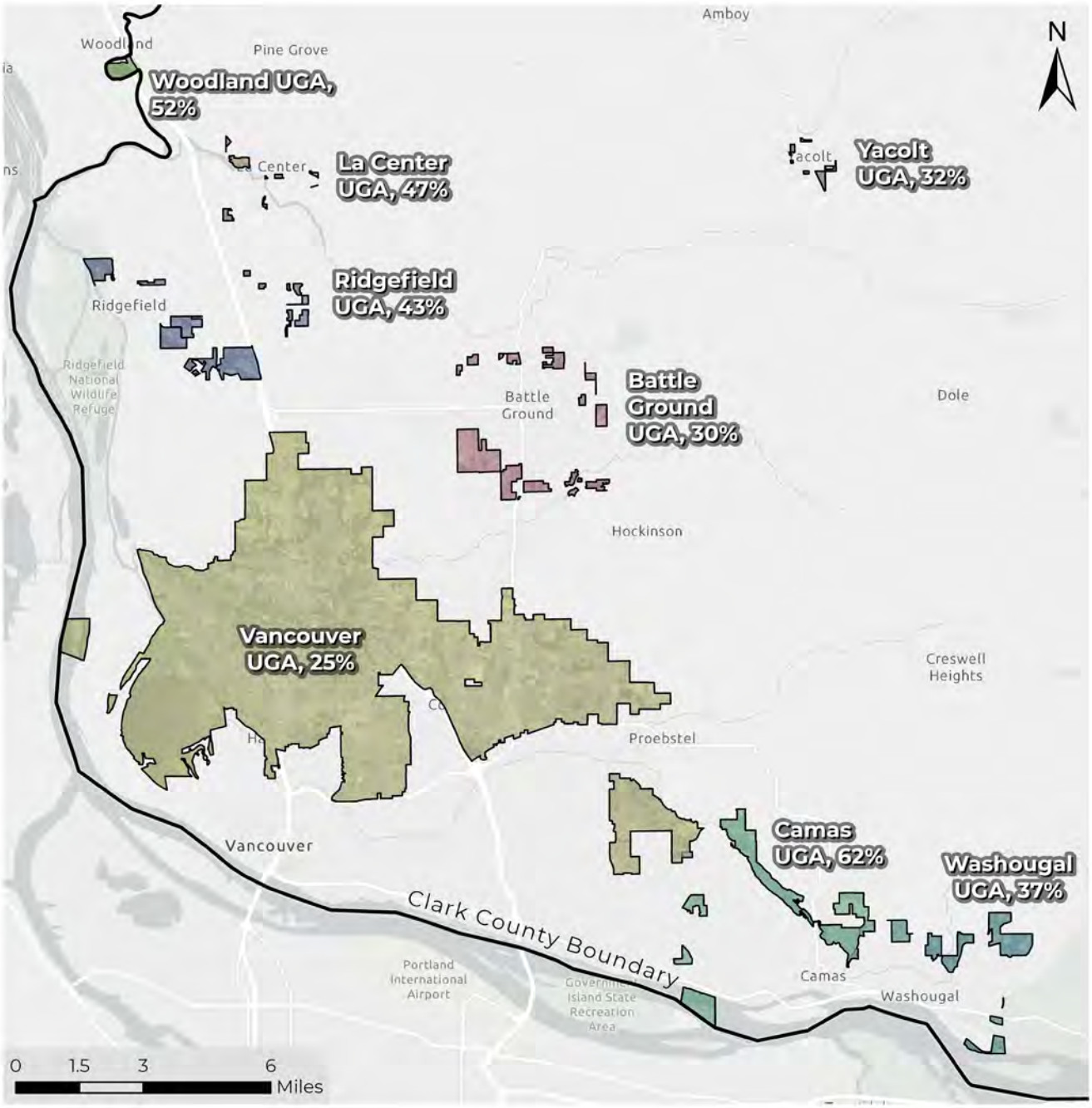


Figure 15. Depiction of Clark County's eight unincorporated urban growth areas.

TREE CANOPY CHANGE BY MUNICIPAL URBAN GROWTH AREAS

Over the twelve-year assessment period, tree canopy gains surpassed losses in some urban growth areas (UGAs). However, four UGAs experienced a net loss of tree canopy, totaling over 400 acres of decline within Clark County UGAs. Particularly affected was Vancouver's UGA, which lost 400 acres of canopy between 2011 and 2023. The UGAs of Camas, Washougal, and Yacolt also faced losses, with reductions of 19 acres, 38 acres, and 5 acres, respectively. The Yacolt UGA experienced the largest percentage loss, with a 6% decrease in canopy coverage.

In contrast, three UGAs (Battle Ground, Ridgefield, and Woodland) gained canopy cover, mitigating some, but not all, of the total tree canopy losses observed throughout the study area. Among these, Battle Ground recorded the most significant gain, increasing its canopy by 35 acres, which represents a 3% increase across its urban growth areas.

Table 4. Land area distribution, urban tree canopy, potential planting area, urban tree canopy change, and impervious surface coverage by UGA.

Planning Area	Land Area Distribution %	Urban Tree Canopy %	Possible Planting Area %	UTC Net Change % (2011 - 2023)	Impervious Surface %
Vancouver	87%	25%	32%	-1.3%	33%
Battle Ground	3%	30%	51%	2.9%	16%
Ridgefield	3%	43%	41%	2.2%	9%
Camas	3%	62%	22%	-1.8%	4%
Washougal	3%	37%	48%	-3.8%	7%
Woodland	0.4%	52%	26%	1.6%	8%
La Center	0.4%	47%	40%	-0.2%	7%
Yacolt	0.2%	32%	55%	-6.2%	7%

Planting trees adjacent to natural areas with established canopy helps increase connectivity of forested habitat in Clark County.

TREE CANOPY COVER BY
ZONING CLASSIFICATIONS

Tree canopy changes were evaluated across 30 zoning classes, which were grouped into nine general zoning categories: Agriculture, Business, Commercial, Industrial, Mixed-Use, Parks/Open Space, Public Facilities, Residential, and University. This approach helps identify how zoning relates to tree canopy coverage and supports targeted strategies for sustainable urban development.

Residential areas occupy 71% of the total land area within Clark County UGAs and account for 67% of the total tree canopy within the study boundary. Agriculture, Parks/Open Space, Public Facilities, and Business zoning categories all had higher tree canopy cover than the UGA-wide average of 28%. Agricultural zones have the highest percentage of canopy (61%), with most located near Vancouver Lake and used for agriculture, wildlife habitat, and recreation. Parks/Open Spaces follow closely, boasting a canopy cover of 53%. Public facilities also contributed significantly to canopy coverage, with over 600 acres of tree canopy.

