URBAN TREE CANOPY

ASSESSMENT

VANCOUVER,
WASHINGTON
OCTOBER | 2021

CITY OF Vancouver WASHINGTON

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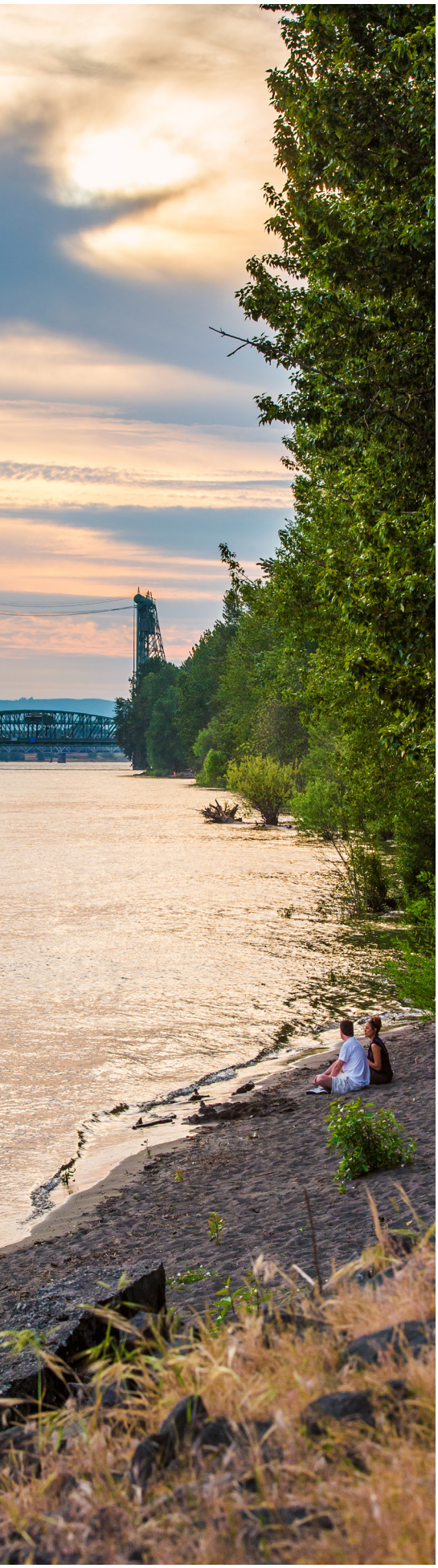

AN ASSESSMENT OF URBAN TREE CANOPY
VANCOUVER, WASHINGTON

It's the little things citizens do.

That's what will make the difference.

My little thing is planting trees.

-Wangaari Mathai

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PREPARED FOR
City of Vancouver, Washington

COMPLETED
October 2021

TABLE OF
CONTENTS

6,066
ACRES OF CANOPY

19%
OF VANCOUVER WAS COVERED BY TREE CANOPY IN 2020

EXECUTIVE SUMMARY

The urban forest in Vancouver is a valuable asset providing residents and visitors with many environmental, social, and economic benefits. This assessment mapped urban tree canopy (UTC), possible planting area (PPA), and tree canopy changes over the last decade and analyzed how they are distributed throughout the City and its land ownership, zoning types, watersheds, ZIP codes, neighborhoods, census tracts, and census blocks.

PROJECT METHODOLOGY

The results, based on 2019/20 and 2011 imagery from the USDA's National Agriculture Imagery Program (NAIP), provide a current and historical look at land cover in Vancouver and will allow the City to revise and develop existing and new strategies to protect and expand the urban forest. A prior land cover assessment (2011), conducted by AMEC Environment and Infrastructure, used 2010 WorldView-2 satellite imagery to map and calculate tree canopy and land cover metrics. However, this study used modern machine learning techniques to create land cover data from both time periods to allow for the most even comparison possible.

VANCOUVER'S URBAN FOREST

In 2019, Vancouver had 19% urban tree canopy cover and 32% possible planting area, not including any surface water bodies within the city. The City's total land cover contained 18% tree canopy, 30% non-canopy vegetation; 2% soil/dry vegetation; 43% impervious surfaces, and 7% water.

Of the five zoning types in Vancouver, Open Space Districts had the highest canopy coverage at 31%. However, Single Family areas contained the most canopy, overall, containing 3,159 acres or 52% of all canopy in the City. Single Family areas also contain the greatest potential for canopy expansion, offering 4,212 acres (30% PPA by area and 42% of the City's total plantable space).

URBAN TREE CANOPY CHANGE

Results from the 2011 AMEC assessment indicated there was 18.6% tree canopy cover in Vancouver in 2010. This study found that canopy cover changed from 16 to 19% from 2011 to 2019 (+3% or 1,027 acres) using the current city boundary which included newly annexed areas. Private lands saw a 3% increase while canopy on public lands expanded 5%. Canopy cover within the public right-of-way increased by 4%. This gain is due in part to the City's annexation of a large area between 2011-2019, which increased the City's overall acres while also adding more canopy, but also in part to the recent ambitious planting efforts that the City has implemented to assist in achieving their goal of 28% canopy by 2030.

ACHIEVING CANOPY GOALS

The results of this analysis can be used to develop plans to protect and expand the urban forest in Vancouver. The UTC and PPA maps and data in this report can be used as a guide to determine where the City has been successful in protecting and expanding its urban forest resource, while also targeting areas to concentrate future efforts based on needs, benefits, and available planting space. Vancouver can use these results to ensure that their urban forest policies and management practices continue to prioritize its maintenance, health, and growth.

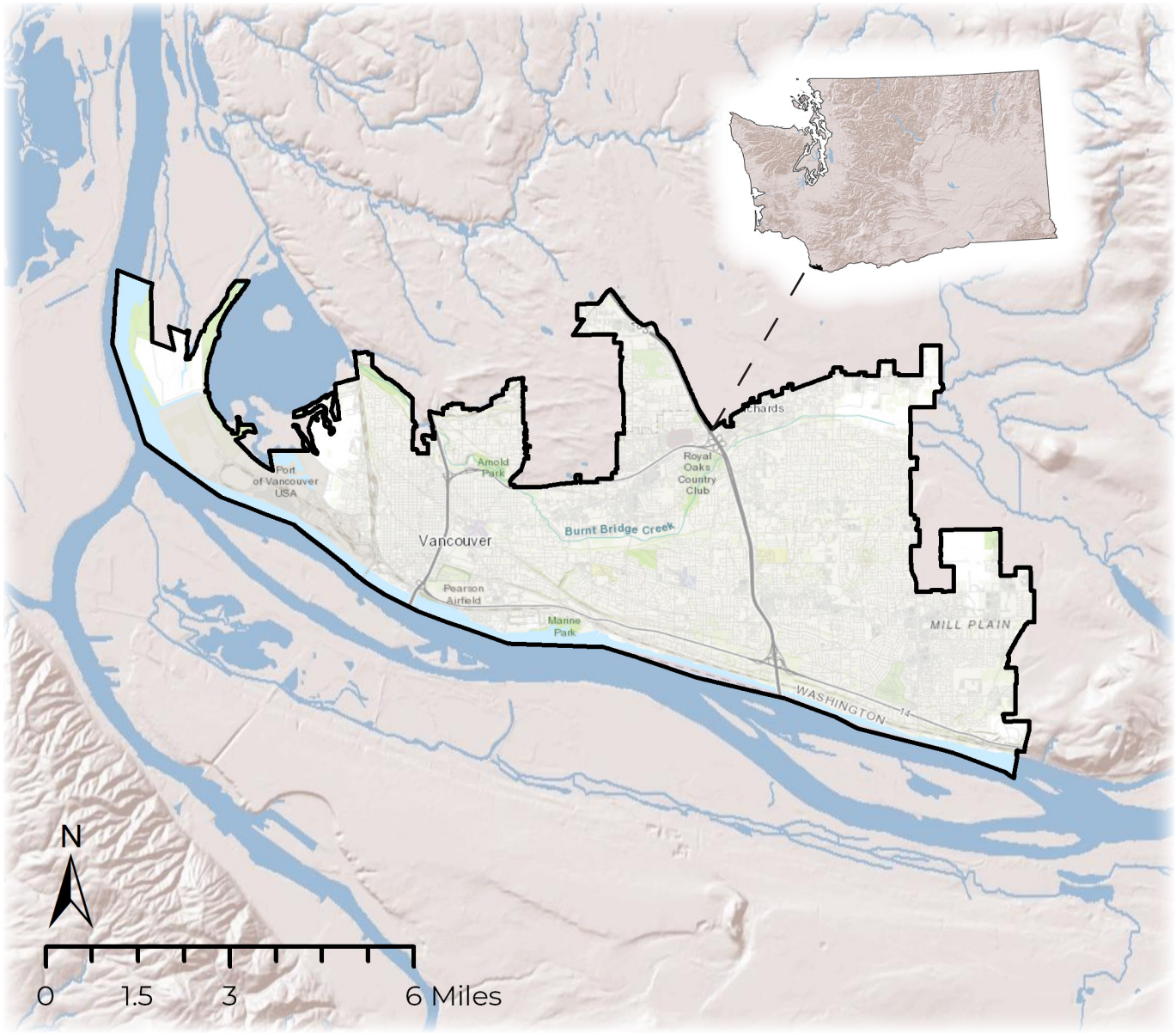


Figure 1. Vancouver occupies approximately 54 square miles in Clark County, Washington.

19%
URBAN TREE CANOPY

32%
POSSIBLE PLANTING AREA

43%
IMPERVIOUS SURFACE

Figure 2. Based on an analysis of 2019 and 2020 high-resolution imagery, Vancouver contains 19% tree canopy, 32% areas that could support canopy in the future, and 43% total impervious areas.

PROJECT METHODOLOGY

Land cover, urban tree canopy, and possible planting areas were mapped using the sources and methods described below. These datasets provide the foundation for the metrics reported at the selected geographic assessment scales.

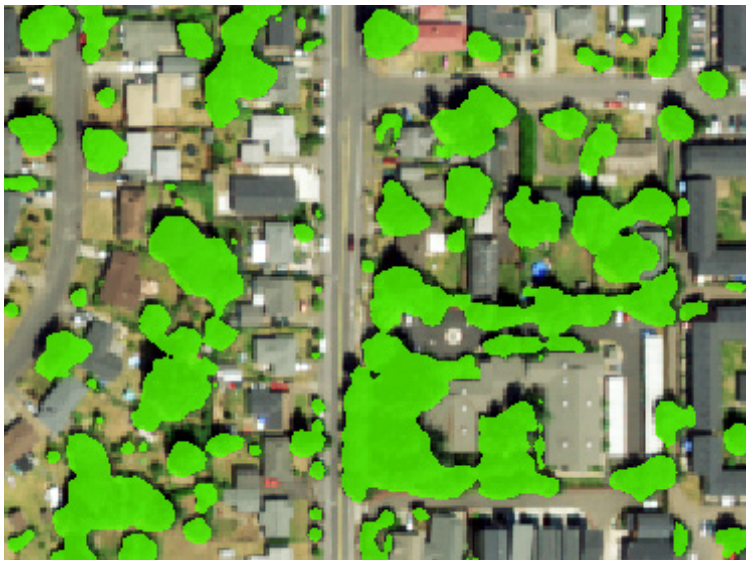
DATA SOURCES

This assessment utilized high-resolution (60-centimeter) multispectral imagery from the U.S. Department of Agriculture's National Agriculture Imagery Program (NAIP) collected in 2019 and 2020 to derive the land cover dataset. The NAIP imagery was used to classify all types of land cover.

MAPPING LAND COVER

The land cover data set is the most fundamental component of an urban tree canopy assessment. Tree canopy and land cover data from the EarthDefine US Tree Map (link: https://www.earthdefine.com/treemap/) provided a five class land cover dataset. The US Tree Map is produced using a modern machine learning technique to extract tree canopy cover and other land cover types from the latest available 2019/2020 NAIP imagery (due to obscurity from wildfire smoke in 2019, parts of the city were collected in 2020). These five classes are shown in Figure 3 and described in the Glossary on page 24.

Figure 3. Five (5) distinct land cover classes were identified in the 2019/2020 tree canopy assessment: urban tree canopy, other non-canopy vegetation, bare soil and dry vegetation, impervious (paved) surfaces, and water.



CLASSIFYING URBAN TREE CANOPY

The EarthDefine US Tree Map was then used as a mask to extract generalized tree species composition using a Normalized Difference Vegetation Index (NDVI), supervised training, and an iterative machine learning approach.

Street-level images from Google StreetView were used to obtain training and verification samples of deciduous and evergreen trees. Generalized tree species composition mapping was performed at a scale to classify larger groves of trees but not individual trees. There were no accuracy standards required or assessed for this classification.

IDENTIFYING POSSIBLE PLANTING AREAS AND UNSUITABLE AREAS FOR PLANTING

In addition to quantifying Vancouver's existing tree canopy cover, another metric of interest in this assessment was the area where tree canopy could be expanded. To assess this, all land area in Vancouver that was not existing tree canopy coverage was classified as either possible planting area (PPA) or unsuitable for planting. Possible planting areas were derived from the non-canopy vegetation layer. Unsuitable areas, or areas where it was not feasible to plant trees due to biophysical or land use restraints (e.g. golf course playing areas, recreation fields, airports, etc.) were manually delineated and overlaid with the existing land cover data set (Figure 4). The final results were reported as PPA Vegetation, Unsuitable Vegetation, Unsuitable Impervious, Unsuitable Soil, and Total Unsuitable.

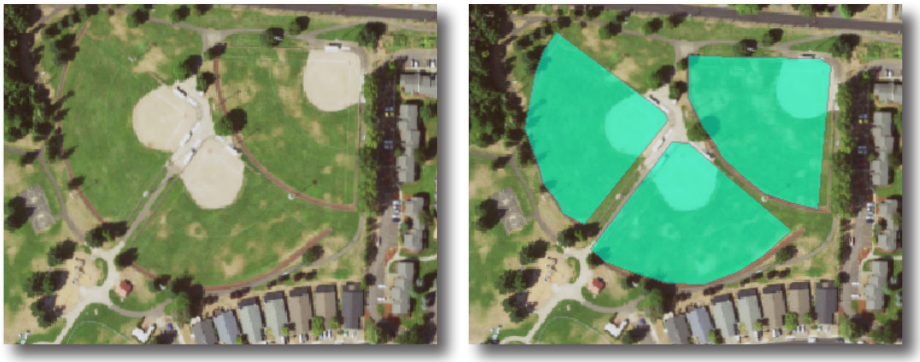


Figure 4.
Vegetated areas where it would be biophysically feasible for tree plantings but undesirable based on their current usage (left) were delineated in the data as "Unsuitable" (right). These areas included recreational sports fields, golf courses, and other open space.

URBAN TREE CANOPY CHANGE ANALYSIS

Tree canopy change between 2011 and 2019/2020 was also analyzed across the same geographic assessment boundaries described in the previous section. Both tree canopy data sets were created using identical machine learning techniques, with the only exceptions being different years and slightly different spatial resolutions of NAIP imagery.

The City hired AMEC Environment and Infrastructure in 2011 to perform a tree canopy assessment using 2010 WorldView-2 satellite imagery. Results from that assessment indicated there was 18.6% tree canopy cover in Vancouver at the time. However, with recent technological advancements in artificial intelligence, computer vision, and machine learning, the City decided to re-assess both current and historical tree canopy data using identical methods to allow for the most even comparison possible.

Both tree canopy data sets were created from the EarthDefine US Tree Map. The 2019/2020 imagery was collected at a higher pixel resolution of 60-centimeters compared to 1-meter for the 2011 imagery. (Due to some of the 2020 imagery being obscured by wildfire smoke, 2019 imagery was used in some places to perform the most recent analysis.) Despite the slight resolution differences, the machine learning techniques used produced highly comparable datasets. To further ensure an even comparison, both datasets were assessed using the most recent city boundary, which changed since the last assessment due to recent annexation. Similar to the UTC and PPA assessment, the urban tree canopy change percentages are based on land area only.

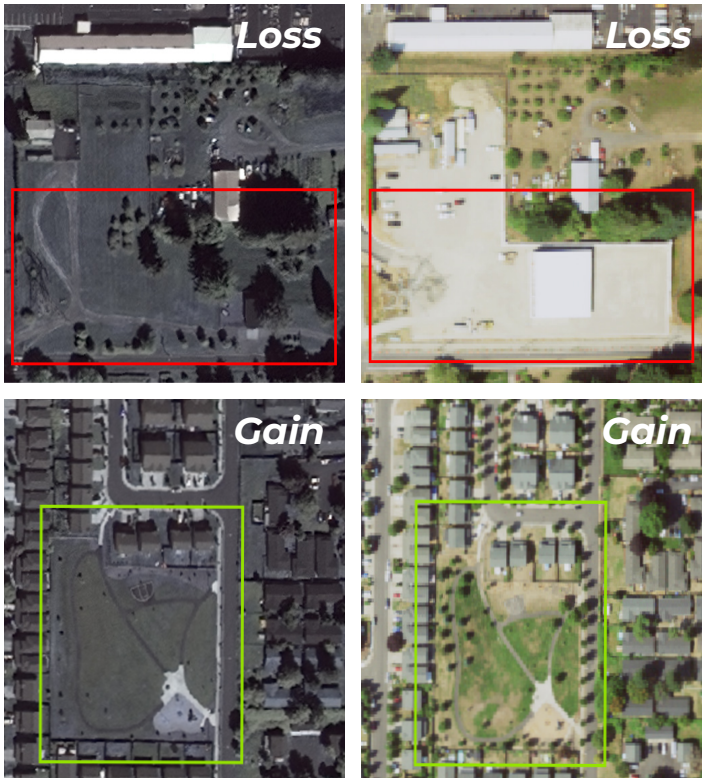


Figure 5. Canopy loss from 2011 to 2020 due to development (top), and canopy gain due to canopy growth (bottom). Additional examples of change are provided in the Key Findings section.

DEFINING ASSESSMENT LEVELS

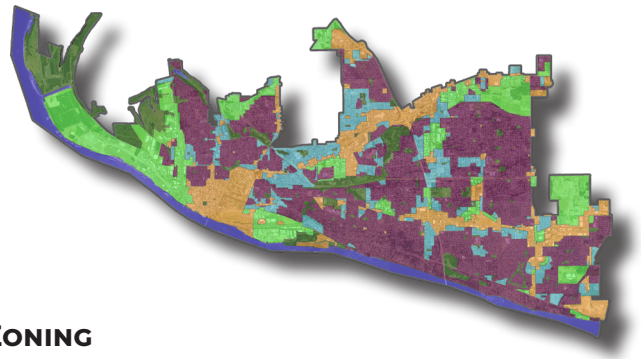
In order to best inform the City of Vancouver's various stakeholders, urban tree canopy and other associated metrics were tabulated across a variety of geographic boundaries (Figure 5). These boundaries include the city boundary, land ownership, zoning, watersheds, ZIP codes, census tracts, neighborhoods, and census blocks.

City Boundary

The City of Vancouver **citywide boundary** is the one (1) main area of interest over which all metrics are summarized.

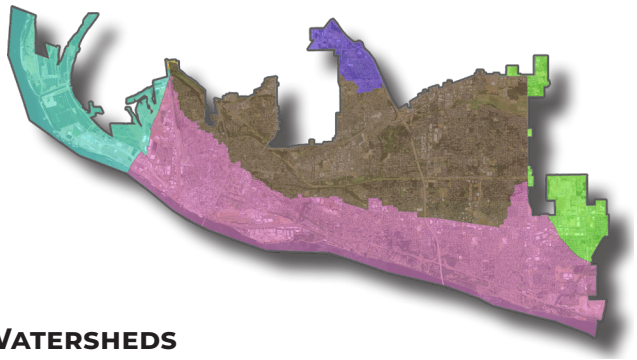
Land Ownership

The **land ownership** in Vancouver was assessed in four (4) different categories including public right-of-way, public, private right-of-way (including Bonneville Power Administration (BPA) and Burlington Northern Santa Fe (BNSF)), and private land ownership. These categories were distinguished by the ownership of each parcel.



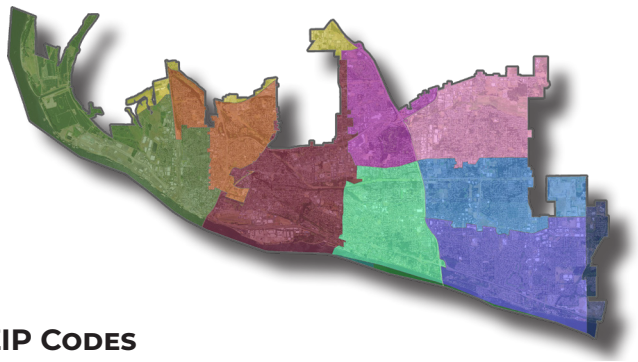
Zoning

Five (5) unique **zoning** types were assessed to provide detail on tree canopy within the current human uses of land throughout Vancouver.



Watersheds

Tree canopy was analyzed for the six (6) **watersheds**, which cover Vancouver, to identify the amount of tree canopy as it relates to stormwater mitigation and water quality.



ZIP Codes

Ten (10) **ZIP codes** were assessed to provide insight into the different areas in Vancouver.

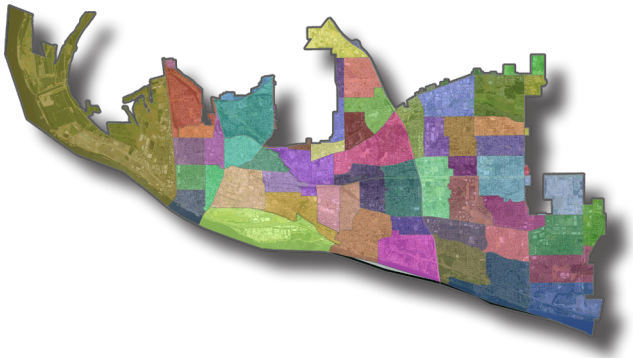
Neighborhoods

Tree canopy was also analyzed in sixty eight (68) Vancouver **neighborhoods** to see gains and losses associated with expansion in residential areas in the City.

US Census Boundaries

Sixty four (64) **census tracts** were assessed to provide information at a geographic scale commonly used to track populations. Census tracts are used by the U.S. Census Bureau to assure statistical consistency when tracking populations across the United States and can be valuable indicators of environmental justice as they are directly linked with demographic and socioeconomic data. Census tracts are further divided into census block groups and then individual census blocks for finer-scale analyses.

In Vancouver, over two-thousand (2,568) individual **census blocks**, which are subdivisions of the census tracts described above, were assessed to provide information at the smallest geographic scale possible. Census blocks are used by the U.S. Census Bureau to assure statistical consistency when tracking populations across the United States and can be valuable indicators of environmental justice as they are directly linked with demographic and socioeconomic data.



Census Tracts

Census Blocks

Figure 6. (continued from previous page) Eight (8) distinct geographic boundaries were explored in this analysis: the full city boundary, land ownership, zoning, watersheds, ZIP codes, neighborhoods, census tracts, and census blocks.

STATE OF THE CANOPY AND KEY FINDINGS

The results and key findings of this study, including the tree canopy cover map and canopy analysis results, are presented below. These results can be used to design a strategic approach to identifying existing canopy and future planting areas. Land cover percentages are based on the total area of interest while urban tree canopy, possible planting area, and unsuitable percentages are based on land area. Water bodies are excluded from land area because they are typically unsuitable for planting new trees without significant modification.

Table 1. Land cover classes in acres and percent in the City of Vancouver.

City of Vancouver	Acres	% of Total
City Boundary	34,576	100%
Tree Canopy	6,066	18%
Non-Canopy Vegetation	10,446	30%
Impervious Surfaces	14,857	43%
Soil & Dry Vegetation	786	2%
Water	2,421	7%

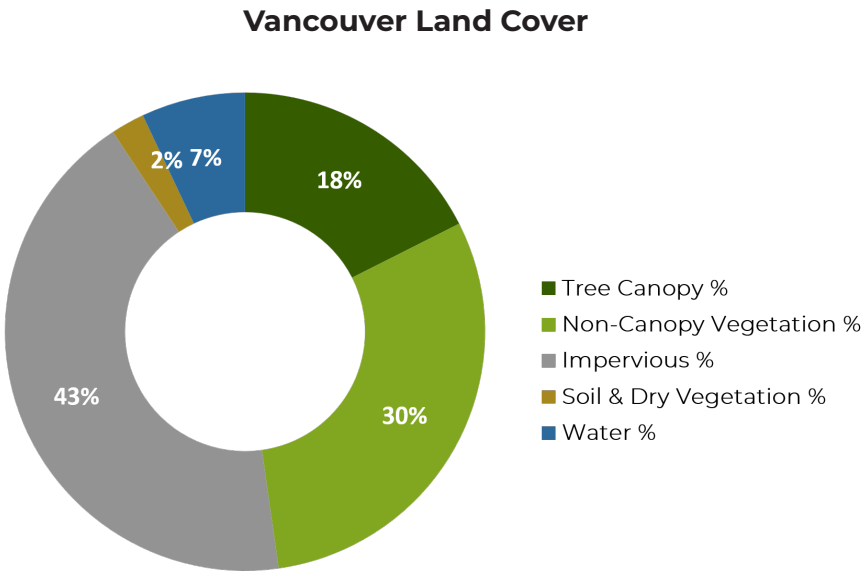


Figure 7. Land cover classes in percent of total area in Vancouver, WA.

CITYWIDE URBAN TREE CANOPY

This urban tree canopy assessment utilized the land cover data as a foundation to determine possible planting areas throughout the City. Additional layers and information regarding land considered unsuitable for planting were also incorporated into the analysis. Note that the results of this study are based on land area, which excludes water bodies, as opposed to total area, which includes water bodies (note the difference between Total Acres and Land Acres in Table 2). Results of this study indicate that within the City of Vancouver, 6,066 acres are covered with urban tree canopy, making up 19% of the City's 32,155 land acres; 10,220 acres are covered with other vegetation where it would be possible to plant trees (PPA), making up 32% of the City; and the other 15,869 acres were considered unsuitable for tree planting, making up 49% of the City. The unsuitable areas include recreational sports fields, golf course playing areas, airfields, and impervious surfaces.

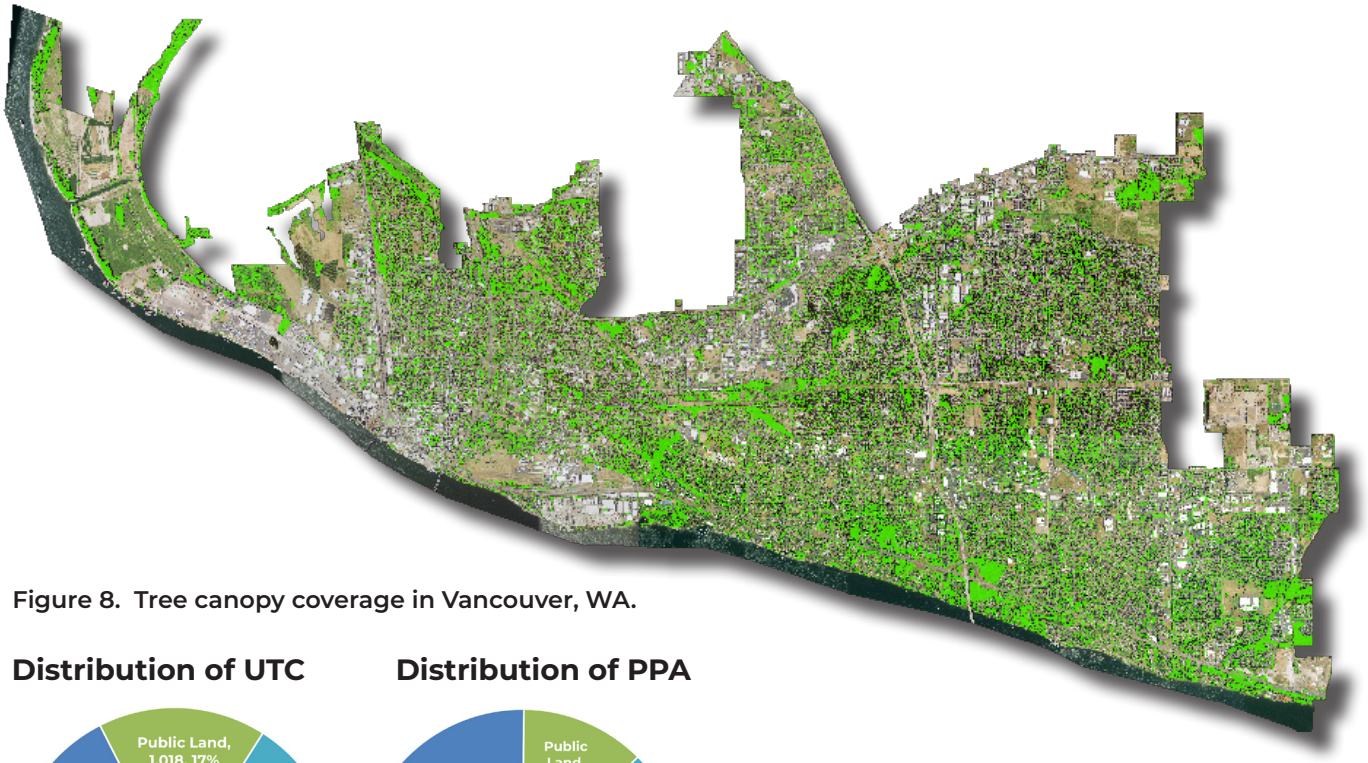


Figure 8. Tree canopy coverage in Vancouver, WA.

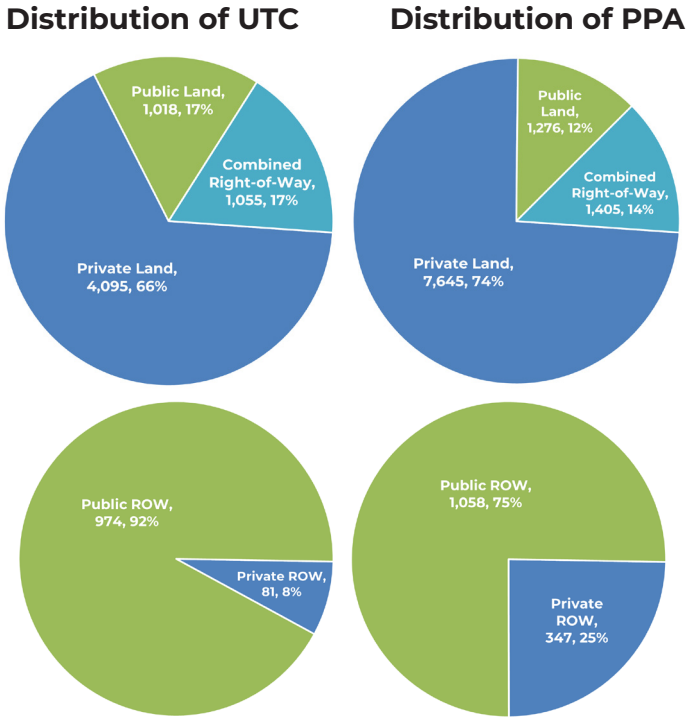


Figure 9. Distribution of existing and potential urban tree canopy by land ownership throughout the City boundary and right-of-way.

In addition to the total amounts of urban tree canopy and possible planting areas contained within each boundary by acres and percent, the City was also interested in the distribution of where it is located throughout the City's total area. Since land ownership plays a large role in the management actions the City can take, UTC and PPA distribution were evaluated by type of land (public, private, or any right-of-way) and type of right-of-way (public or private).

Currently, 66% of all UTC in Vancouver is found on private land, with public land and rights-of-way occupying the remaining 34% (17% each). Similarly, private land contains 74% of all PPA, while 14% is found in the ROW and just 12% on public lands. In contrast, when only the ROW was assessed, the vast majority of both UTC (92%) and PPA (90%) was found in publicly-owned ROW, which highlights the efforts the City has made to increase its urban tree canopy along streets.

Table 2. Urban tree canopy assessment results by acres and percent. (Percentages based on land acres.)

City of Vancouver	Acres	%
Total Area	34,576	100%
Land Area	32,155	93%
Urban Tree Canopy	6,066	19%
Total Possible Planting Area	10,220	32%
Unsuitable Impervious	14,857	43%
Unsuitable Vegetation	227	<1%
Unsuitable Soil	786	2%
Total Unsuitable Area	15,869	49%

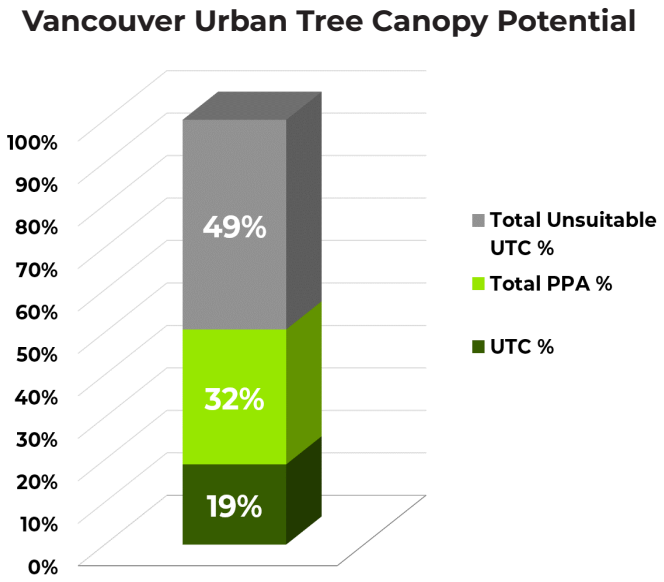


Figure 10. Urban tree canopy, possible planting area, and area unsuitable for UTC in the City of Vancouver.

The city's 6,066 acres of urban tree canopy were further divided into several subcategories based on whether the trees were deciduous (broad-leafed) or evergreen and whether their canopy had an impervious or pervious understory. Tree canopy overhanging an impervious surface can provide many benefits through ecosystem services such as localized cooling provided by shading of impervious surfaces and increased stormwater absorption. Results indicated that Vancouver's UTC was predominantly deciduous, with 79% deciduous canopy and 21% evergreen canopy. In Vancouver, 13% of all tree canopy had an impervious understory.

Table 3. Detailed urban tree canopy classifications.

City of Vancouver	%
Deciduous UTC	79%
Evergreen UTC	21%

CITYWIDE URBAN TREE CANOPY CHANGE

There was an increase in Vancouver's tree canopy over the eight to nine-year study period. Throughout the city, the average canopy cover increased from 16% in 2011 to 19% in 2019/2020. Tree canopy increased by approximately 1,027 acres citywide, yielding a 3% raw increase (20% relative to 2011 acreage) since 2011. Although there was an overall increase in canopy, further analysis revealed that there were also some losses in the City due to development expansion and tree removals.

The increase in tree canopy in Vancouver can be attributed to crown growth of maturing trees and growth of newly planted trees in 2011. Current levels of urban tree canopy in Vancouver can be maintained with careful planning and planting efforts. Vancouver's urban forest includes many large-stature mature trees which may eventually succumb to old age, stress, and other environmental factors. It is important that the City continue to plant new large stature trees to replace them when they reach the end of their lives in order to maintain and grow current canopy levels and the valuable ecosystem services that they provide.

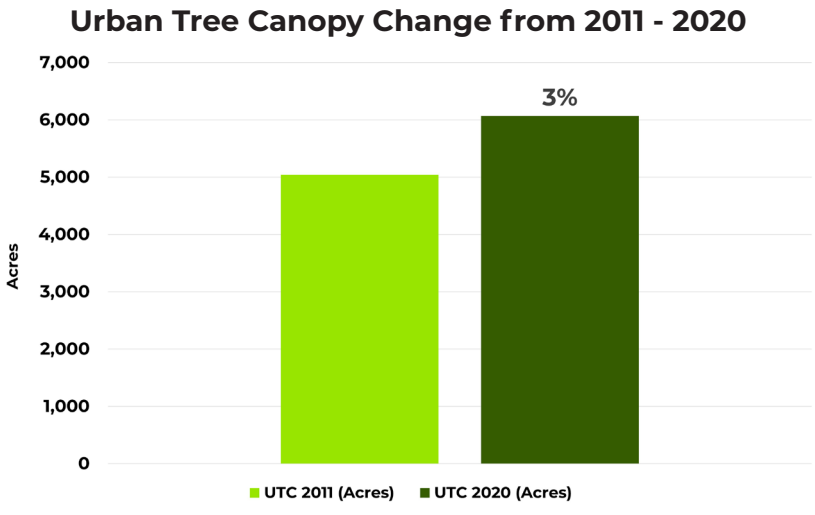


Figure 11. Urban tree canopy change from 2011-2020 in Vancouver.

URBAN TREE CANOPY BY LAND OWNERSHIP

UTC and PPA were assessed across land ownership types including public and private property as well as the rights-of-way (ROW) within each. The Private ROW includes Bonneville Power Administration (BPA) and Burlington Northern Santa Fe (BNSF) lines, while the public ROW includes City- or other government entity areas. UTC varied greatly across the different land ownership types, especially between public and private properties. Public lands had 38% canopy coverage, much higher than found on private lands at 18%. The public right-of-way also contained a higher percentage of canopy cover at 15% compared to 12% within the private ROW. PPA ranged from 17% in the public right-of-way to 50% in the private right-of-way. Private properties contained 34% PPA while public contained 47%. Private land makes up 70% of land area in Vancouver and, thus, contained 4,095 acres or 66% of all UTC and 7,645 acres or 74% of all PPA in the City. However, since private ROW such as the BPA and Burlington Railroad could most likely not be converted to canopy, these areas were removed from the land area and PPA calculations, and in that scenario, the City loses approximately 347 acres, dropping the total PPA from 10,325 to 9,979 acres or 31.8 to 31.4%.