Commercial and Industrial zones have the lowest canopy cover, at 14% and 16%, respectively. Commercial areas also have the highest impervious surface coverage, with over 50% of these zones covered by paved surfaces. Industrial and Residential areas follow, with 38% and 36% impervious cover.

Residential areas offer the greatest potential for expanding the canopy with 8,329 acres (about 13 square miles) available for planting. These areas represent 71% of all plantable space in the UGAs. Industrial, Business, and Commercial zones each provide 500 acres or more of potential planting space, totaling over 2,000 acres and representing 7%, 6%, and 5% of the UGAs' plantable area, respectively.

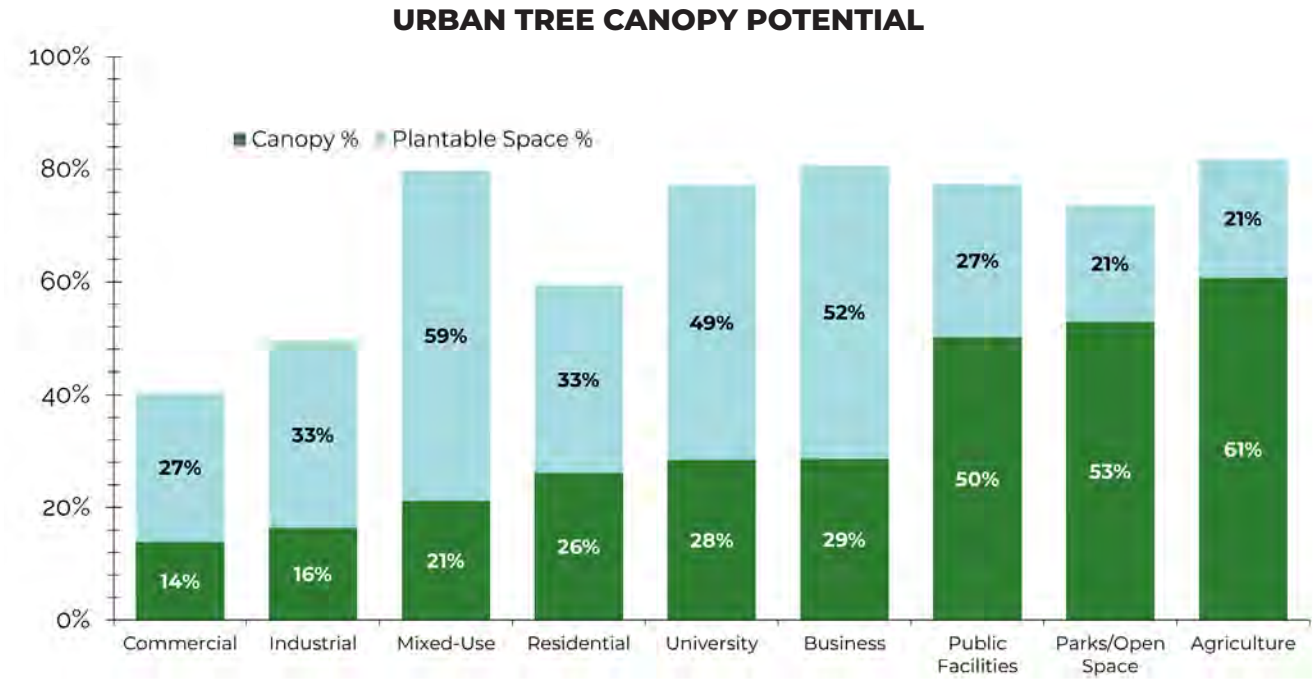


Figure 16. Urban tree canopy potential by general zoning classes.

Commercial areas had less than average canopy cover, greater than average impervious cover, and over 500 acres of plantable space.

TREE CANOPY CHANGE BY ZONING CLASSIFICATIONS

Between 2011 and 2023, tree canopy changes varied across the nine general zoning categories. Five categories experienced gains in tree canopy: University, Agriculture, Public Facilities, Parks/Open Space, and Mixed-Use University zones had the largest percentage increase at 4%, but this represented only a 13-acre gain due to the zone's small size of 379 acres.

Agriculture-zoned areas saw the most significant total increase in canopy, likely due to favorable growing conditions within the UGA. Public Facilities added 32 acres of tree canopy, a 3% increase on these properties.

Despite these gains, the overall tree canopy in the UGAs declined. The largest reduction of tree canopy occurred in Residential areas, where there was a loss of 385 acres, equivalent to about 300 football fields, or a 2% net decrease in total across residential properties. Commercial and Industrial zones also experienced similar losses, with reductions of 38 acres and 41 acres, respectively, each representing a 2% net decrease in canopy cover. These losses outweighed the gains in other zoning categories.

Friends of Trees volunteers planted street trees in unincorporated neighborhoods of the Vancouver UGA from 2017 to 2019 with grant funding Clark County received from the Lower Columbia Fish Recovery Board.

TREE CANOPY COVER BY CENSUS BLOCKS

An analysis was conducted at the UGA's census block scale to reveal detailed patterns in tree canopy coverage. A census block is a division of census block groups (refer to page 26 for a detailed understanding of census block groups). These blocks are the smallest geographic unit defined by the United States Census Bureau for collecting and tabulating complete census data. In urban settings, a census block often aligns with a city block bounded by streets, while in suburban or rural regions, its boundaries may be formed by roads, rivers, or other visible or legal features. The population within a census block can vary widely, and some blocks may have no residents at all.

In Clark County's UGAs, 80% of the 1,922 census blocks (CBs) have tree canopy cover below the average of 28% for the entire UGA. Meanwhile, 91 blocks, representing 5% of the total, had urban tree canopy coverage of 50% or greater.