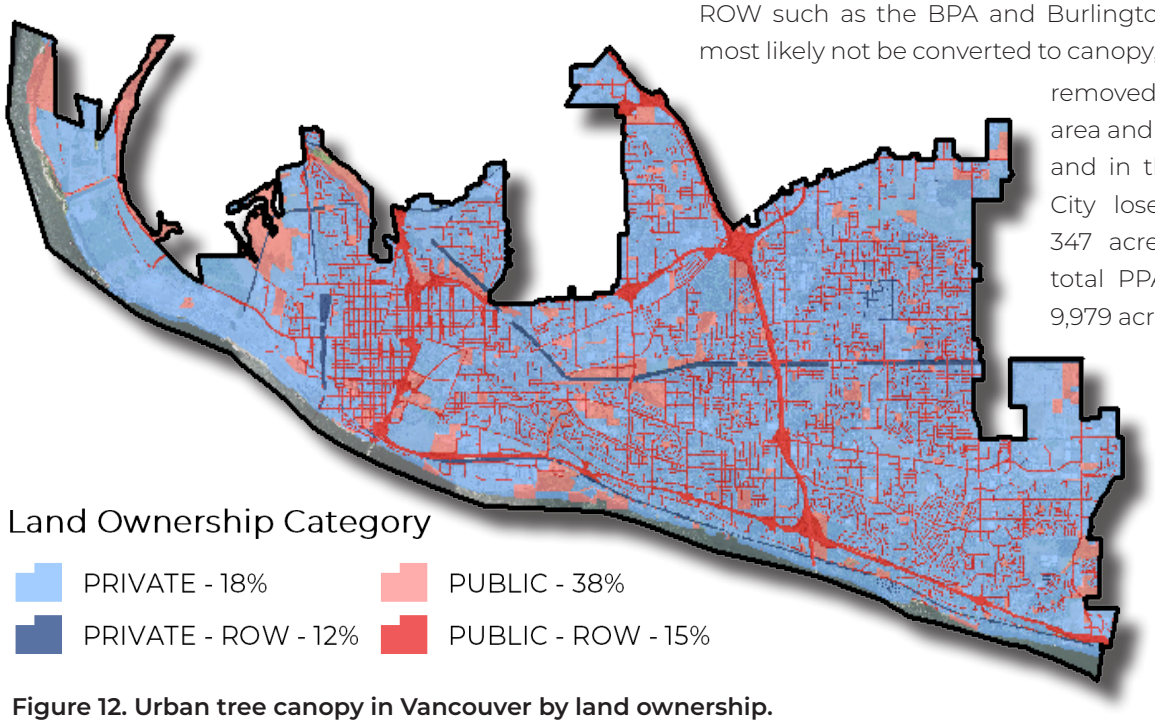


Figure 12. Urban tree canopy in Vancouver by land ownership.

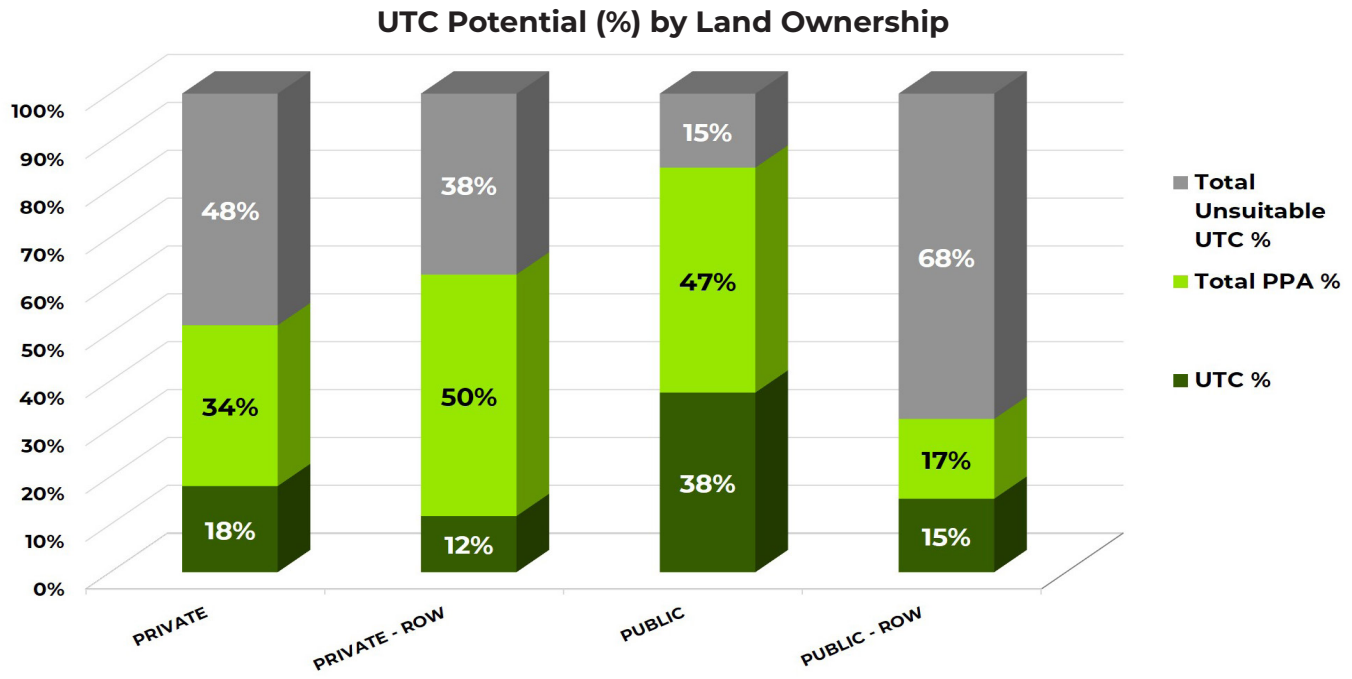


Figure 13. Possible planting area, unsuitable, and urban tree canopy percent by land ownership.

CANOPY CHANGE BY LAND OWNERSHIP

When UTC change since 2011 was assessed, private land ownership accounted for 70% of Vancouver's land area and had an increase of 653 acres, or 3%, of tree canopy from 2011 to 2020. The highest percentage increase in canopy by land ownership was on public land, which increased by 134 acres or 5%. The increase in canopy on public lands highlights the City's progress with recent planting efforts. Both public and private right-of-way areas had an increase in canopy as well at 2 and 4%, respectively.

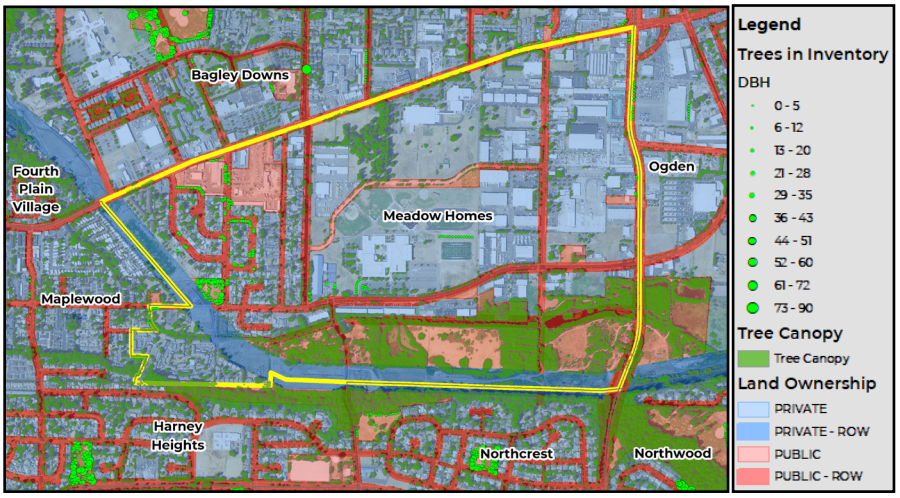


Figure 14. Trees planted on public land and ROW in the Meadow Homes neighborhood, which had some of the least UTC in 2011 but one of the greatest increases from 2011 to 2019 (by 7% from 9% to 17%) of all neighborhoods in Vancouver.

URBAN TREE CANOPY BY ZONING

UTC and PPA were assessed within five zoning types. A total of 23 unique zoning types were aggregated to help simplify the results. The unique types are shown under each aggregate category in Table 5. UTC varied considerably across the different zoning types. Open Space Districts had the highest with 31% UTC, and Industrial had the lowest with 10% UTC. The Open Space Districts zone includes the City's parks, greenways, and natural areas. PPA ranged from 23% in Commercial areas to 56% in Open Space Districts. As the largest zoning type by area in the City, Single Family contained the largest portions of UTC and PPA with 3,159 acres of UTC (52% of all UTC in the City) and 4,212 acres of PPA (42% of all PPA in the City).

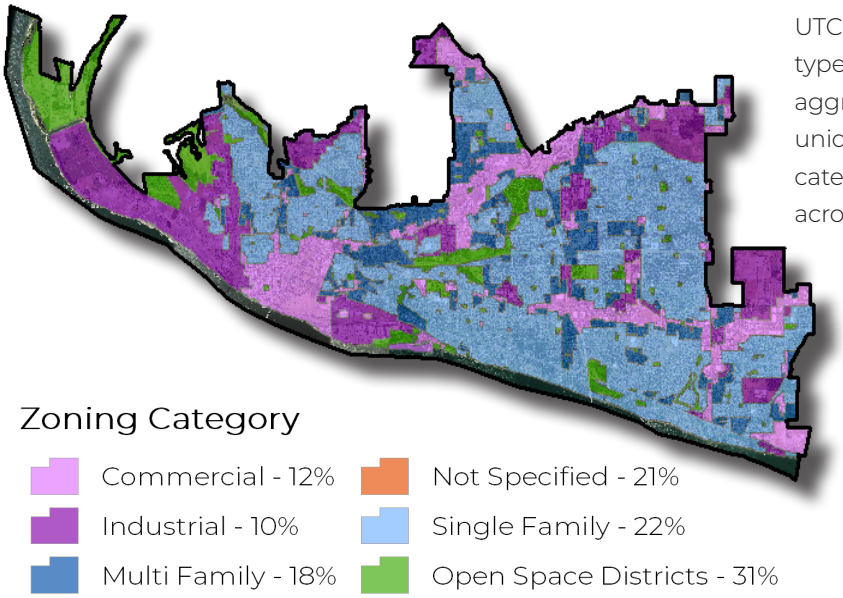


Figure 15. Urban tree canopy in Vancouver by zoning.

CANOPY CHANGE BY ZONING

UTC change within the city's zoning types varied from a 2% gain to a 5% gain. The greatest proportional gains of canopy were seen in the Open Space Districts and Commercial, gaining 5 and 4% canopy, respectively. Single Family areas had the largest increase in canopy acreage gaining 450 acres (3%) since 2011. Multi Family areas also gained 3% canopy. Industrial areas had the smallest increase in tree canopy gaining 2% or 125 acres.

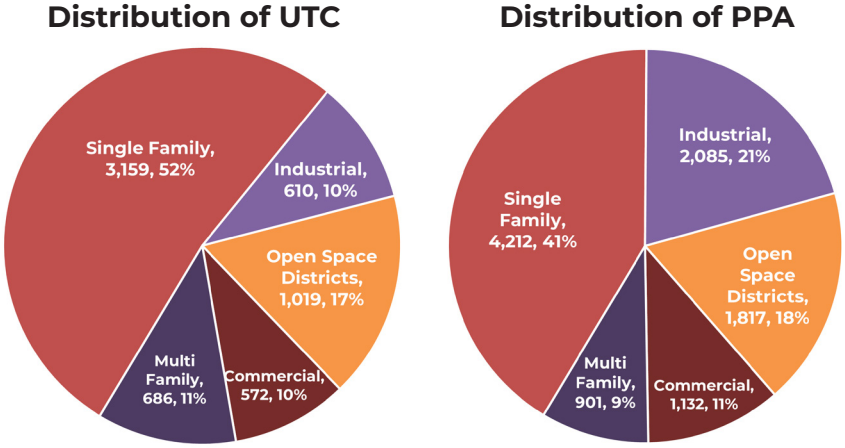


Figure 16. Distribution of UTC and PPA by zoning.

Table 4. Urban tree canopy assessment results by zoning. UTC and PPA results include acres, percent of area covered by UTC or PPA (%), and distribution of the City's total UTC or PPA within each aggregated zoning type.

Zoning	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	*Dist.*	*Acres*	*%*	*Dist.*	*Acres*	*%*	*Dist.*
Commercial · Neighborhood commercial (NC, C1, CN, CNB) · Community commercial (CC, C2, CCB) · Mixed use (MX) · General commercial (GC, CG) · Waterfront mixed use (WX,WMU,WLS) · Riverview gateway mixed use (RGX) · Central park mixed use (CPX) · City center (CX)	4,886	15%	572	12%	9%	1,132	22%	11%
Industrial · Heavy industrial (IH, MH, HI) · Light industrial (IL, ML, LI, IND, LI/EC) · Office commercial industrial (OCI) · Employment Center Mixed Use (ECX)	6,029	19%	610	10%	10%	2,085	35%	21%
Multi Family · Residential (R-18, MF-18) · Residential (R-22, AR-22) · Residential (R-30) · High density residential-35du/ac (R-35)	3,790	12%	686	18%	11%	901	24%	9%
Single Family · Low density residential-2du/ac (R-2) · Low density residential-4du/ac (R-4, RLD-4) · Low density residential-6du/ac (R-6, RLD-6) · Low density residential-9du/ac (R-9)	14,097	44%	3,159	22%	52%	4,212	30%	42%
Open Space Districts · Park · Greenway/open space (GW) · Natural area (NA)	3,249	10%	1,019	31%	17%	1,817	56%	18%
Totals	**32,050**	**100%**	**6,046**	**19%**	**100%**	**10,147**	**32%**	**100%**

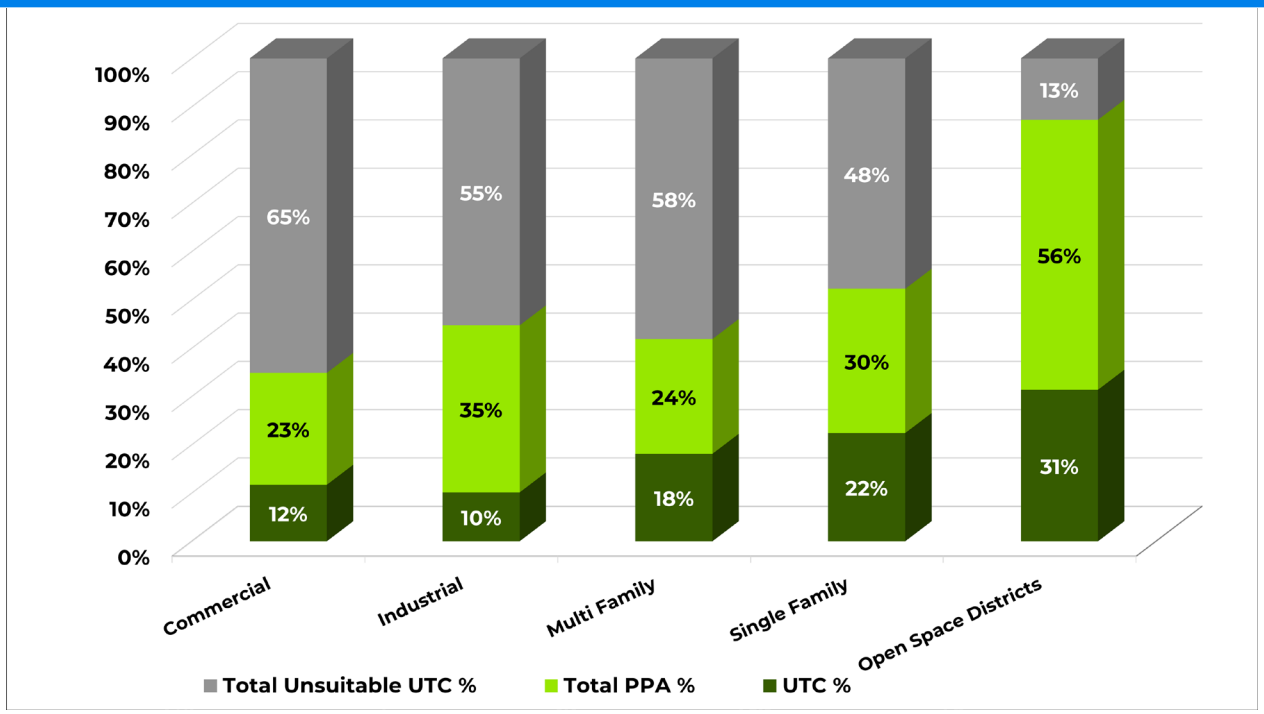


Figure 17. UTC (acres) compared to total area and land area by zoning.

URBAN TREE CANOPY BY WATERSHEDS

UTC and PPA were assessed in Vancouver's watersheds comprising a total of 32,163 land acres. Only a small portion of the City of Vancouver lies within the Lakeshore watershed, and that area had relatively high canopy cover with 30% coverage. After that, the Salmon Creek, Columbia Slope, and Burnt Bridge Creek watersheds all had around 20% cover. Possible planting area was highest in Vancouver Lake/Lake River watershed which contained 61% PPA, and this watershed also had the lowest amount of canopy cover at 16%. Planting in watersheds with high amounts of possible planting area and low existing tree canopy will contribute positively to stormwater mitigation in Vancouver.

CANOPY CHANGE BY WATERSHEDS

UTC had a positive change within Vancouver's watersheds. All six of the watersheds within Vancouver had a small to moderate increase in canopy. From 2011-2020, UTC in most watersheds increased between 3 and 5%. The watershed with the largest amount of land area, Burnt Bridge Creek, had the lowest increase in canopy with 2.9%. The one outlier, Lakeshore, had a greater increase of 7%, but only 16 acres of land are within city limits and within the watershed boundary. This increase in canopy within watersheds can contribute to higher water quality in these areas by reducing the amount of stormwater runoff within the City. Watersheds with greater amounts of surface water bodies had lower amounts of canopy increase. Prioritization of future tree plantings in those watersheds will be key to improving stormwater and water quality issues.

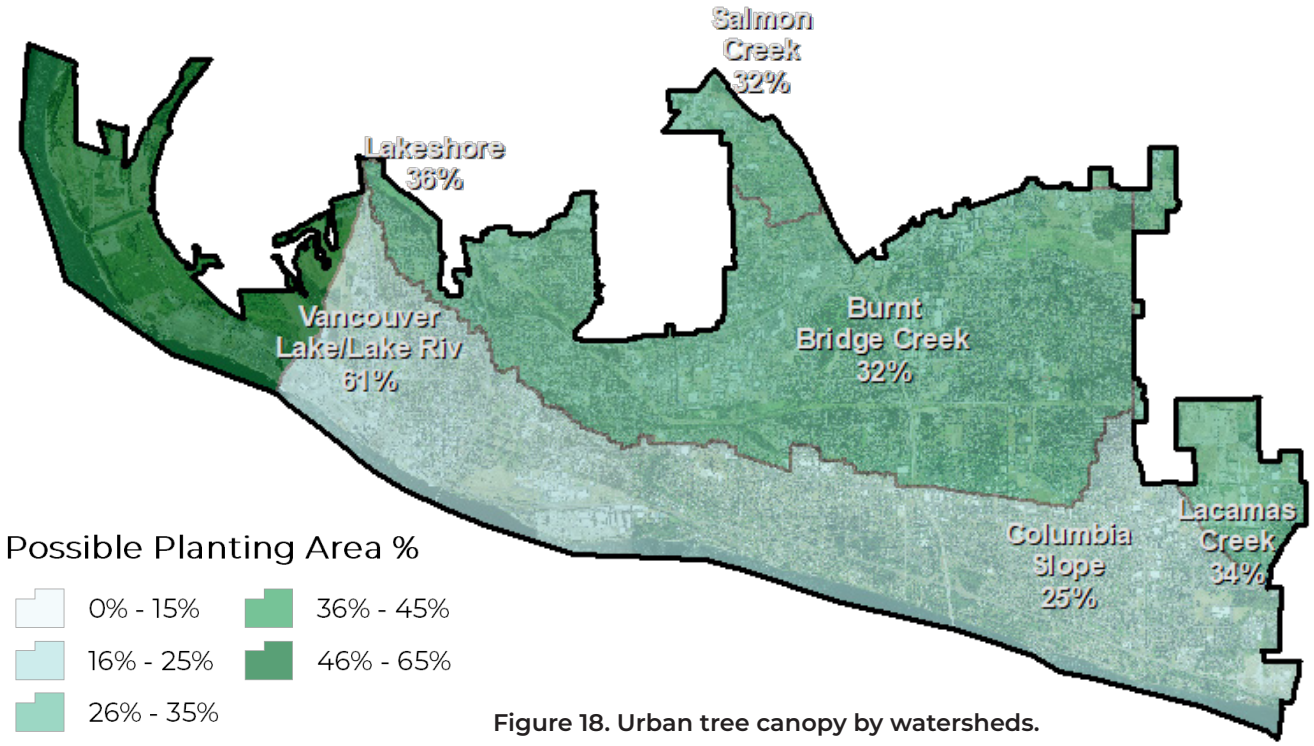


Figure 18. Urban tree canopy by watersheds.

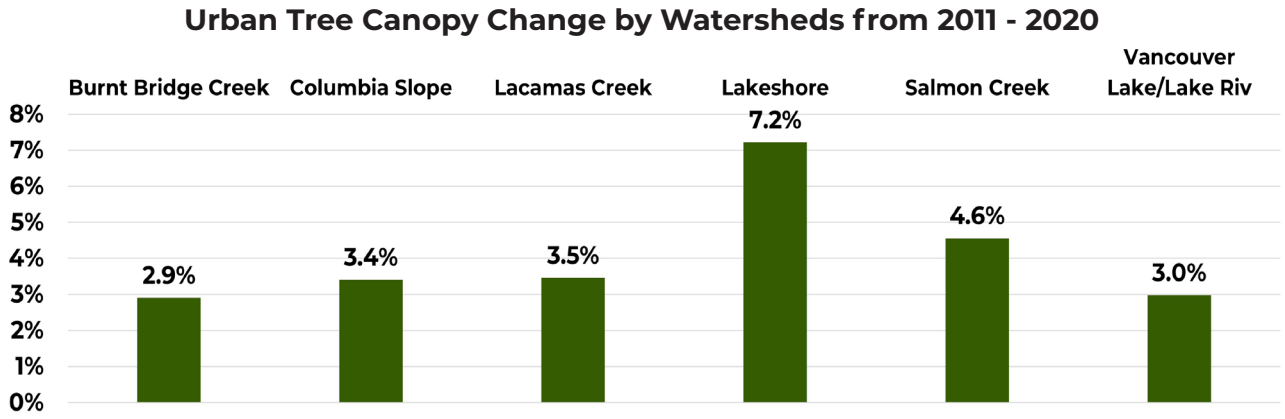


Figure 19. Urban tree canopy change from 2011-2020 in Vancouver by watersheds.

URBAN TREE CANOPY BY ZIP CODES

UTC and PPA were assessed in Vancouver's ten ZIP codes. UTC has a slight variance across each ZIP code with most having within 16 and 24% canopy cover. The highest UTC was in ZIP codes 98663 and 98664, both had 24%. The ZIP code with the lowest UTC was 98660 with 13% UTC. The ZIP code 98683 also contained the largest portion of UTC in Vancouver with 1,057 acres or 17% of all tree canopy in the City. The greatest opportunity for future canopy expansion was found in 98660 with 43% of its land area classified as plantable space. That makes up 2,123 acres of PPA or 21% of all PPA in Vancouver.

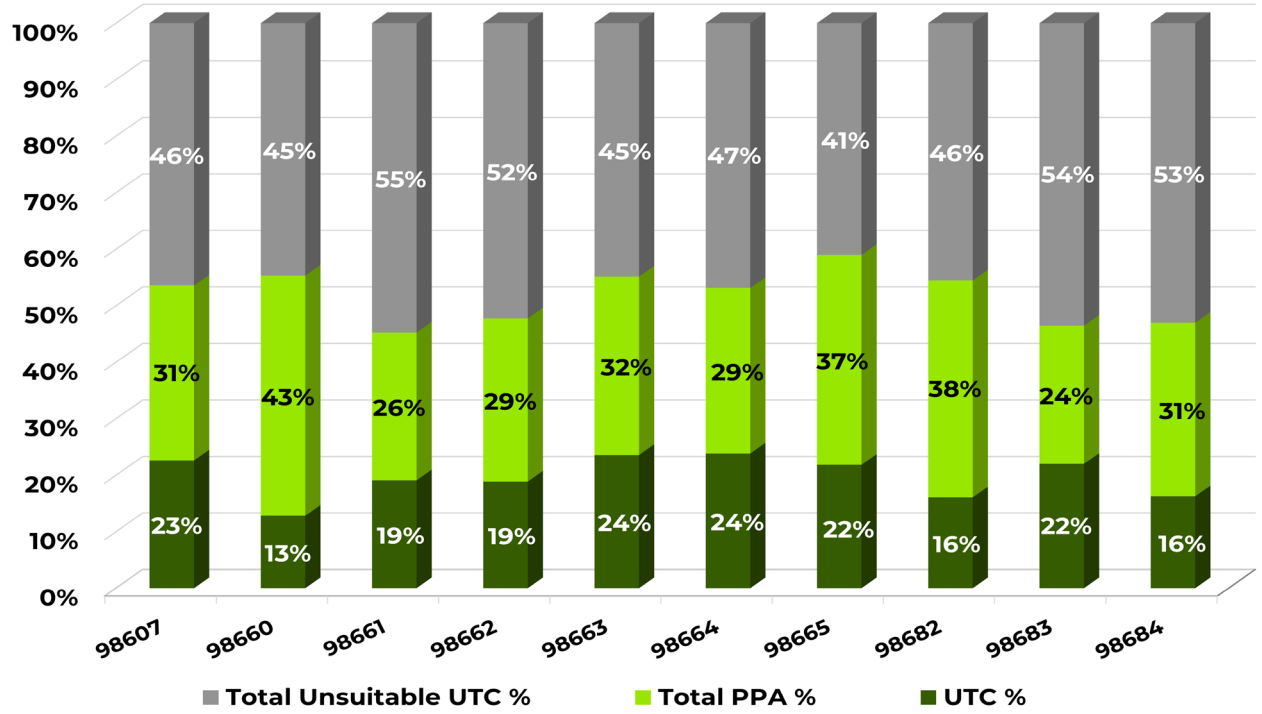


Figure 20. Possible planting area, unsuitable, and urban tree canopy percent by ZIP codes.

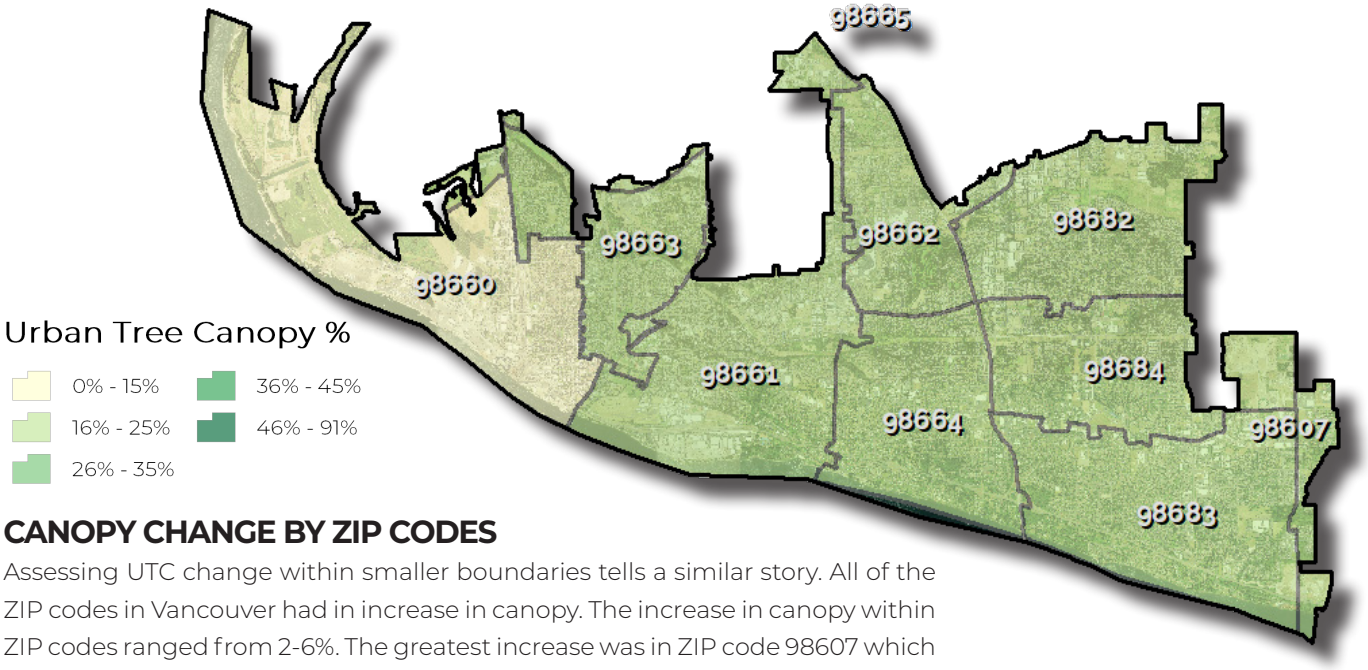


Figure 21. Urban tree canopy by ZIP codes.

CANOPY CHANGE BY ZIP CODES

Assessing UTC change within smaller boundaries tells a similar story. All of the ZIP codes in Vancouver had in increase in canopy. The increase in canopy within ZIP codes ranged from 2-6%. The greatest increase was in ZIP code 98607 which gained 42 acres of canopy or approximately 6% since 2011. This ZIP code is one of the smallest by land area but also had some of the lowest canopy cover in the city in 2011. Conversely, the lowest increase was seen in ZIP code 98684 which gained approximately 63 acres or 2% since 2011.

URBAN TREE CANOPY BY CENSUS TRACTS

UTC and PPA were assessed in Vancouver's census tracts. UTC varied across the 64 census tracts. The highest UTC cover was 46% and the lowest was 6%. PPA also varied significantly across census tracts with the highest being 57% and the lowest being 7% PPA. The highest percentages of UTC were found in the southeast and northwest parts of the City. The greatest opportunity for future canopy expansion was found in the northwest and northeast sides of the City with high percentages of PPA and large amounts of land area. It is important to verify these areas as actual plantable spaces prior to any development of planting projects as some of these areas are currently being used for agricultural purposes.

CANOPY CHANGE BY CENSUS TRACTS

Tree canopy change in census tracts consisted of both losses and gains. Losses in canopy ranged from 1 to 5% and occurred in just five out of 64 tracts. Gains ranged from 1 to 12% in the remaining 59 tracts. A majority of all census tracts gained an average of 3% or more canopy. The most substantial gain within a tract was 105 acres, which occurred in the largest census tract by land area.

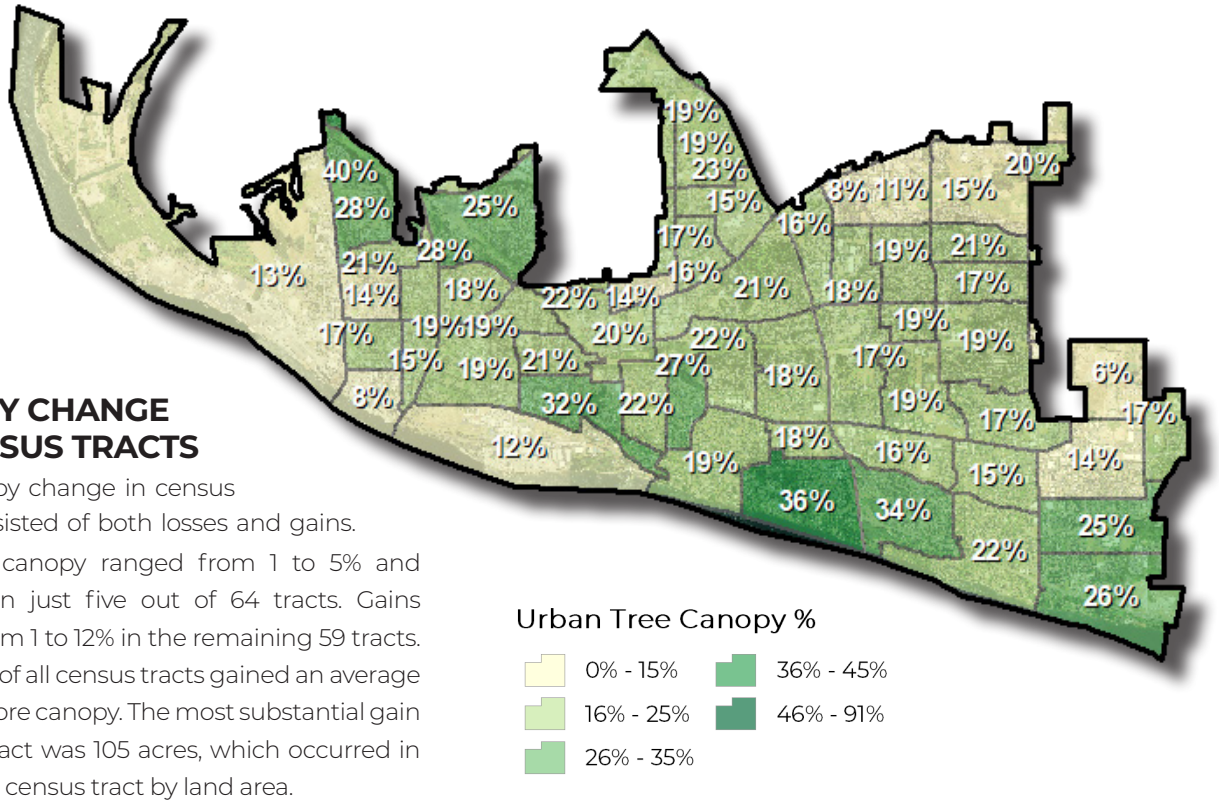


Figure 22. Urban tree canopy percent by census tracts.

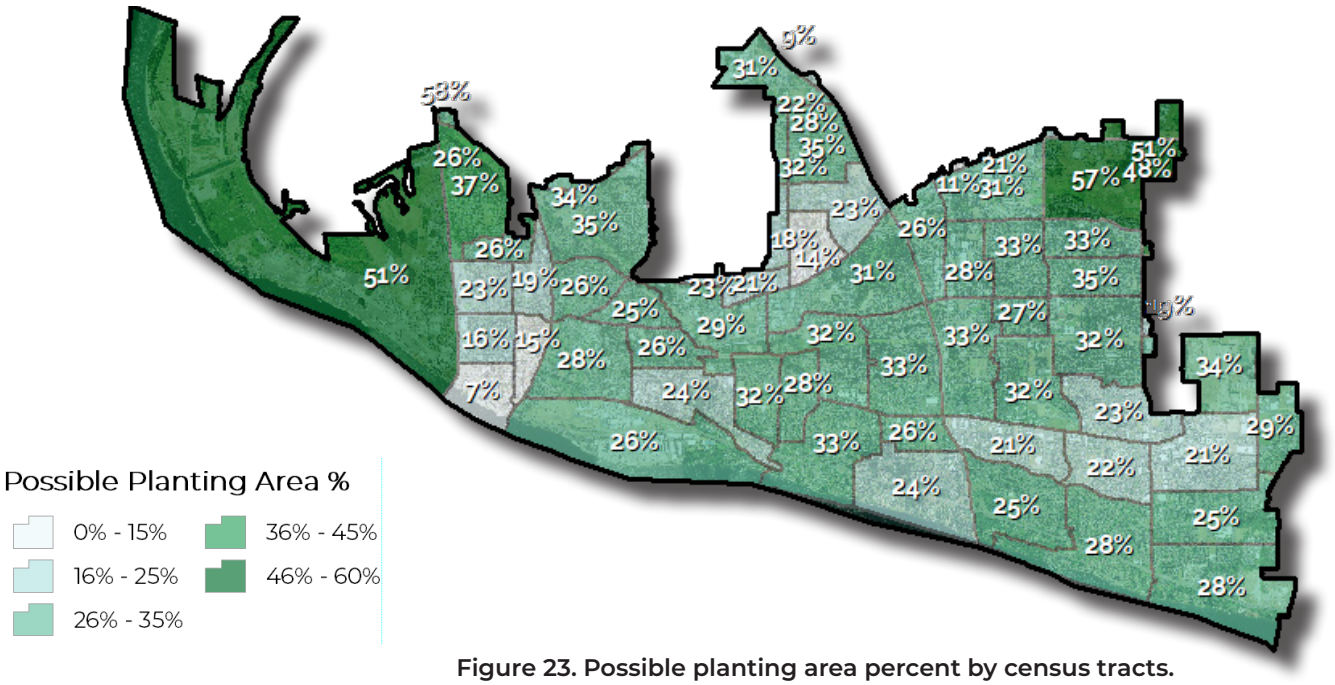


Figure 23. Possible planting area percent by census tracts.

URBAN TREE CANOPY BY CENSUS BLOCKS

UTC and PPA were assessed by census blocks, representing the smallest unit of analysis. A 63% majority of census blocks ranged from 0-20% UTC and 90% ranged from 0-30%. Census blocks containing over 50% UTC only represented 2% of all census blocks. A 75% majority of census blocks ranged from 0-30% PPA. Both PPA and UTC percentages varied significantly by census blocks. Census blocks containing over 50% PPA only represented 3% of all census blocks.