TREE CANOPY COVER BY CENSUS BLOCKS

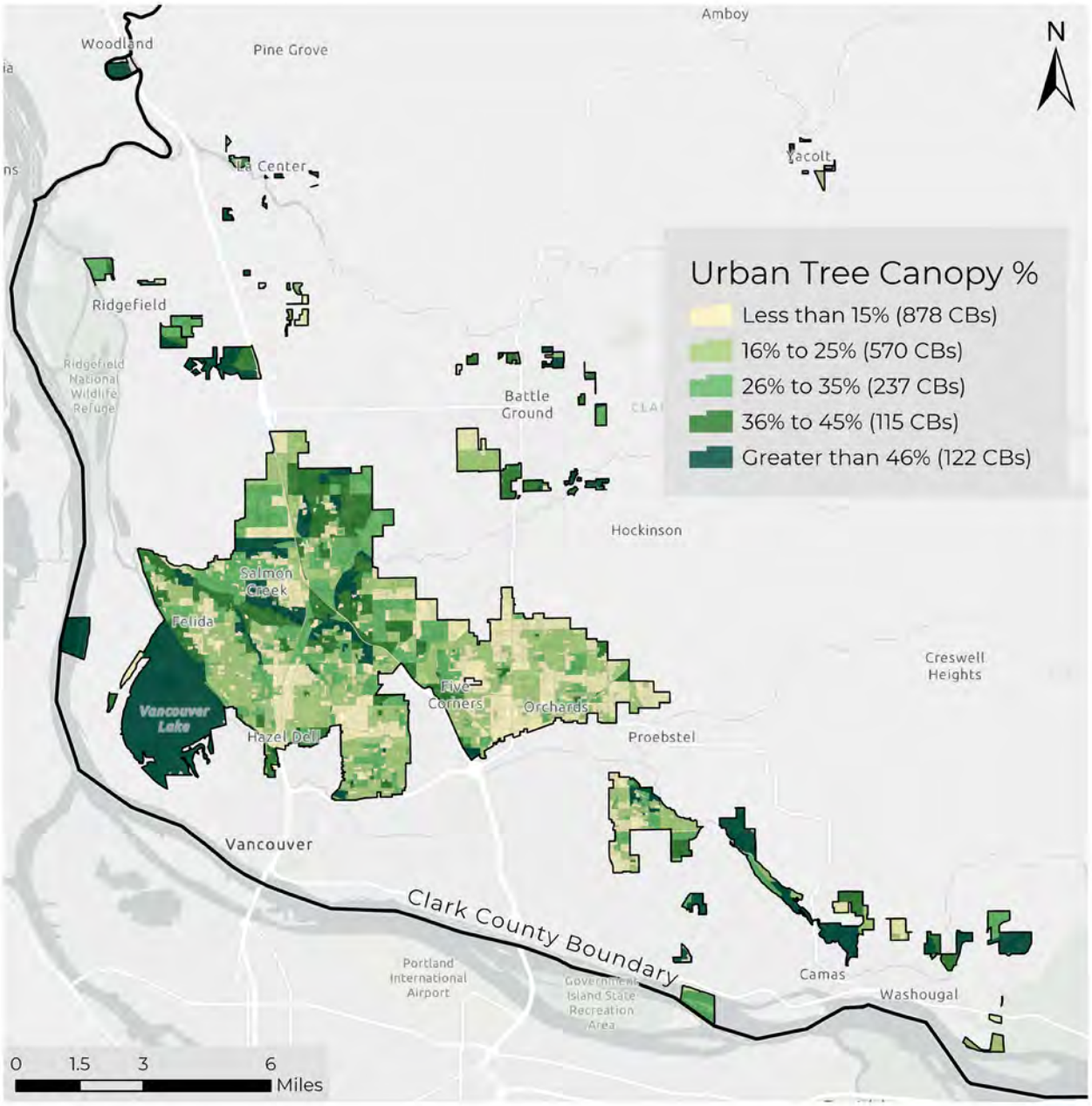


Figure 17. Urban tree canopy cover percent by census blocks (CBs).

PLANTABLE SPACE BY CENSUS BLOCKS

Nearly three-quarters (74%) of census blocks in the unincorporated urban growth areas have less than 33% of their land classified as potential planting area. The lowest percentages of plantable space are concentrated in the urban core of Vancouver and nearby neighborhoods, where development density is highest. In contrast, blocks with the greatest planting potential (those exceeding the UGA-wide average of 33%) are more commonly found on the urban fringe and in outlying areas such as near Ridgefield, Battle Ground, Camas, and Washougal. This pattern suggests that opportunities for expanding tree canopy are more limited in the established urban center, while suburban and peripheral zones retain larger areas suitable for new tree planting.

PLANTABLE SPACE PERCENT BY CENSUS BLOCKS

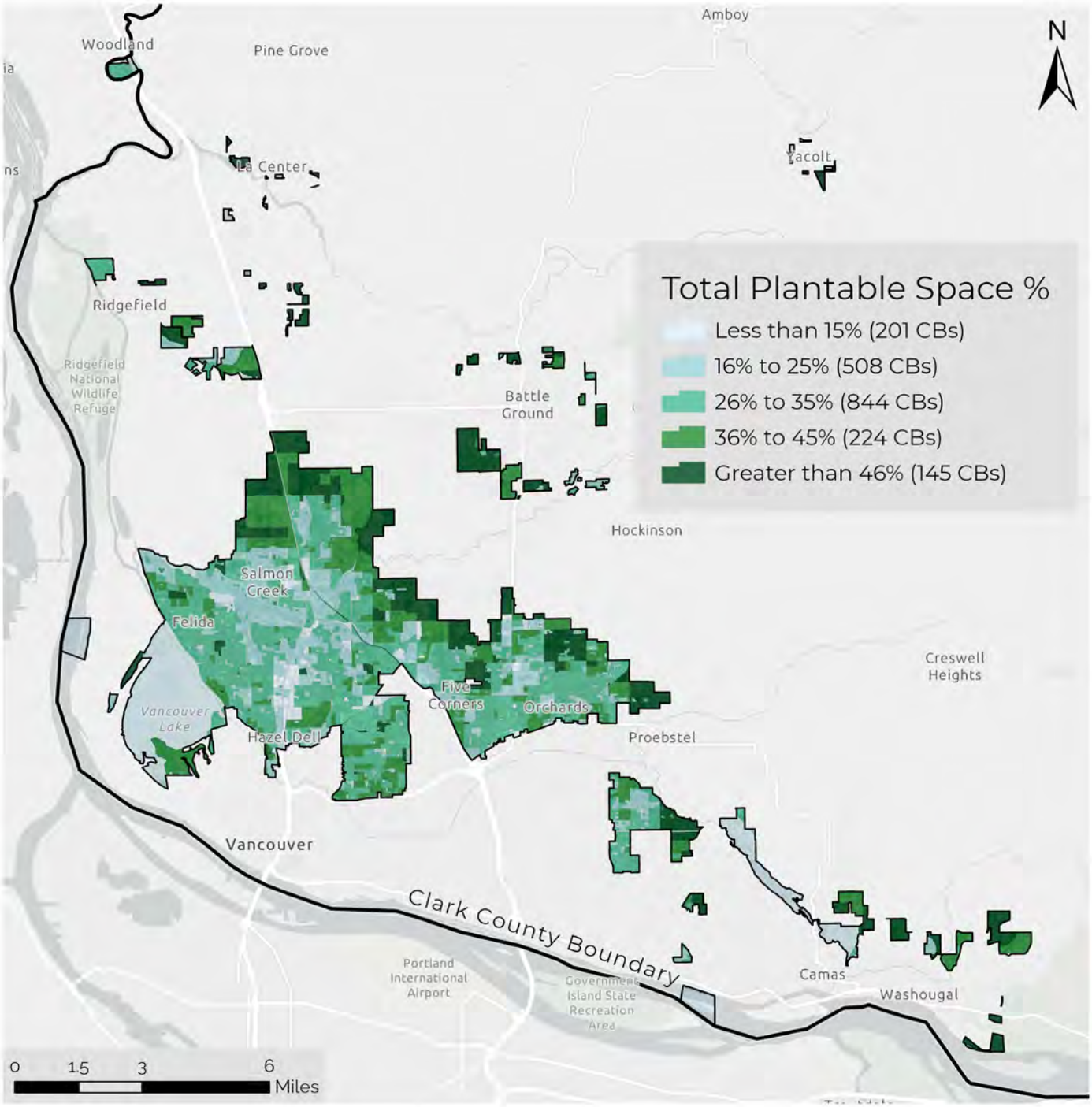


Figure 18. Potential planting area percentage by census blocks (CBs).