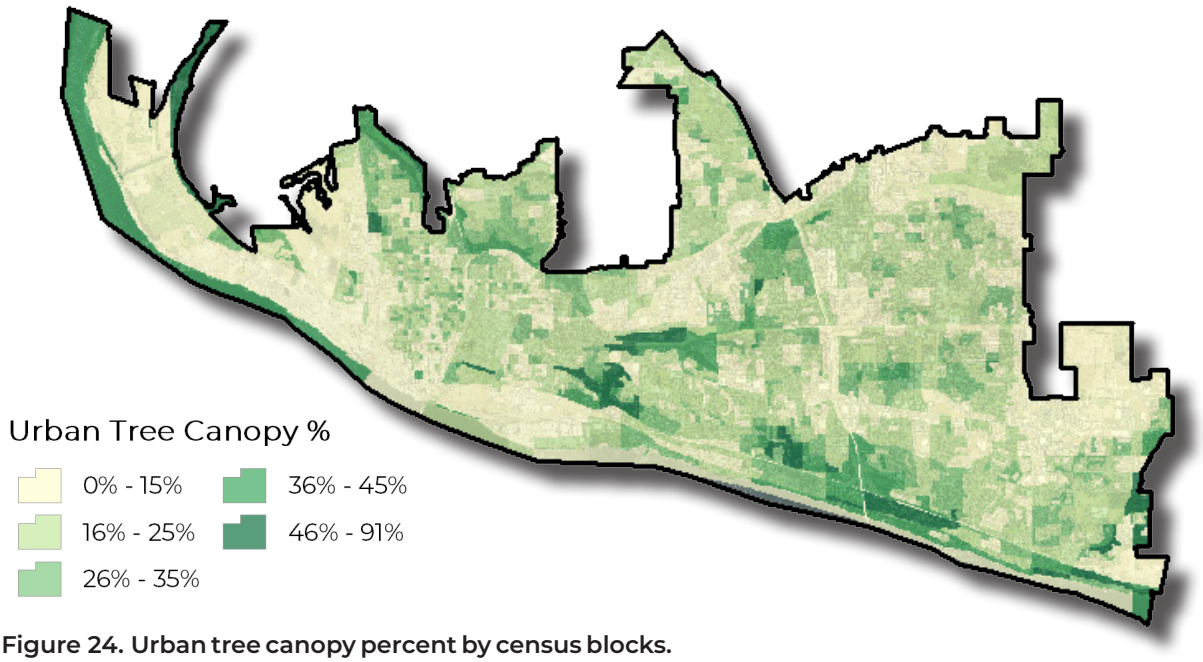


Figure 24. Urban tree canopy percent by census blocks.

CANOPY CHANGE BY CENSUS BLOCKS

In this smallest geographic scale used in this study, finer details on where specific changes are occurring are evident and best viewed in a map such as TreePlotter CANOPY. Tree canopy change within the 2,568 census blocks, again, consisted of both losses and gains. Losses in canopy ranged from 1 to 9 acres, and gains in canopy ranged from 0 to 15 acres. A large percentage of census blocks had no or very little change in canopy coverage due to their small size and lack of trees in both 2011 and 2019/2020. The largest census blocks were just over 1,000 acres of land area while some consisted of less than one acre of land.

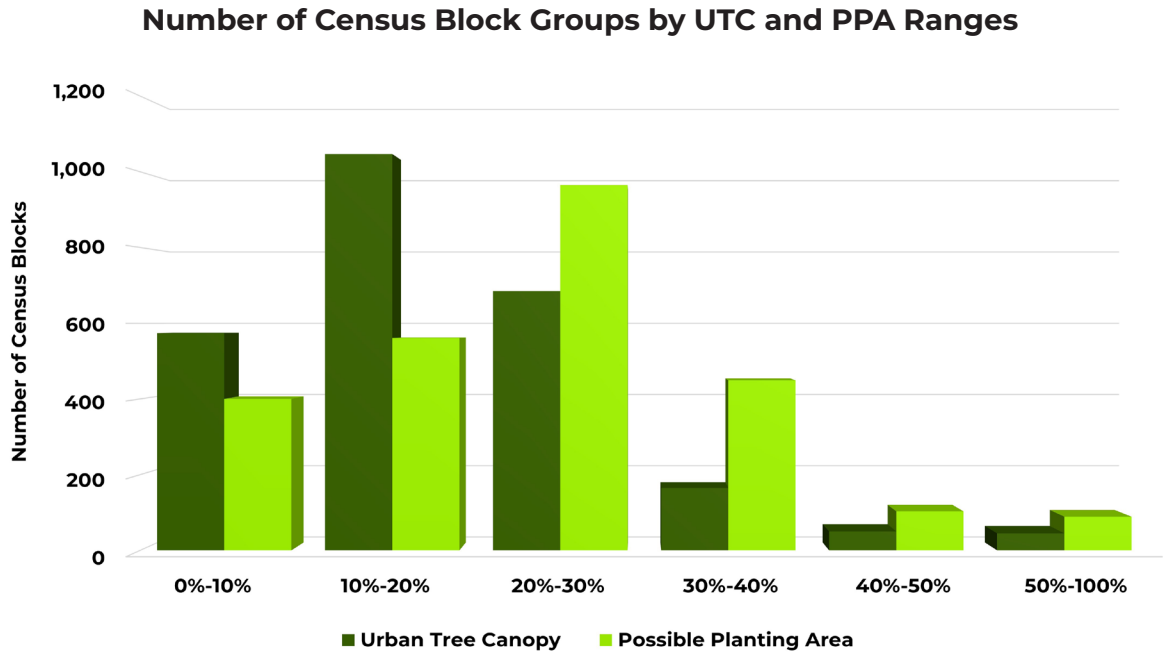
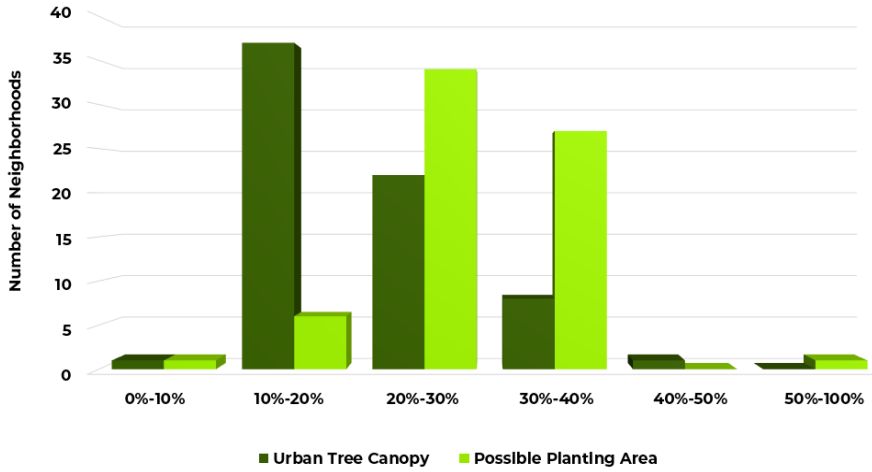


Figure 25. Possible planting area and urban tree canopy ranges by number of census blocks.

URBAN TREE CANOPY BY NEIGHBORHOODS

UTC varied greatly across neighborhoods in Vancouver. For a full table of results, see Appendix A on page 22. The highest UTC% was found in South Cliff (47%), while the lowest UTC was found in the Esther Short neighborhood (9%). PPA had similar variance with the highest PPA in Fruit Valley (52%) and the lowest found in Esther Short (8%). Fruit Valley is, by far, the largest neighborhood in the City at almost four times the size of the next largest. This is attributed to the large amounts of agricultural and industrial land in Fruit Valley. Fruit Valley, in turn, contains 500 acres, or 9%, of all tree canopy and 2,000 acres, or 52%, of the City of Vancouver's plantable space. A majority of the City's neighborhoods fell within the 10-30% UTC range and the 15-35% PPA range.

Number of Neighborhoods by UTC and PPA Ranges



Distribution of UTC and PPA

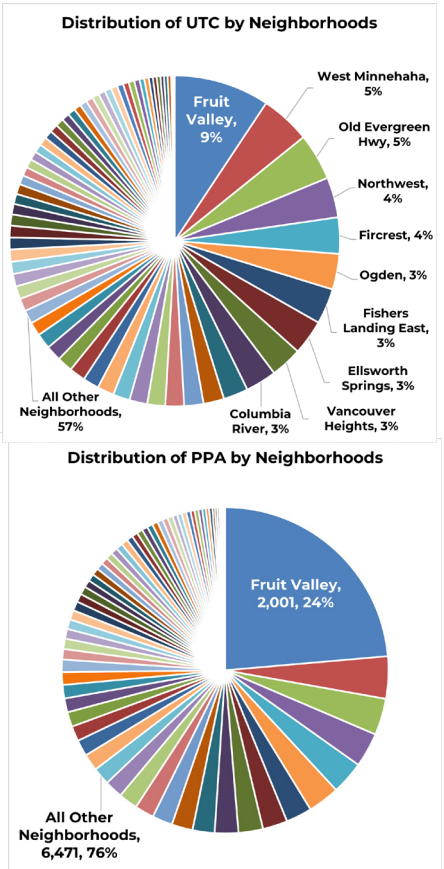


Figure 26. (above) UTC and PPA ranges by number of neighborhoods.

Figure 27. (right) Distribution of UTC and PPA by neighborhoods. Note that the high percentage of PPA in Fruit Valley includes agricultural lands which may not be suitable for tree planting.

CANOPY CHANGE BY NEIGHBORHOODS

Between 2011 and 2019/2020, Vancouver's neighborhoods saw both gains and losses in canopy. There were five neighborhoods that experienced losses in canopy ranging from 1 to 4%. These included Bella Vista, Countryside Woods, Evergreen Shores, First Place, and Forest Ridge. Evergreen Shores experienced the greatest loss in canopy cover with a 4% decrease or 13% in relationship to it's historical canopy. Increases in canopy in Vancouver's neighborhoods ranged from 1 to 11%. The greatest increase in canopy was in the Fisher's Creek neighborhood which gained 25 acres of tree canopy or 11% canopy cover.

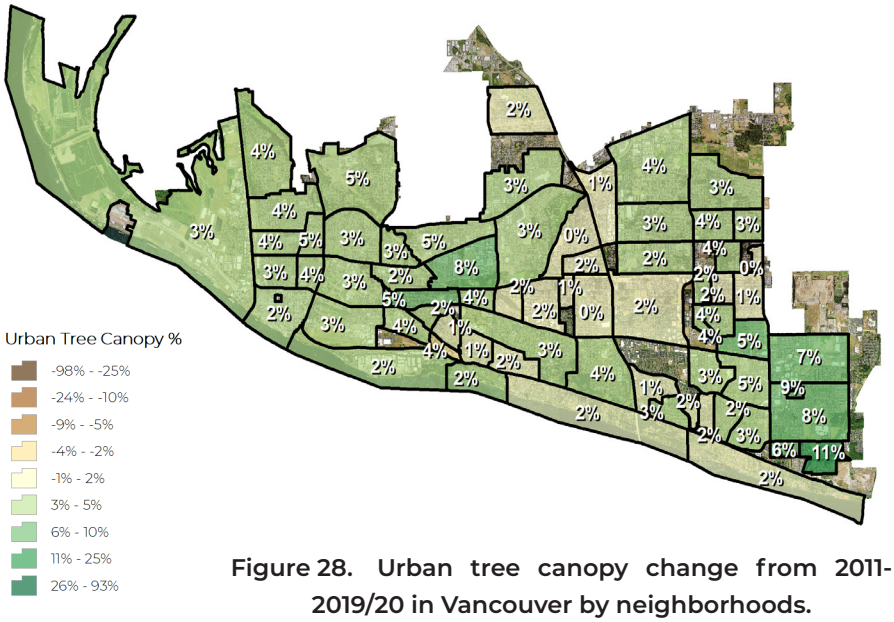


Figure 28. Urban tree canopy change from 2011-2019/20 in Vancouver by neighborhoods.

QUANTIFYING ECOSYSTEM BENEFITS

Using the best available science from i-Tree tools, values were calculated for some of the benefits and functions provided by trees and forests in Vancouver. The urban forest holds millions of dollars of savings in avoided infrastructure costs, pollution reduction, and stored carbon.

AIR QUALITY

Trees produce oxygen, indirectly reduce pollution by lowering air temperature, and improve public health by reducing air pollutants which cause death and illness. The existing tree canopy in Vancouver removes 297K pounds of air pollution annually, valued at over $2 million.

STORMWATER AND WATER QUALITY

Trees and forests mitigate stormwater runoff which minimizes flood risk, stabilizes soil, reduces sedimentation in streams and riparian land, and absorbs pollutants, thus improving water quality and habitats. The tree canopy in Vancouver absorbs 243 million gallons of water per year. Extrapolated citywide, this means that Vancouver's existing canopy provides over $2 million annually in stormwater benefits.

CARBON STORAGE AND SEQUESTRATION

Trees accumulate carbon in their biomass; with most species in a forest, the rate and amount increase with age. Vancouver's trees store approximately 447 million pounds of carbon, valued at over $38 million, and each year the tree canopy absorbs and sequesters approximately 14 million pounds of carbon dioxide, valued at over $1 million.

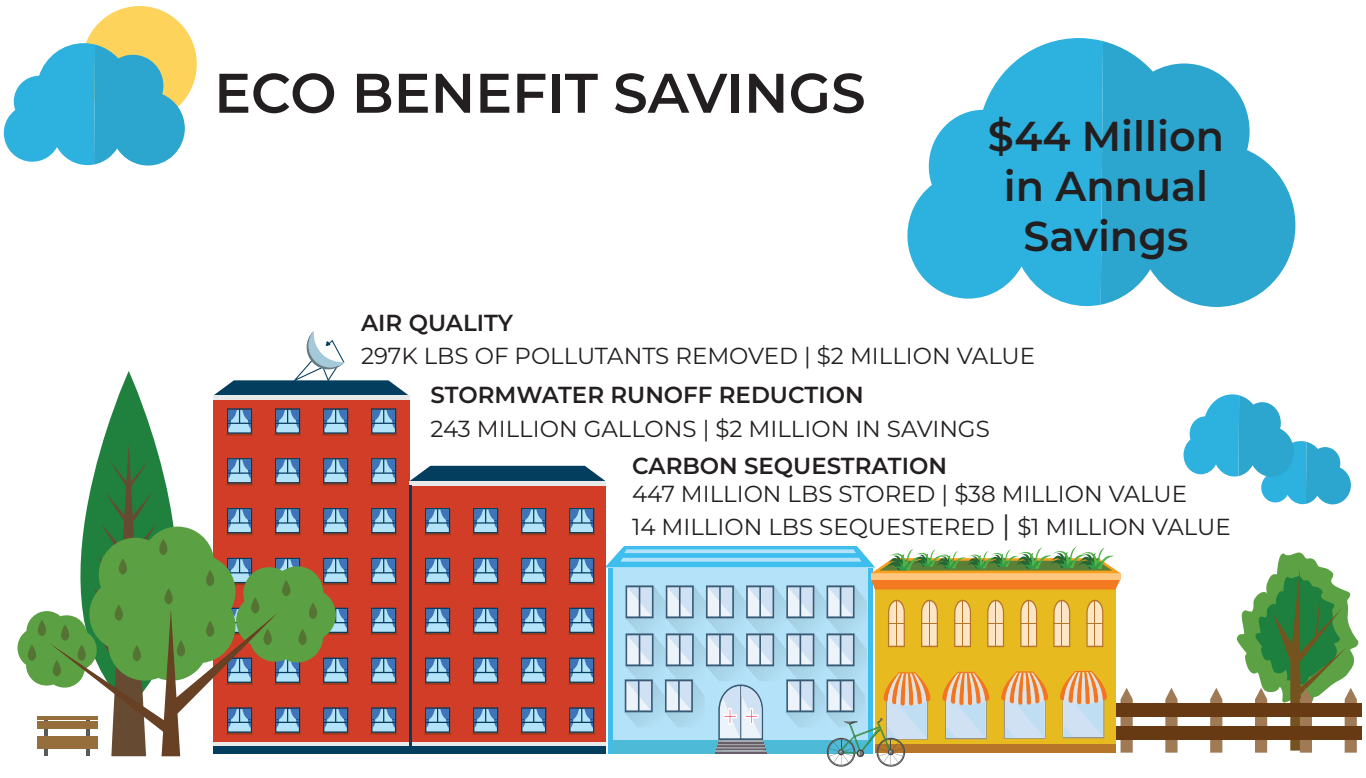


Figure 29. Eco-benefits of Vancouver's urban forest.

POSSIBLE REASONS FOR TREE CANOPY CHANGE

Tree canopy change can happen for a variety of reasons. Gains in canopy are the result of new tree plantings and existing tree growth, whereas losses can be caused by natural tree mortality, improper or inadequate tree maintenance leading to decline, and tree removals due to development. For this reason, gains in canopy typically happen at a slower rate and can be more difficult to visualize, while losses can seem much larger when whole areas of trees are removed. Even in places where the net canopy percentage remained relatively unchanged, gains and losses are always occurring. To get a clearer understanding of the full picture, examples of gains and losses from every zoning category were compiled.

ZONING:

COMMERCIAL
Commercial areas in Vancouver consist of general, neighborhood, and mixed-use commercial areas, including the City Center.

INDUSTRIAL
Light, heavy, mixed-use, and office commercial industrial zones make up the industrial zoning category.

MULTI-FAMILY
The multi-family zoning class includes medium- and high-density residential areas (18, 22, 30, and 35 du/ac).

SINGLE-FAMILY
The single-family zoning class includes all of Vancouver's low-density residential zones (2, 4, 6, and 9 du/ac).

OPEN SPACE DISTRICTS
Open space districts, including Vancouver's parks, greenway open space, and natural areas.

MANAGEMENT OPTIONS FOR ACHIEVING CANOPY COVER GOALS

The city of Vancouver has adopted, as part of the Urban Forest Management Plan, a goal of achieving 28% canopy cover by 2030. Through the commission of this report, Vancouver has already demonstrated its commitment to increasing canopy cover. To continue the progress that the City has already made in meeting this goal, appropriate canopy goal benchmarks will need to be set, and strategies for reaching these goals will need to be implemented.

SETTING APPROPRIATE GOALS

Setting canopy goals that are appropriate for management areas (i.e. neighborhoods, watersheds, zoning or ownership class) will ensure that resources are allocated effectively. City planners should examine areas that have shown increases over time for tactics that can be applied in other areas, and continue supporting these areas with the resources that have made them successful.

Table 5. Urban tree canopy in Vancouver's zoning classes by percentile. The 75th percentile is 22% UTC.

Zoning	2019/20 Urban Tree Canopy %		Difference from Goal	Acres Needed
Commercial	12%	25-50th Percentile	-11%	523
Industrial	10%	0-25th Percentile	-12%	741
Multi Family	18%	50-75th Percentile	-4%	163
Single Family	22%	75-100th Percentile	0%	-
Open Space Districts	31%	75-100th Percentile	9%	-
Total		**19%**	**-4%**	**1,427**

75TH PERCENTILE RULE

The "75th Percentile rule" was introduced for the city of Portland, OR in 2003 as a technique for encouraging ambitious regional canopy cover goals. By this rule, the goal is to achieve canopy cover percent that is equal to the 75th percentile value within any sector. For example, the 75th percentile UTC% for Vancouver's five zoning classes is 22%. The table above shows how many acres of canopy would need to be added in each category to attain 22%. At a finer scale, Vancouver's neighborhoods are symbolized according to their percentile in the map below. Ranking by percent canopy cover indicates that the 75th percentile of neighborhoods have at least 26% canopy cover. A goal of achieving at least 26% canopy cover within each neighborhood would satisfy the "75th Percentile rule".