TREE CANOPY CHANGE BY CENSUS BLOCKS

The spatial distribution of urban tree canopy changes in census blocks across Clark County UGAs highlight several key trends. The most substantial canopy losses are concentrated in clusters within Vancouver's more densely developed neighborhoods and in select areas near Camas and Washougal. In contrast, significant canopy gains are relatively uncommon and are primarily located along the urban fringe, particularly in outlying blocks near Camas, Washougal, and the northern edges of the UGA. Most census blocks experienced only minor changes, with small increases or decreases in canopy, reflecting a balance between ongoing development and incremental tree planting or removal. Overall, while blocks that gained tree canopy between 2011 and 2023 experienced a total increase of 486 acres, this was outweighed by losses in blocks that lost canopy, which amounted to 887 acres of canopy lost during the same period (amounting to the net decrease of 400 acres of tree canopy across the UGAs).

CANOPY CHANGE PERCENT BY CENSUS BLOCKS

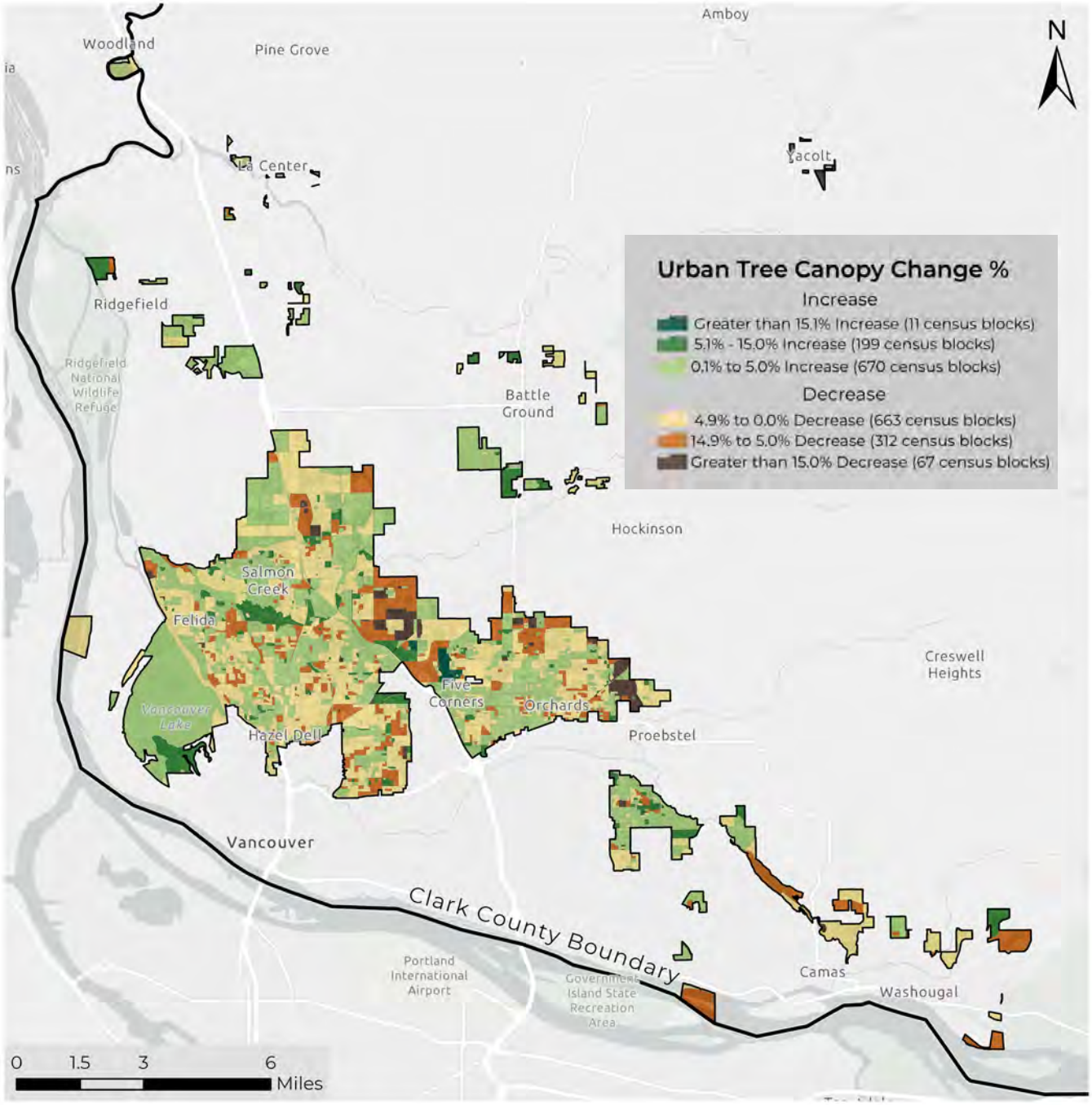


Figure 19. Tree canopy change percent (2011 - 2023) by census blocks.

PLANTING PRIORITIZATION BY

CENSUS BLOCK GROUPS

CONSIDERING SOCIOECONOMIC FACTORS

Clark County urban growth areas comprise 147 census block groups (CBGs), which are clusters of census block boundaries designed to create even population distributions. These areas are essential for analyzing the equitable distribution of tree canopy across the UGAs and can be linked to demographic and socio-economic data from the American Community Survey (ACS).

Of the 147 CBGs in the study area, 94 had a tree canopy percentage below the UGA-wide average of 28%. The remaining 53 block groups (about one-third of the total) exceeded this average with tree canopy density of over 28%. Notably, two-thirds of the census block groups had between 20% and 40% of their land available for tree planting. However, available space is not the only factor to consider when focusing on plans for opportunities to expand the tree canopy.

Increasing tree canopy cover can offer numerous benefits for local communities and visitors. Eight variables representing a range of socioeconomic, demographic, and accessibility factors were analyzed at the census block group level to prioritize areas for future planting. Efforts to target plantings in areas with the lowest tree canopy and the greatest socioeconomic need often result in improved social, economic, and community outcomes, in addition to the inherent environmental benefits produced by tree planting.