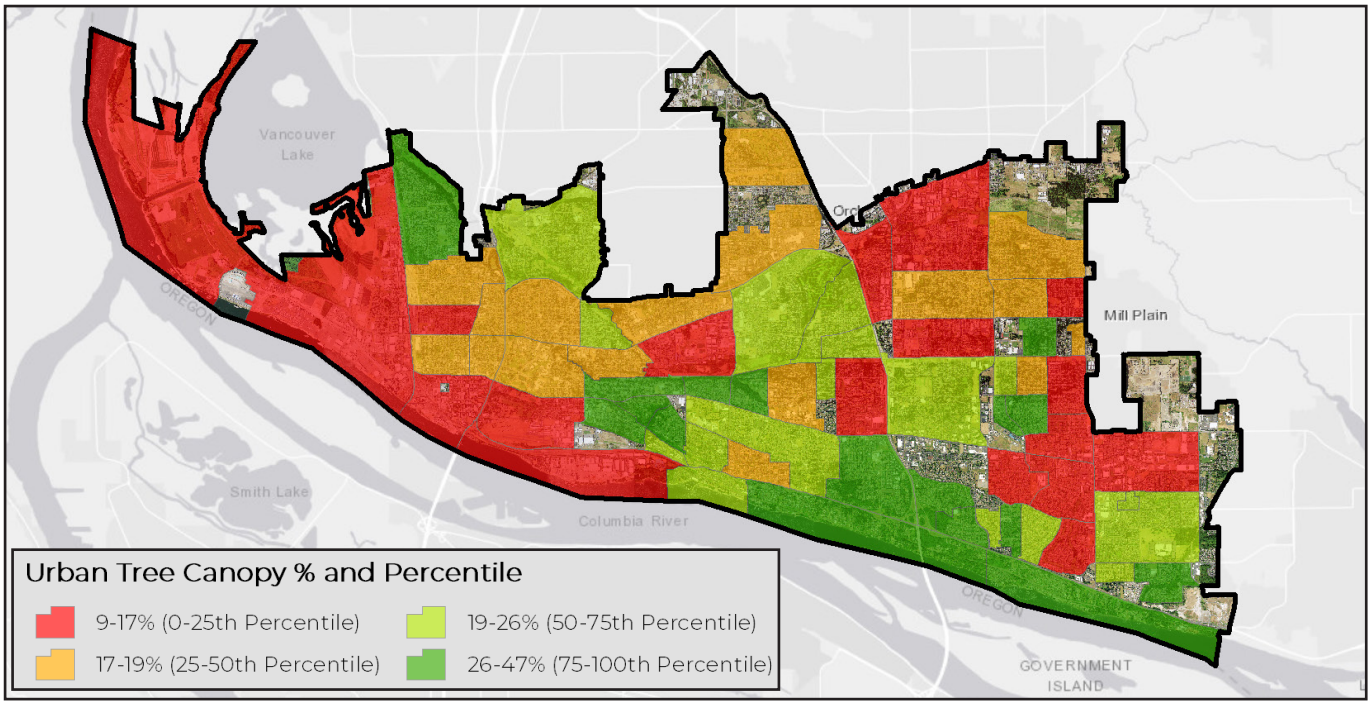
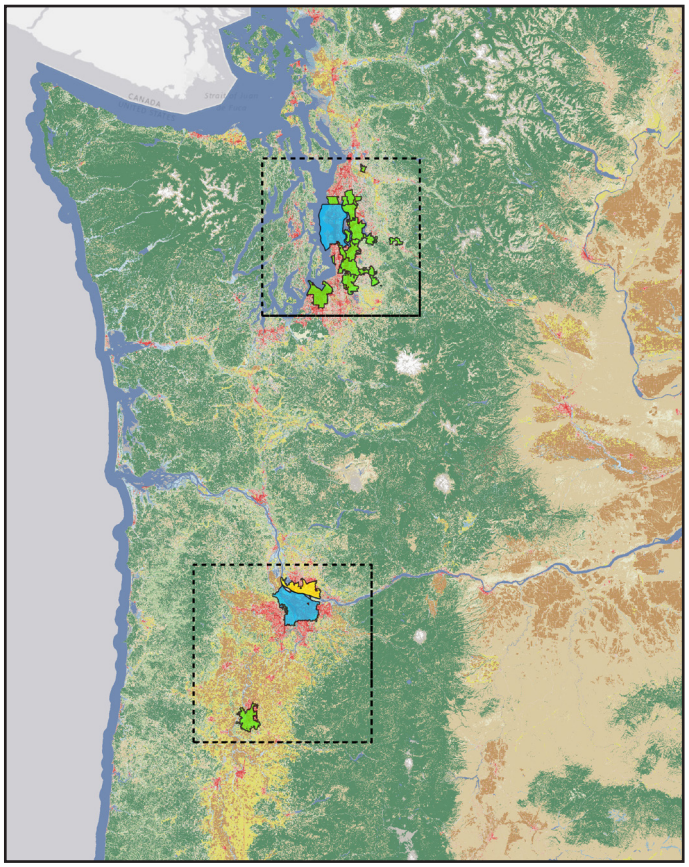
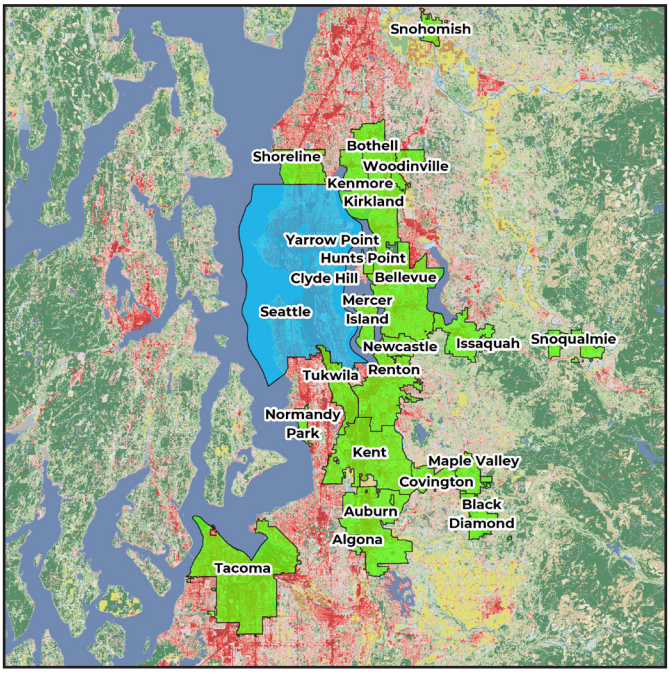


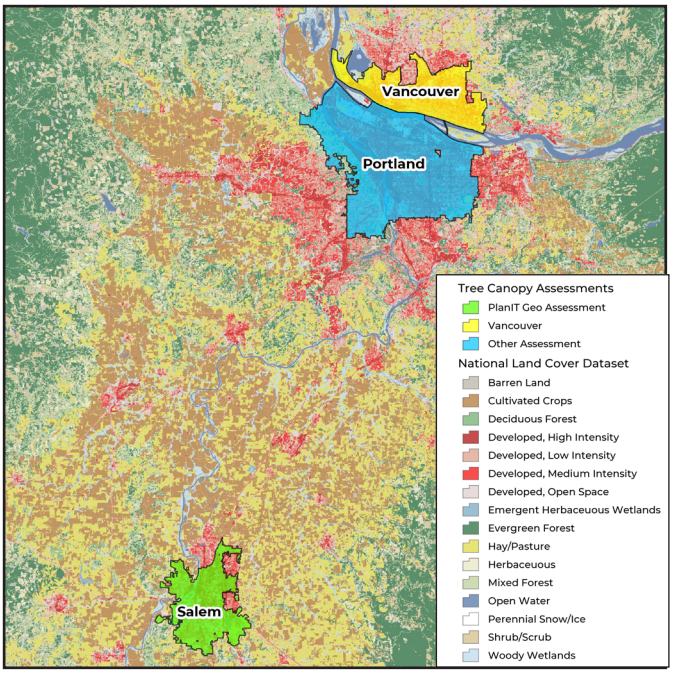
Figure 30. Urban tree canopy in Vancouver's neighborhoods by percentile. Neighborhoods in red or orange currently have less than 26% UTC, the City's canopy goal according to the 75th percentile rule.

VANCOUVER COMPARED TO NEARBY COMMUNITIES

Compared to other cities in the Pacific Northwest region, Vancouver has less existing urban tree canopy (19%) but more potential planting area (32%) than most communities. Based on data from PlanIT Geo's projects in other municipalities in Washington and Oregon and canopy assessments performed externally, several cities in the region have been able to attain the 40% possible canopy cover estimation feasible for this climate zone. Three cities assessed have surpassed 50% canopy. Many of the nearby communities fell within the 30-40% canopy range, and a few others had between 20-30% canopy. Vancouver was the only city with less than 20% UTC (see Figure 32 on the following page). Portland, Oregon assessed its community's urban forest in two regions, east and west of the Willamette River. The eastern side, which does not contain Forest Park and is most similar to Vancouver, contained 20% UTC. Meanwhile, Salem, Oregon contained 24%, indicating that a lower UTC may be possible in this region as compared to the northern cities. When the cities are observed in the context of the USDA's National Land Cover Dataset, which provides land cover classifications at a much broader scale, it is apparent that Vancouver is surrounded by relatively more Hay/Pasture and Shrub/Scrub and less Deciduous or Evergreen forest land than the rest of the communities.







Sources:

- PlanIT Geo tree canopy assessments: all cities except Portland and Seattle
- Arbor Day Foundation. (2019). Self-reported data from cities applying for Tree City USA recognition.
- Hauer, Richard & Petersen, Ward. (2016). Municipal Tree Care and Management in the United States: A 2014 Urban & Community Forestry Census of Tree Activities.
- Ramsey, Jeff and Angie DiSalvo. (2018). Tree Canopy and Potential in Portland, Oregon. Portland Parks & Recreation Urban Forestry.
- O'Neil-Dunne, Jarlath. (2016). Seattle Tree Canopy Assessment. University of Vermont Spatial Analysis Laboratory.

Figure 31. Nearby communities with a recent urban tree canopy assessment.

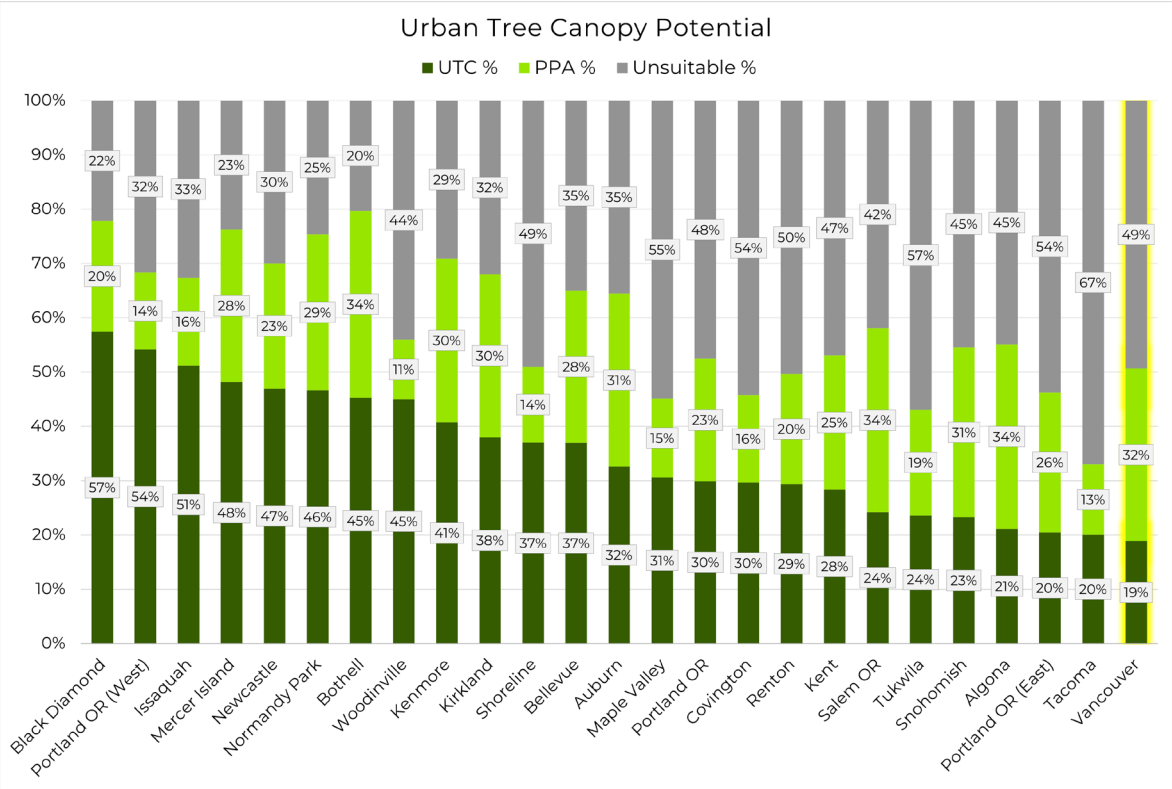


Figure 32. Existing UTC, PPA, and unsuitable areas of selected Washington and Oregon cities.

This disparity in Vancouver's UTC compared to other regional communities could be the result of a variety of factors affecting the city's capacity to support urban trees, including slight climatic differences, hydrology, percent of developed versus vegetated land, tree maintenance and management activities, budgets, and more. Fortunately, Vancouver has relatively greater PPA than most of the communities assessed (32%), and the City has already begun implementing an aggressive tree planting initiative to promote the expansion of its urban forest. In 2019, over 1,300 new trees were planted – more than nearly every community in the comparison except for significantly larger cities like Portland and Seattle. For the complete results by cities, including canopy cover and management activities reported to Tree City USA, refer to the Appendix.

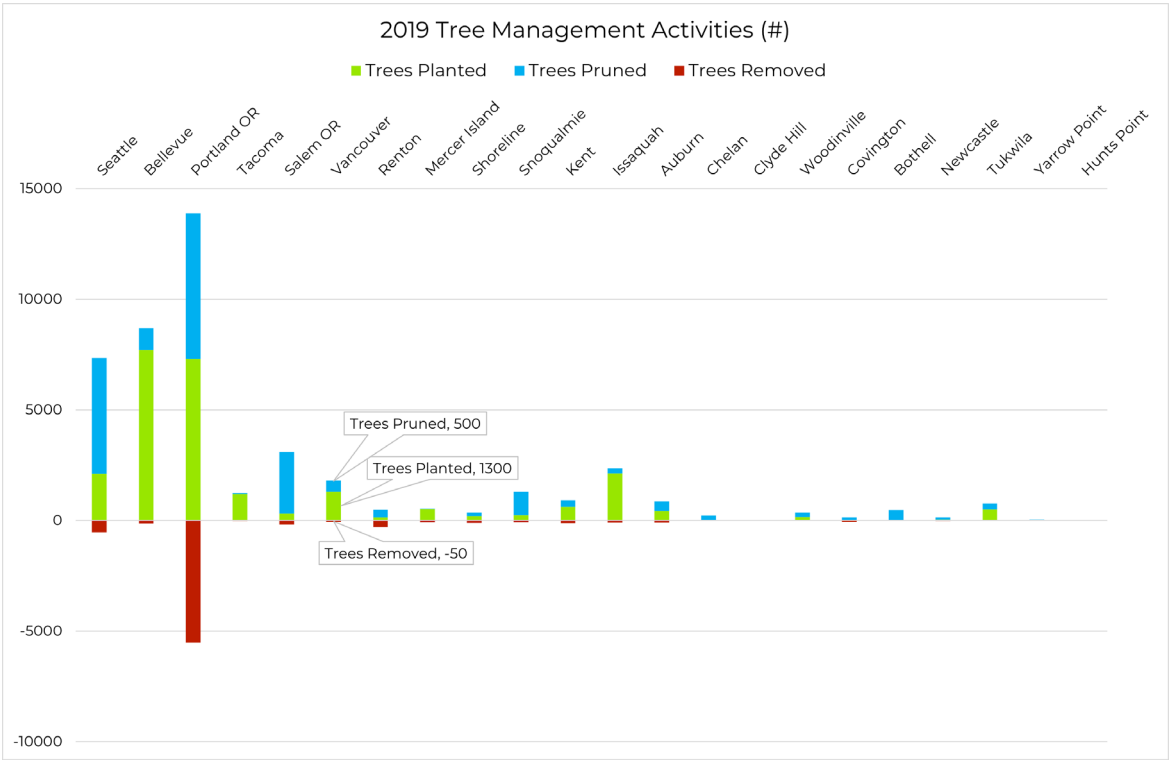


Figure 33. Tree planting, pruning, and removals of selected Washington and Oregon cities.

CONCLUSIONS AND RECOMMENDATIONS

The City of Vancouver has demonstrated that it values its natural resources and wants to maintain a healthy and sustainable urban environment. Recurring assessments of the City's tree canopy represent important steps in ensuring the long-term health of its urban forest. A greater percent of canopy cover can be achieved with proper planning, investment, and care of existing trees. The City should continue to monitor the health of the urban forest and implement the following recommendations to ensure the urban forest is considered during future city planning and development to sustain and enhance the benefits that trees provide to the community.

Continue to monitor changes in the urban forest using regularly updated data

To preserve, protect, and maintain Vancouver's tree canopy, the City should continue to have a tree canopy assessment performed at regular intervals such as through a subscription to TreePlotter CANOPY. The next update in TreePlotter CANOPY is slated to occur in early 2022 with data from summer 2021. As the City grows, they will be able to use these data to ensure that their urban forest policies and management practices prioritize its maintenance, health, and growth. The City's urban forest provides Vancouver with a wealth of environmental, social, and even economic benefits which relate back to greater community pride and interest in citywide initiatives and priorities. These results can be used to identify where existing tree canopy cover should be preserved, where there are opportunities to continue to expand the City's canopy cover, and which areas would receive the greatest benefits from the investment of valuable time and resources into Vancouver's urban forest.

1. Leverage the results of this assessment to promote the urban forest

The results of this assessment should be used to encourage investment in urban forest monitoring, maintenance, and management; to prepare supportive information for local budget requests/grant applications; and to develop targeted presentations for city leaders, planners, engineers, resource managers, and the public on the functional benefits of trees in addressing environmental issues. The land cover, tree canopy, and urban tree canopy change data should be disseminated to diverse partners for urban forestry and other applications while the data are current and most useful for decision-making and implementation planning. The information from this study can help establish new canopy cover goals for the short- and long-term to continue to expand Vancouver's urban forest.

2. Use the urban tree canopy change data to identify areas to prioritize canopy expansion

The City and its various stakeholders can utilize the results of the UTC, PPA, and urban tree canopy change analyses to identify the best locations on public and private land to focus future tree planting and canopy expansion efforts. Trees can play a large role in improving public health by improving air quality, reducing temperatures, and addressing climate change. The City can acquire parcels for public use as part of the Open Space District to be used as carbon sinks to address community access to nature, climate, human health, and equity. Plantable space in the right-of-way is often found close to high concentrations of impervious surfaces. Focus on planting the right tree in the right place and planting large-species trees where appropriate to maximize ecosystem services. Results revealed that 21% of all plantable space in Vancouver is found in industrial areas. Planting trees near impervious surfaces can offset the urban heat island effect, stormwater runoff, and energy consumption. Industrial areas also often have high concentrations of impervious surfaces. The priority planting analysis should be used to identify planting opportunities adjacent to high concentrations of impervious surfaces in these areas and other city-maintained properties. Results revealed that 10% of plantable space is in the public ROW, adjacent to impervious surfaces. The City can develop a proactive street tree maintenance program to take on the responsibility of planting and managing street trees, ensuring healthy trees are distributed equitably across the city. Given the majority of tree loss was attributed to development,

the City should evaluate city codes to increase tree preservation and create space for existing trees during the development process, and space for new larger stature trees to be planted both on private property and within the public right of way to maximize the benefits of trees.