The five socioeconomic variables incorporated into this assessment were sourced from the 2022 U.S. Census American Community Survey 5-year summaries, and urban heat island information was derived from surface temperature data captured on July 9, 2024, during a heatwave event. Each variable was normalized and assigned equal weight in the prioritization criteria, and the final score for each CBG was calculated by summing the normalized values. The rankings range from high priority (dark blue) to low priority (light yellow) and were calculated for each criterion, as well as overall, to highlight where multiple needs overlap**. The top 15 priority census block groups are in Vancouver's UGA.**

Areas with Low Existing Tree Canopy: Census block groups with lower tree canopy cover percentages and higher non-canopy land are prioritized for planting.

Possible Tree Canopy: Census block groups with greater plantable areas are prioritized for expanding urban tree canopy.

Urban Heat Island Effect: Census block groups with higher surface temperatures are prioritized for planting to mitigate heat effects.

Poverty Rate: Census block groups with higher percentages of residents below the poverty level are prioritized for planting to enhance benefits designated poverty level.

Unemployment Rate: Census block groups with higher unemployment rates are prioritized for planting opportunities.

Vulnerable Population: Census block groups with larger ratios of residents under 18 or over 65 are prioritized for planting to support vulnerable populations.

Median Household Income: Census block groups with lower median household incomes are prioritized for planting to address environmental inequality.

Educational Attainment: Census block groups with lower percentages of residents with a high school diploma or GED are prioritized for planting to improve outcomes.

OVERALL PRIORITIZATION BY CENSUS BLOCK GROUPS (CBGS)

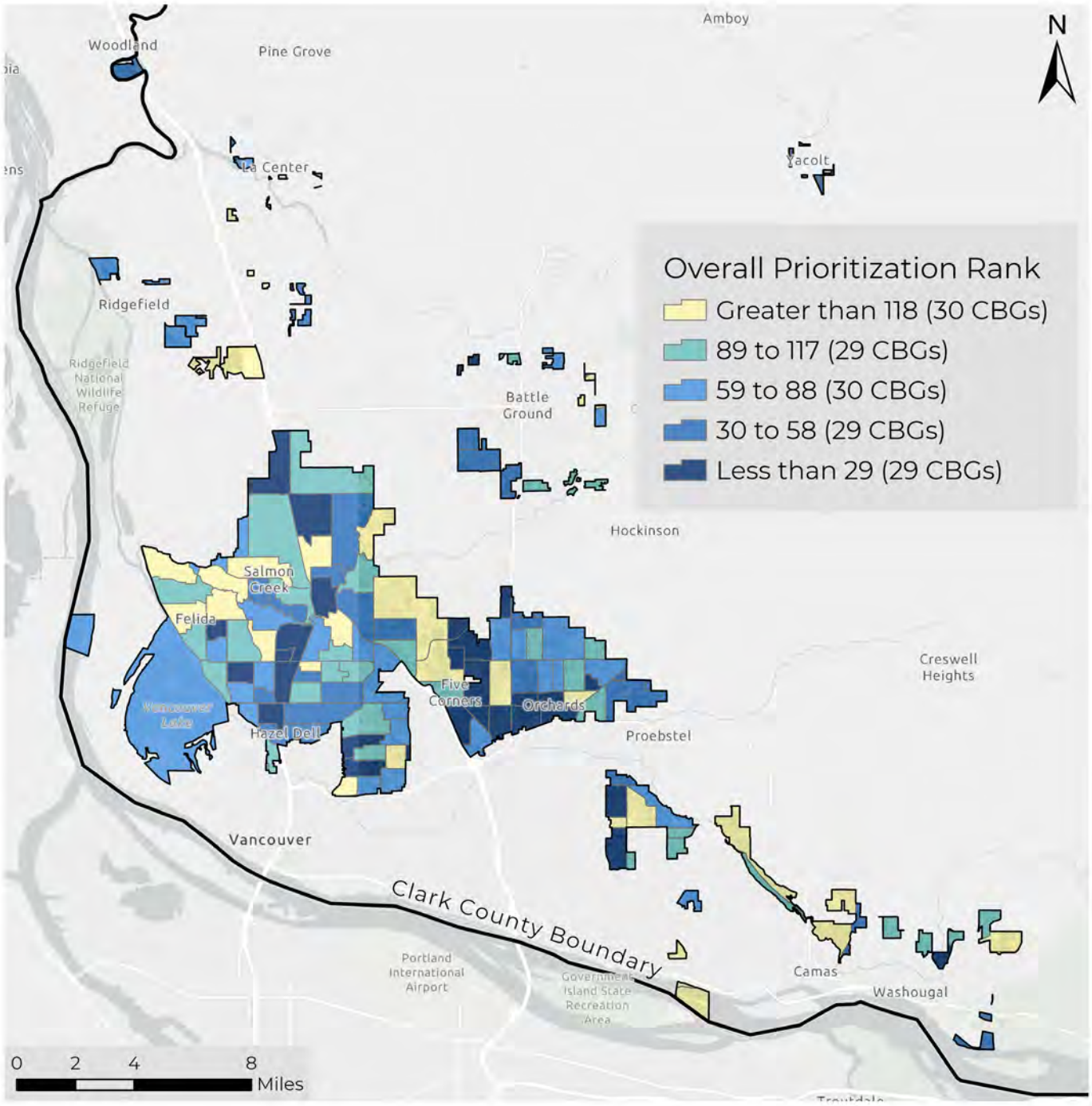


Figure 20. Overall prioritization rankings for the census block groups (CBGs) based on the eight prioritization criteria. Lower rankings (darker colors) indicate an overall higher priority for tree plantings. The top 15 priority census block groups are in Vancouver's UGA. All but two census block groups that make up the highest priority class (darkest blue) reside in Vancouver's UGA.

TREE CANOPY PRIORITIZATION PILOT STUDY

MINNEHAHA NEIGHBORHOOD

TREE CANOPY IN THE MINNEHAHA NEIGHBORHOOD

Minnehaha is a small neighborhood near the southern boundary of Clark County's unincorporated Vancouver urban growth area, adjacent to the City of Vancouver. Its name comes from the Dakota language, meaning "waterfall" or "curling water." This neighborhood was selected as a pilot area for urban tree canopy implementation because it has both a lower percentage of tree canopy compared to other neighborhoods in Clark County and a higher level of socioeconomic need.

As of 2023, tree canopy covered 252 acres (23%) of Minnehaha, which is 5% below the UGA-wide baseline average of 28%. Between 2011 and 2023, Minnehaha experienced a net canopy decrease of 2%, resulting in a loss of 25 acres of tree canopy.

Impervious surfaces constitute 40% of Minnehaha, which is 10% higher than the average for the surrounding urban growth areas. This significant level of impervious cover contributes to increased heat and reduces the absorption of stormwater. Therefore, adding more trees is essential for mitigating heat and improving environmental quality.

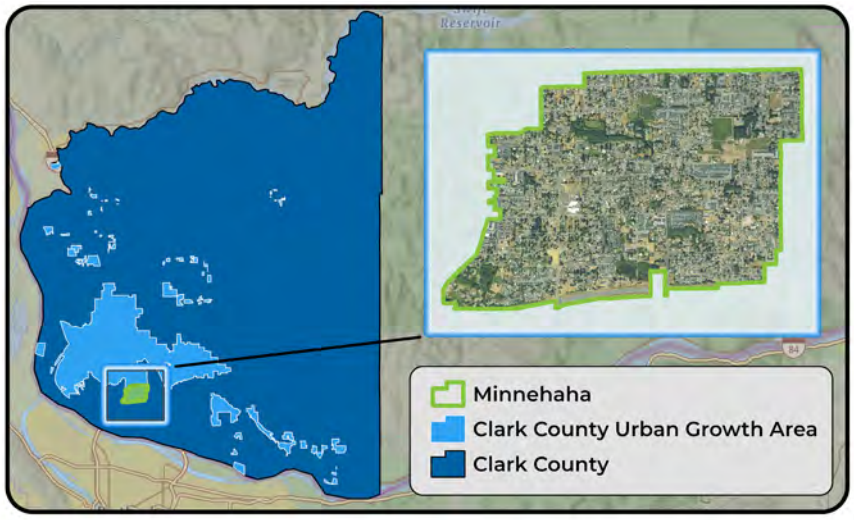


Figure 21. The Minnehaha neighborhood encompasses 1,092 acres in the southwestern part of the County urban growth areas.

One third (34%) of Minnehaha, or about 368 acres, has been identified as suitable for planting trees. These areas, which are located along road rights-of-way, on private properties, near bus stops, and within parks, represent key opportunities to expand the tree canopy. Increasing tree cover in these locations would provide much-needed shade for walkways, sidewalks, and park benches. Planting large stature trees in these areas would help counteract the heat effects associated with high impervious surface coverage and offer further benefits such as improved air quality, better stormwater management, and enhanced livability in the neighborhood. The following page describes an approach to prioritizing areas based on these factors and others including sociodemographic data.

Canopy Metrics in Minnehaha:

277 Acres (25%)
UTC 2011

252 Acres (23%)
UTC 2023

-25 Acres
UTC Change 2011-2023

-2%
Net Change

-9%
Relative Change

Net change is the absolute change in tree canopy as a percentage of total land area. It tells you how much the canopy has changed relative to the entire land area.
Relative change is the change in tree canopy as a percentage of the previous 2011 canopy. It tells you how much the canopy has changed relative to what it was before.

Table 5. Land cover and census data for the census block groups in Minnehaha. The top 3 priority census block groups are in bold and were selected based on their overall prioritization ranks. For more information on methodology, see Page 26. The average surface temperature is derived from temperature data captured on July 9, 2024, during a heat-wave event.

Census Block Groups in Minnehaha	% of Population in Poverty	% of Working Class Unemployed	Median Income	Avg. Surface Temp.	Impervious Surface %	UTC %	Possible Planting Area %	UTC Change % (2011 - 2023)
53-011-041110-1	15	27	$132,792	118	38	25	29	**0%**
53-011-041110-2	**35**	**34**	**$67,763**	**122**	**46**	**21**	**32**	-3%
53-011-041110-3	3	17	$175,456	117	35	29	31	-1%
53-011-041110-4	**13**	**15**	**$80,179**	**120**	**35**	**20**	**40**	-3%
53-011-041112-1	10	20	$93,672	121	39	22	38	-4%
53-011-041112-2	1	35	$104,208	122	40	24	35	-3%
53-011-041112-3	**28**	**48**	**$45,625**	**125**	**53**	**22**	**23**	2%

The Minnehaha area had a 23% tree canopy cover, which was 5% below the UGA-wide average of 28%.

This area also had above-average impervious cover (40%) and experienced a loss of canopy cover over the 12-year study period.

PRIORITY CENSUS BLOCK GROUPS WITHIN THE MINNEHAHA NEIGHBORHOOD

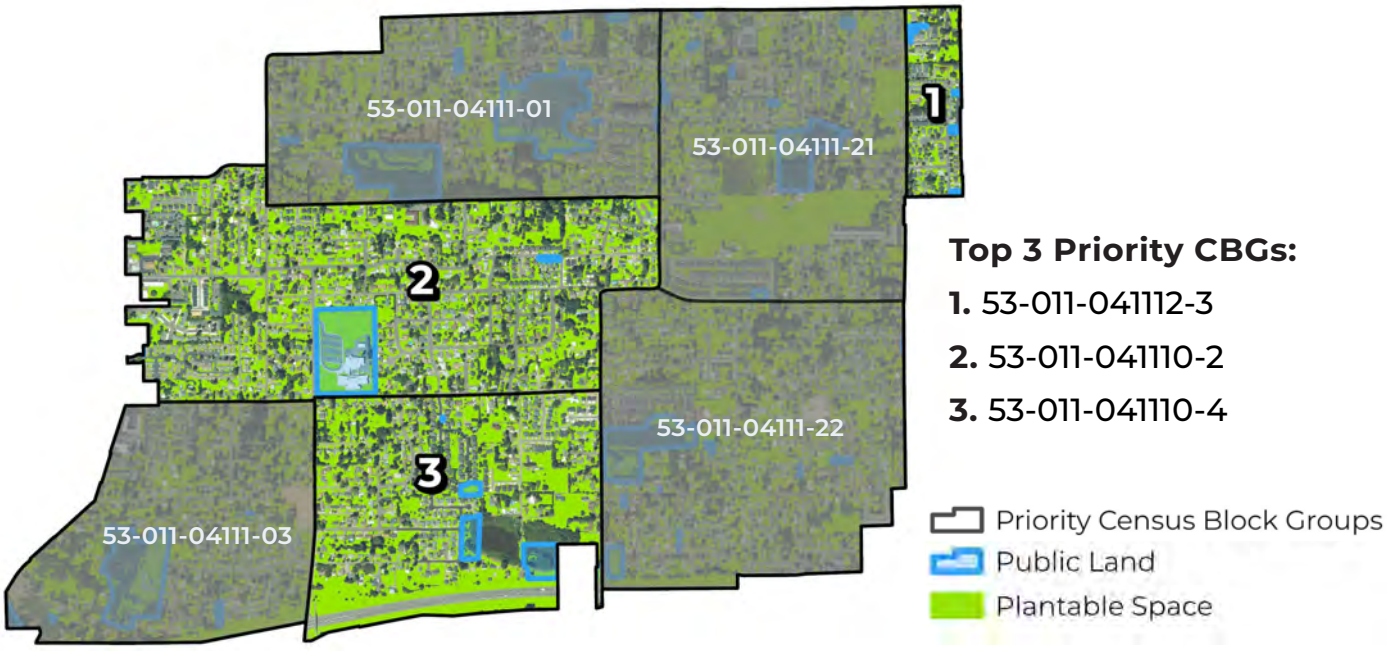


Figure 22. Plantable space in Minnehaha's top three priority census block groups. The highest priority is designated as 1, with subsequent priorities arranged in descending order.