74%
OF ALL PLANTABLE SPACE IN VANCOUVER IS LOCATED ON PRIVATE LAND

3. Develop outreach programs towards private landowners

In Vancouver, 74% of PPA is found in areas designated as Private land. The City should focus on community outreach and education programs to better inform citizens and private landholders of the environmental, health, social, and financial benefits that trees provide and consider other strategies to help preserve existing trees and grow the tree canopy in the 7,500+ acres of plantable space on private properties. The City should explore options to develop grant programs for tree maintenance or removal of hazard or invasive trees within the city to remove barriers for overburdened communities which lack tree canopy. Tree giveaways, tree planting programs, and tree maintenance events can help to promote new tree plantings. To promote new plantings, expand the partnership with the local non profit Friends of Trees, to plant more trees on private property, focusing on low-canopy and underserved neighborhoods. The City should also continue to develop partnerships with Community Based Organizations and individual champions throughout neighborhoods to build stewardship at the community level. In addition, the City should continue to conduct volunteer tree planting and tree maintenance events to increase awareness levels in the community.

4. Use TreePlotter to identify areas in need of tree canopy & prioritize planting efforts

To maximize impact, see greater return on investment, and provide the greatest number of benefits to the community, we recommend that the City focus planting and management efforts in areas with high weighted priority rankings. Planting priority maps and data, displayed in TreePlotter™ CANOPY, show land cover metrics and the areas of highest priority collectively and individually for all planting prioritization criteria including Tree Equity Score and other public health data from the Washington Health Disparities map. The City should also use the GIS data provided to create unique weighted scenarios to focus efforts in targeted areas that meet specific criteria. For instance, the City could find areas that have low UTC, high PPA, or would offer the greatest benefits to air quality and summertime temperature reduction. Focusing urban forest management resources on expanding and maintaining tree canopy in areas like these will have positive impacts on multiple factors that the City has deemed important. Efforts should focus on outreach to the residents of these neighborhoods, as well as local business and land owners, in order to promote new tree plantings and continued maintenance of existing trees.

REPORT APPENDIX

ACCURACY ASSESSMENT

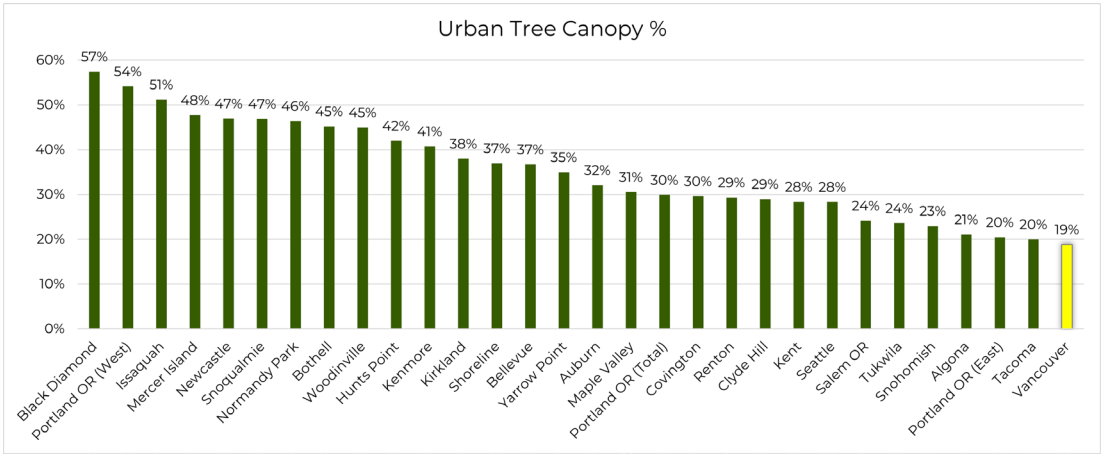
The EarthDefine US Tree Map has an overall accuracy of 96.6%. In census defined urban areas the overall accuracy is higher at 97.3%. Accuracy was assessed using 48,000 random points (1,000 points/state). The state of Washington, specifically, has an accuracy of 98.3%.

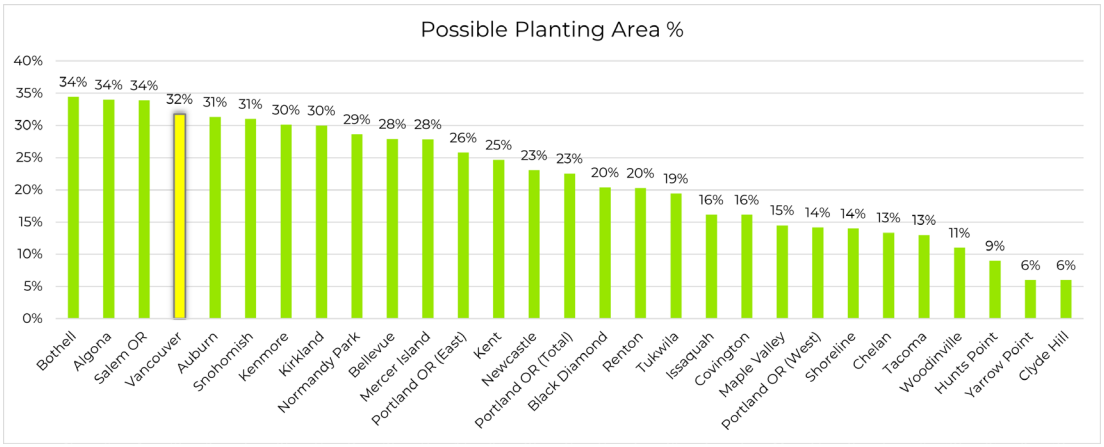
URBAN TREE CANOPY POTENTIAL BY NEIGHBORHOODS

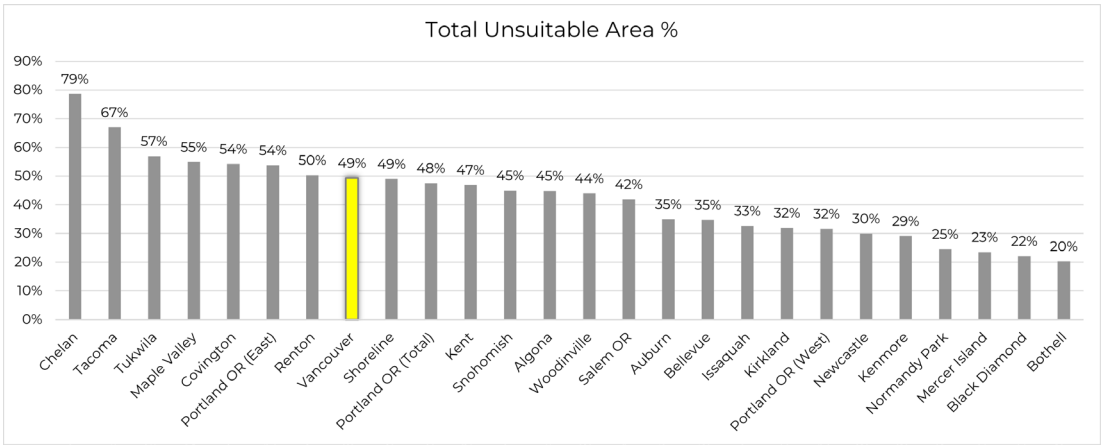
Neighborhoods	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	*Dist.*	*Acres*	*%*	*Dist.*	*Acres*	*%*	*Dist.*
Airport Green	68	0%	19	27%	0%	14	21%	0%
Arnada	155	1%	28	18%	1%	28	18%	0%
Bagley Downs	447	2%	84	19%	2%	104	23%	1%
Bella Vista	112	0%	37	33%	1%	32	29%	0%
Bennington	701	3%	82	12%	2%	152	22%	2%
Burnt Bridge Creek	568	2%	108	19%	2%	206	36%	2%
Burton Evergreen	150	1%	44	30%	1%	49	33%	1%
Burton Ridge	170	1%	35	20%	1%	57	34%	1%
Carter Park	221	1%	30	14%	1%	47	21%	1%
Cascade Highlands	389	1%	64	17%	1%	81	21%	1%
Cascade South East	179	1%	37	21%	1%	44	25%	1%
Central Park	462	0	84	18%	2%	127	27%	1%
Cimarron	57	0%	11	19%	0%	13	24%	0%
Columbia River	532	2%	163	31%	3%	170	32%	2%
Columbia Way	538	2%	67	12%	1%	87	16%	1%
Countryside Woods	249	1%	37	15%	1%	78	31%	1%
Dubois Park	132	0%	53	40%	1%	28	21%	0%
East Mill Plain	288	1%	41	14%	1%	69	24%	1%
Edgewood Park	195	1%	59	30%	1%	48	25%	1%
Ellsworth Springs	624	2%	183	29%	3%	137	22%	2%
Esther Short	404	1%	35	9%	1%	34	8%	0%
Evergreen Highlands	184	1%	45	25%	1%	56	30%	1%
Evergreen Shores	70	0%	18	26%	0%	15	21%	0%
Fairway/164th Ave.	262	1%	40	15%	1%	58	22%	1%
Father Blanchet Park	207	1%	37	18%	1%	69	33%	1%
Fircrest	904	3%	190	21%	4%	289	32%	3%
First Place	128	0%	24	19%	0%	44	34%	1%
Fishers Creek	228	1%	67	29%	1%	47	20%	1%
Fishers Landing East	821	3%	186	23%	3%	198	24%	2%
Forest Ridge	85	0%	19	22%	0%	29	35%	0%

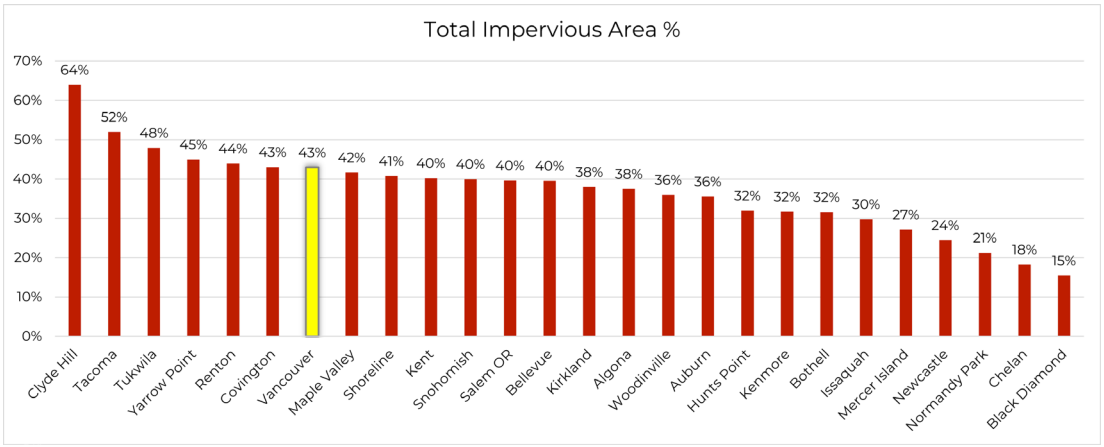
Neighborhoods	Land Area		Urban Tree Canopy			Possible Planting Area		
	Acres	*Dist.*	*Acres*	*%*	*Dist.*	*Acres*	*%*	*Dist.*
Fourth Plain Village	190	1%	45	23%	1%	52	27%	1%
Fruit Valley	3847	14%	500	13%	9%	2001	52%	24%
Green Meadows	487	2%	94	19%	2%	176	36%	2%
Harney Heights	226	1%	62	27%	1%	60	27%	1%
Hearthwood	164	1%	43	26%	1%	39	24%	0%
Hough	262	1%	46	18%	1%	46	18%	1%
Hudsons Bay	589	2%	81	14%	2%	185	31%	2%
Image	525	2%	98	19%	2%	161	31%	2%
Kevanna Park	381	1%	64	17%	1%	113	30%	1%
Landover-Sharmel	433	2%	65	15%	1%	124	29%	1%
Lewis and Clark Woods	77	0%	20	26%	0%	19	25%	0%
Lincoln	460	2%	88	19%	2%	107	23%	1%
Maplewood	238	1%	46	19%	1%	57	24%	1%
Marrion	434	2%	71	16%	1%	142	33%	2%
Meadow Homes	522	2%	87	17%	2%	160	31%	2%
Mountain View	277	1%	43	15%	1%	61	22%	1%
North Garrison Heights	334	1%	62	18%	1%	82	25%	1%
North Hearthwood	99	0%	19	20%	0%	37	37%	0%
North Image	1009	4%	130	13%	2%	307	30%	4%
Northcrest	121	0%	34	28%	1%	38	32%	0%
Northfield	35	0%	8	23%	0%	5	16%	0%
Northwest	720	3%	210	29%	4%	266	37%	3%
Northwood	159	1%	55	34%	1%	49	31%	1%
Oakbrook	383	1%	94	24%	2%	146	38%	2%
Ogden	957	4%	187	19%	3%	278	29%	3%
Old Evergreen Hwy	702	3%	245	35%	5%	217	31%	3%
Parkside	230	1%	43	19%	1%	81	35%	1%
Parkway East	165	1%	25	15%	0%	56	34%	1%
Riveridge	237	1%	72	30%	1%	60	25%	1%
Riverview	164	1%	32	20%	1%	58	36%	1%
Rose Village	477	2%	81	17%	2%	117	25%	1%
Shumway	162	1%	30	19%	1%	32	20%	0%
South Cliff	104	0%	49	47%	1%	21	20%	0%
Vancouver Heights	747	3%	165	22%	3%	208	28%	2%
VanMall	592	2%	101	17%	2%	88	15%	1%
Village at Fishers Landing	85	0%	21	25%	0%	18	22%	0%
West Minnehaha	1017	4%	261	26%	5%	355	35%	4%
Wildwood	152	1%	53	35%	1%	40	26%	0%
Totals	**27,292**	**100%**	**5,352**	**20%**	**100%**	**8,471**	**31%**	**100%**