TREE PLANTING EFFORTS IN THE MINNEHAHA NEIGHBORHOOD

To address Minnehaha's lower-than-average tree canopy and high socioeconomic need, Clark County Public Works launched a collaborative effort with the Clark Conservation District, local partners, and state agencies to expand tree planting in the neighborhood. The project focuses on planting trees along county roads, in parks, and in front of homes, with at least 250 residents participating in a free tree giveaway. To further engage the community, three volunteer tree planting events were held in January 2025 at Road's End Neighborhood Park, Bosco Farm Neighborhood Park, and Douglas Carter Fisher Neighborhood Park, where residents and volunteers helped plant 650 trees throughout Minnehaha. The goal is to plant up to 1,000 new trees in the neighborhood by the end of 2025. This initiative is supported by the Clean Water, Roads Maintenance and Operations, and Parks and Nature divisions of Public Works, with funding from the Washington State Department of Natural Resources Urban and Community Forestry Program.

Increasing Minnehaha's tree canopy will help reduce urban heat, improve air quality, manage stormwater, and offer economic, health, and social benefits-such as higher property values, improved mental health, and stronger neighborhood connections. This project also serves as a model for expanding urban tree canopy programs in other neighborhoods across urban growth areas.

Clark County volunteers water new street trees planted in the road right-of-way.

ECOSYSTEM

BENEFITS

I-Tree tools were used to calculate the benefits and functions of the canopy throughout Clark County UGAs, utilizing the latest available research. Trees produce oxygen, indirectly reduce pollution by lowering air temperature, and improve public health by reducing air pollutants that can cause illness and death. Likewise, canopy coverage has been shown to mitigate stormwater runoff, minimizing flood risk, stabilizing soil, reducing sedimentation in streams and riparian areas, and absorbing pollutants, thus improving water quality and habitats. Trees play a critical role in sequestering carbon from the atmosphere through photosynthesis and storing it long-term in their biomass. **Clark County UGAs' existing canopy provides an estimated $6,987,027 annually in avoided infrastructure costs and an additional $75,116,030 in stored carbon.**

THE VALUE OF THE URBAN FOREST IN THE URBAN GROWTH AREA OF CLARK COUNTY

Figure 23. Ecosystem service benefits of canopy cover in the urban growth area. Data sourced from I-Tree, the US Forest Service, the Arbor Day Foundation, and the U.S. Environmental Protection Agency.

CONCLUSIONS AND RECOMMENDATIONS

Clark County UGAs' forests provide the community with essential resilience-boosting services, such as reducing air temperatures, improving public health, and enhancing endemic wildlife habitats such as the multiple salmon species that rely on the Clark County Watersheds that feed into the Lower Columbia River. However, forests in the Pacific Northwest United States face numerous challenges. Drought, forest fires, extreme storms, pests, diseases, and ongoing development pose significant threats to the UGAs' tree canopy.

Regular assessments of Clark County's tree canopy serve multiple purposes: establishing a baseline, acting as a report card, and supporting strategic guidance for maintaining the UGAs' long-term canopy health. The findings from these assessments help inform planning, investment, and management strategies, ensuring that the communities most in need of forest benefits receive targeted support and access to critical resources. The following recommendations are based on results from this Urban Tree Canopy Assessment.

RECOMMENDATIONS

1. **Implement tree canopy requirements in the County's Municipal Stormwater Permit**
   By no later than December 2026, the County must use available, existing data to map tree canopy in support of stormwater management on Permittee-owned or operated properties. Additionally, by December 2028, Clark County must adopt and implement tree canopy goals and policies to enhance stormwater management. This includes establishing objectives for how the existing or future tree canopy can contribute to stormwater management and improve water quality in receiving waters. It also includes efforts to maintain the existing mature tree canopy, focusing on overburdened communities. Prioritizing efforts to increase tree canopy in these communities is a key aspect of the County's Stormwater Permit.

2. **Integrate Tree Canopy Goals into Regional Planning**
   As parts of Clark County continue to grow and urbanize, it is essential to preserve the existing tree canopy. Since it can take decades for newly planted trees to mature and have a significant impact, protecting the current canopy is the best way to maintain stable coverage until future increases can be achieved. Use the data from this assessment to establish both short-term and long-term goals:

   - Set annual tree planting targets.
   - Implement regularly scheduled maintenance programs.
   - Increase tree diversity by planting a wider variety of large stature tree species.
   - Establish specific canopy coverage goals for designated target years.
   - Review long-term land-use and development plans to include policies that protect mature trees and create canopy ordinances for new developments.

3. **Once finalized and adopted, implement tree-related climate goals and associated policies outlined in Clark County's Comprehensive Climate Element as required by Washington State's Growth Management Act. Draft policy concepts include, but are not limited to:**

   - Protect and plant more trees in both rural and urban areas, with targeted efforts to equitably increase tree canopy cover and provide ongoing maintenance support.
   - Increase, enhance, and protect county-owned plantings and greenspaces, while identifying, preserving, and rewilding critical areas such as riparian zones, wetlands, prairies, forests, and open spaces.
   - Develop and implement a comprehensive plan for trees and greenspaces that advances climate resilience, ecosystem health, and equity, in alignment with relevant laws and best practices.

- Expand funding, policies, and community partnerships for tree planting, invasive species removal, restoration, and sustainable forestry, prioritizing native and climate-resilient species.
- Promote inclusive education, engagement, and volunteer opportunities around tree stewardship and natural areas, and advocate for long-term protection of forests and critical habitats.

4. Use this Urban Tree Canopy Assessment as a platform and framework to establish future Urban Forestry Programs in Clark County

This includes the completion of an official Urban Forestry Management Plan to serve as the backbone for all urban forestry efforts. It encompasses initiatives to continue mapping and inventorying tree canopy, complete assessments and planning, and develop programs. It also involves building resources for private landowners and working lands, as well as establishing technical and financial assistance and incentives for forest landowners. Additionally, identifying essential funding for long-term maintenance and stewardship is crucial to sustaining urban tree canopy programs. Efforts to build regulatory backstops are also critical in ensuring that forest practice requirements are met, that critical riparian and shoreline areas are protected, and that impacts on tree canopy are mitigated. The protection of essential riparian and shoreline areas remains crucial, along with creating new requirements to mitigate impacts on the tree canopy. Furthermore, enhancing staff capacity, expertise, and resources to develop new tree canopy programs is vital, as are efforts to foster new partnerships with local organizations dedicated to protecting and restoring the urban tree canopy in Clark County.

5. Establish partners and resources to engage the Community and Partner with Private Landowners

Since much of Clark County's plantable space is on private land, community involvement is key to increasing canopy and mitigating canopy losses. Develop outreach programs to engage residents, schools, and local businesses in tree planting and care. Initiatives like Arbor Day celebrations, workshops, and volunteer planting events can educate the public about the benefits of trees and encourage participation. Pairing these programs with tree giveaways, private property planting initiatives, and tree maintenance events to boost canopy growth on private land. Building financial and technical assistance resources to implement urban tree canopy programs on private property is an essential first step.

6. Expand and Protect Canopy in Underserved Areas

Direct tree-planting efforts toward neighborhoods identified in the planting prioritization analysis, especially those with high levels of impervious surfaces, low canopy cover, or significant concentrations of residents dealing with socioeconomic inequity. Planting new trees and/or preserving existing mature canopies in these areas can help reduce urban heat islands, lower energy costs, and create calming spaces that alleviate stress and promote community engagement. By prioritizing these underserved areas, we can maximize the impact of forest management resources and ensure a fair distribution of green infrastructure.

7. Promote a Resilient Urban Forest

The findings of this assessment offer valuable information that can help develop a more resilient urban forest in Clark County UGAs. This data can support state, county, and local budget requests, as well as grant applications aimed at enhancing the county's resilience. Urban forests play a crucial role in addressing regional challenges by managing stormwater to reduce the burden on infrastructure during heavy rains and improving water quality by filtering pollutants before they reach rivers in Clark County. Additionally, they provide shade that helps lower urban heat island effects and protect buildings and residences by acting as a buffer against high winds. Together, these efforts contribute to creating a more sustainable and livable community for both residents and visitors.

8. Monitor Progress and Adapt Strategies

To track progress, revise strategies, and stay informed about areas of canopy growth and loss, it is essential to conduct recurring canopy assessments using updated imagery every 2-3 years using imagery data, such as the NAIP Imagery used in this assessment. The 2025 NAIP Imagery data will be available sometime in 2026. Continuous monitoring will ensure that management efforts remain effective, aligned with Clark County Conservation District's goals, and maintain a thriving, resilient urban forest.

REPORT

APPENDIX

A. EXPANDED METHODOLOGY

1. Data Acquisition and Preparation

PlanIT Geo utilized 2023 EarthDefine US Tree Map data (derived from 60-centimeter multispectral NAIP imagery and LiDAR) and 1-meter resolution NAIP imagery from 2011 to map tree canopy and land cover. The tested accuracy of the US Tree Map in Washington is 98.8% according to EarthDefine's accuracy assessment using 1,000 random points throughout the state.

2. Land Cover Classification

Training labels for seven land cover classes—tree canopy (including overhanging impervious surfaces), shrub vegetation, herbaceous/grass, bare soil/dry vegetation, impervious surfaces, open water, and tree canopy over impervious—were developed using NAIP imagery, LiDAR, and external datasets. Identical Deep Convolutional Neural Network (DCNN) workflows were applied to both the 2011 and 2023 imagery for consistency, with hyperparameter-optimized models performing semantic segmentation. Post-classification refinements included knowledge-based rules (e.g., masking water bodies using NDWI) and manual QA/QC.

3. Possible Planting Areas Delineation

All areas lacking tree canopy were further classified as either suitable or unsuitable for planting. Unsuitable areas for canopy expansion (e.g., airports, sports fields, utility corridors, wetlands) were excluded by manually digitizing these features. These areas, while vegetated and potentially suitable for tree planting from a biophysical perspective, are considered unsuitable due to land use constraints. The original seven-class land cover data was then converted into Urban Tree Canopy potential classes, resulting in the following final classifications: Possible Planting Area, Unsuitable Impervious, Unsuitable Vegetation, Unsuitable Wetland, Unsuitable Soil, and Water. This refined classification provides a detailed spatial framework for prioritizing tree planting efforts.

4. Historical Canopy Change Analysis

The 2011 and 2023 tree canopy classifications were compared using GIS overlay analysis to quantify changes in canopy extent over the 12-year period. This approach enabled the identification of areas where tree canopy was lost, gained, or remained stable, providing essential baseline data for evaluating the effectiveness of urban forestry initiatives. It should be noted that the 2011 historical tree canopy data is a single-class dataset; therefore, land cover change analysis was limited to the tree canopy class only. This methodology enables precise tracking of canopy changes since 2011 while maintaining methodological consistency across time periods, ensuring comparable results for long-term urban forest management planning.

5. Multi-Scale Spatial Analysis

Land cover metrics (area and percent cover) were calculated for the entire Area of Interest (Urban Growth Area) and for each assessment geography. Raster and vector outputs supported both fine-grained analysis and regional planning.

GLOSSARY/KEY TERMS

Land Acres: Total land area, in acres, of the assessment boundary (excludes water).

Non-Canopy Vegetation: Areas of grass and open space where tree canopy does not exist.

Possible Planting Area - Vegetation: Areas of grass and open space where tree canopy does not exist, and it is biophysically possible to plant trees.

Shrub: Areas of shrub or other leafy and woody vegetation (smaller than 6ft tall) that are not classified as tree canopy.

Soil/Dry Vegetation: Areas of bare soil and/or dried, dead vegetation.

Total Acres: Total area, in acres, of the assessment boundary (includes water).

Unsuitable Impervious: Areas of impervious surfaces that are not suitable for tree planting. These include buildings and roads and all other types of impervious surfaces.

Unsuitable Planting Area: Areas where it is not feasible to plant trees. Airports, ball fields, golf courses, etc. were manually defined as unsuitable planting areas.

Unsuitable Soil: Areas of soil/dry vegetation considered unsuitable for tree planting. Irrigation and other modifiers may be required to keep a tree alive in these areas.

Unsuitable Vegetation: Areas of non-canopy vegetation that are not suitable for tree planting due to their land use.

Urban Tree Canopy (UTC): The “layer of leaves, branches and stems that cover the ground” (Raciti et al., 2006) when viewed from above; the metric used to quantify the extent, function, and value of the urban forest. Tree canopy was generally taller than 10-15 feet tall.

Water: Areas of open, surface water not including swimming pools.

Partner organizations host tree potting events to prepare trees for future planting events.

MAY | 2025

TREE CANOPY COVER

ASSESSMENT

CLARK COUNTY, WASHINGTON
URBAN GROWTH AREAS

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