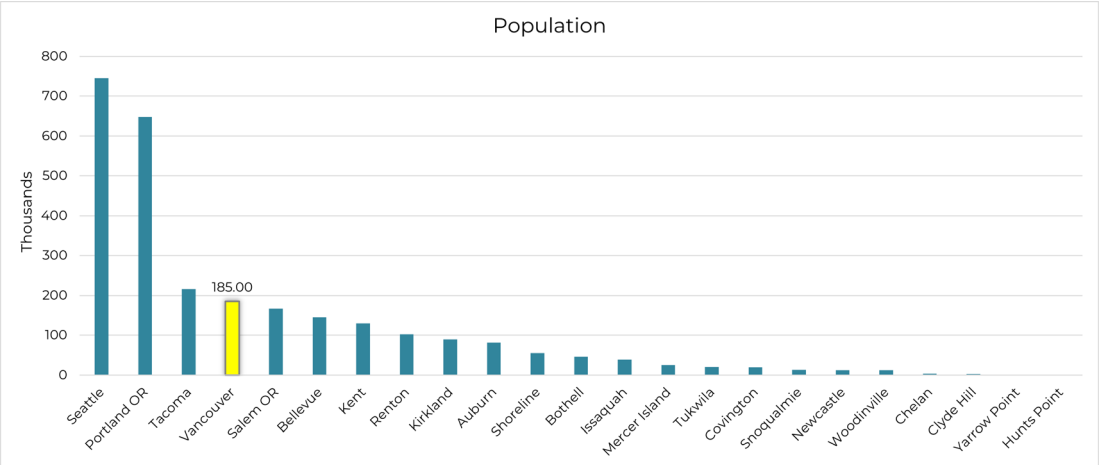
COMPARING VANCOUVER'S URBAN TREE CANOPY WITH NEARBY CITIES

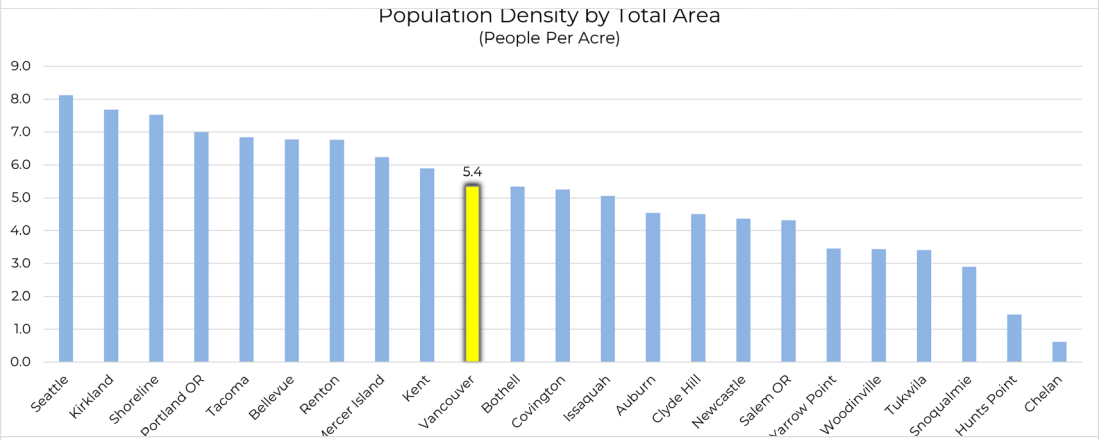


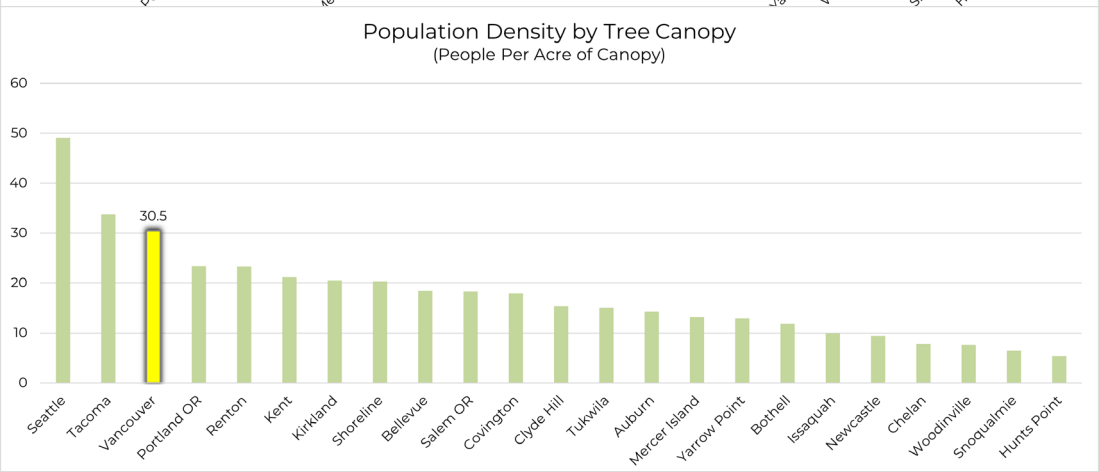


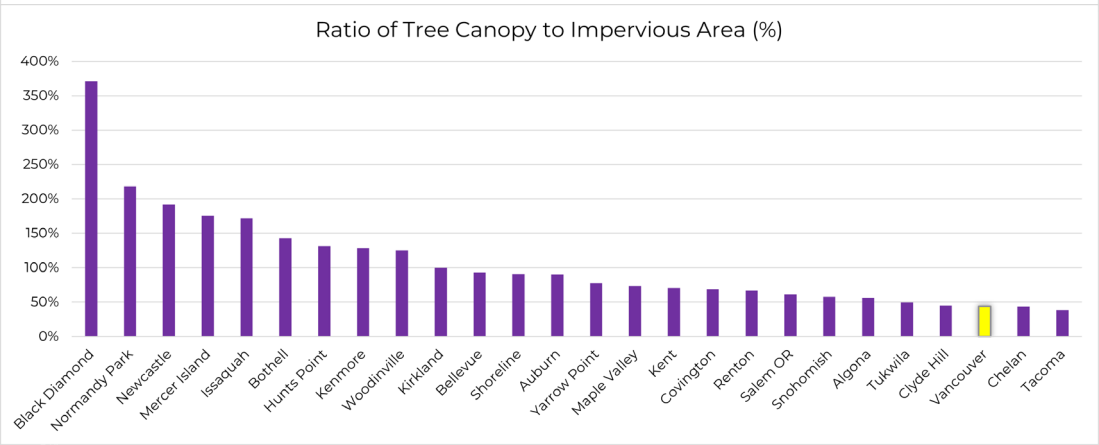


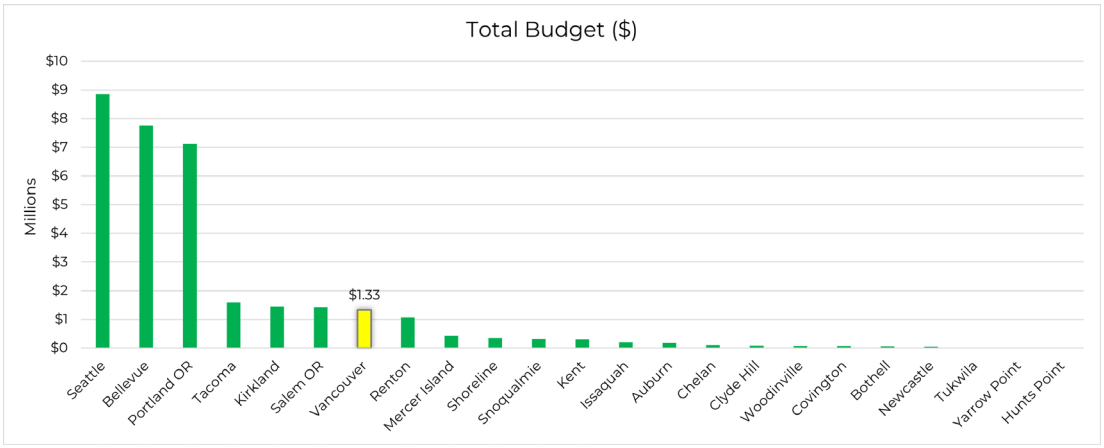


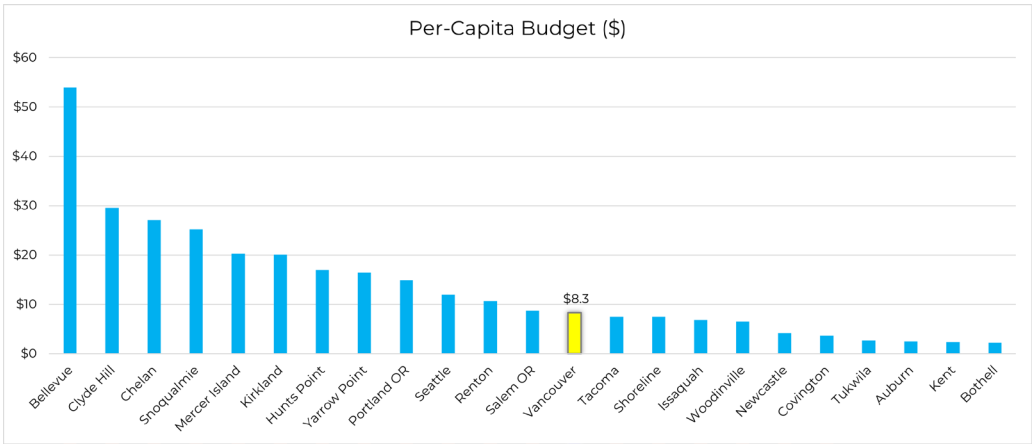

Population
Thousands
800
700
600
500
400
300
200
100
0
185.00
Seattle
Portland OR
Tacoma
Vancouver
Salem OR
Bellevue
Kent
Renton
Kirkland
Auburn
Shoreline
Bothell
Issaquah
Mercer Island
Tukwila
Covington
Snoqualmie
Newcastle
Woodinville
Chelan
Clyde Hill
Yarrow Point
Hunts Point

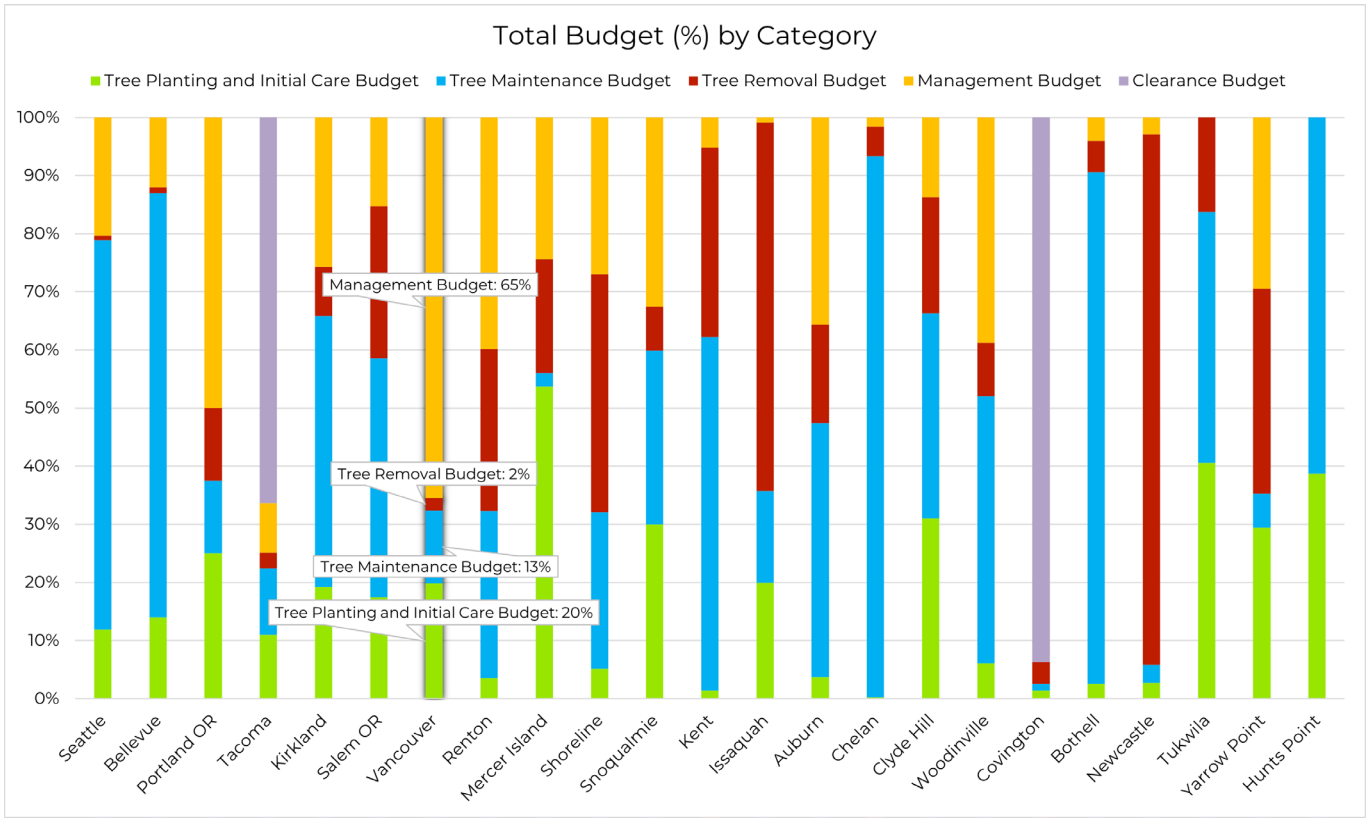

Population Density by Total Area
(People Per Acre)
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
5.4
Seattle
Kirkland
Shoreline
Portland OR
Tacoma
Bellevue
Renton
Mercer Island
Kent
Vancouver
Bothell
Covington
Issaquah
Auburn
Clyde Hill
Newcastle
Salem OR
Yarrow Point
Woodinville
Tukwila
Snoqualmie
Hunts Point
Chelan

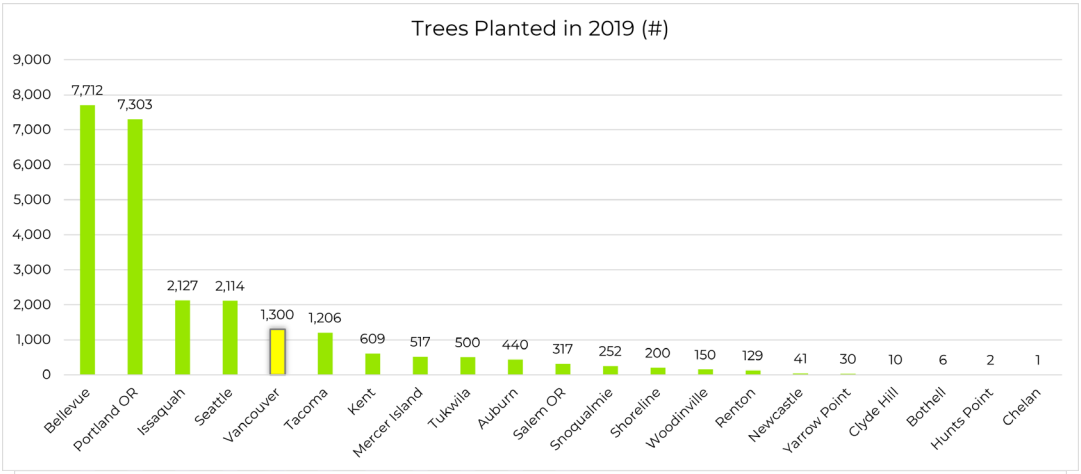

Population Density by Tree Canopy
(People Per Acre of Canopy)
60
50
40
30
20
10
0
30.5
Seattle
Tacoma
Vancouver
Portland OR
Renton
Kent
Kirkland
Shoreline
Bellevue
Salem OR
Covington
Clyde Hill
Tukwila
Auburn
Mercer Island
Yarrow Point
Bothell
Issaquah
Newcastle
Chelan
Woodinville
Snoqualmie
Hunts Point

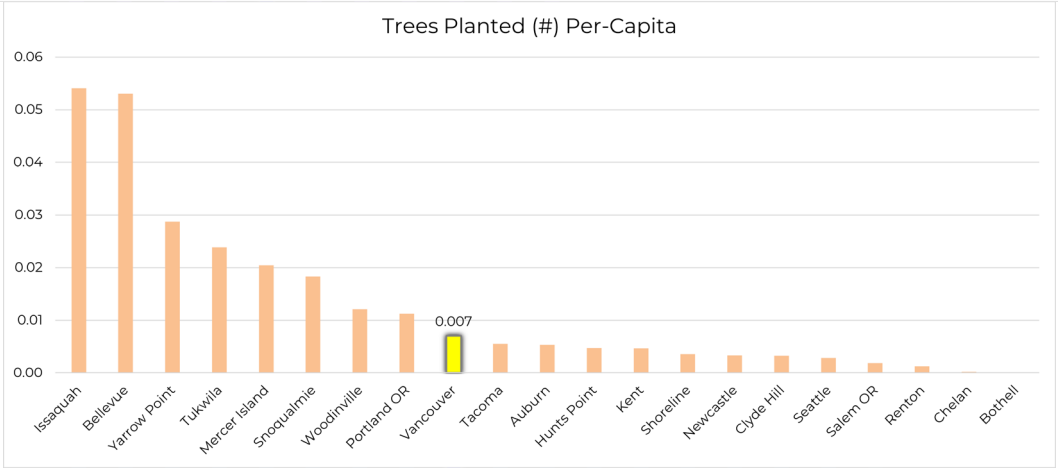

Ratio of Tree Canopy to Impervious Area (%)
400%
350%
300%
250%
200%
150%
100%
50%
0%
Black Diamond
Normandy Park
Newcastle
Mercer Island
Issaquah
Bothell
Hunts Point
Kenmore
Woodinville
Kirkland
Bellevue
Shoreline
Auburn
Yarrow Point
Maple Valley
Kent
Covington
Renton
Salem OR
Snohomish
Algona
Tukwila
Clyde Hill
Vancouver
Chelan
Tacoma

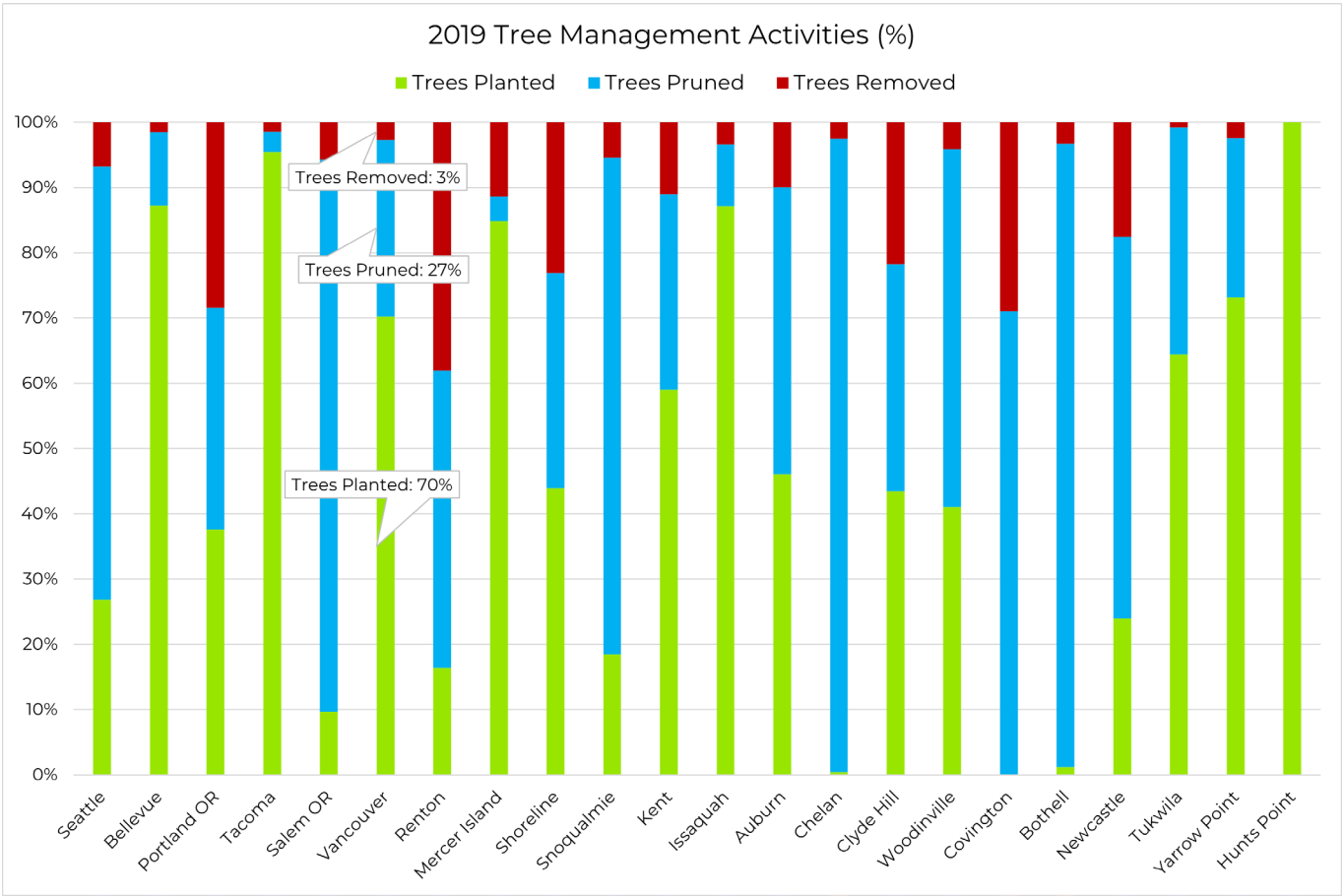

Total Budget ($)
Millions
$10
$9
$8
$7
$6
$5
$4
$3
$2
$1
$0
$1.33
Seattle
Bellevue
Portland OR
Tacoma
Kirkland
Salem OR
Vancouver
Renton
Mercer Island
Shoreline
Snoqualmie
Kent
Issaquah
Auburn
Chelan
Clyde Hill
Woodinville
Covington
Bothell
Newcastle
Tukwila
Yarrow Point
Hunts Point

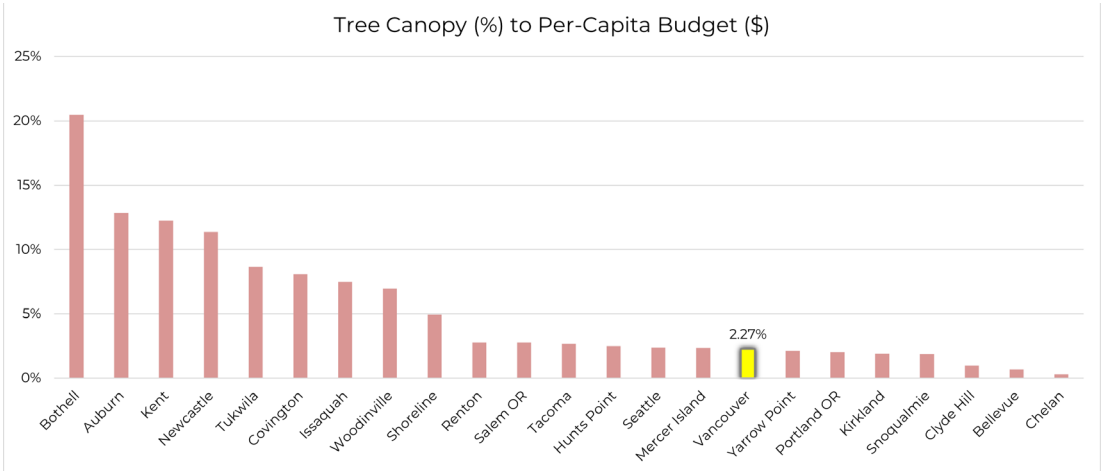

Per-Capita Budget ($)
$60
$50
$40
$30
$20
$10
$0
$8.3
Bellevue
Clyde Hill
Chelan
Snoqualmie
Mercer Island
Kirkland
Hunts Point
Yarrow Point
Portland OR
Seattle
Renton
Salem OR
Vancouver
Tacoma
Shoreline
Issaquah
Woodinville
Newcastle
Covington
Tukwila
Auburn
Kent
Bothell

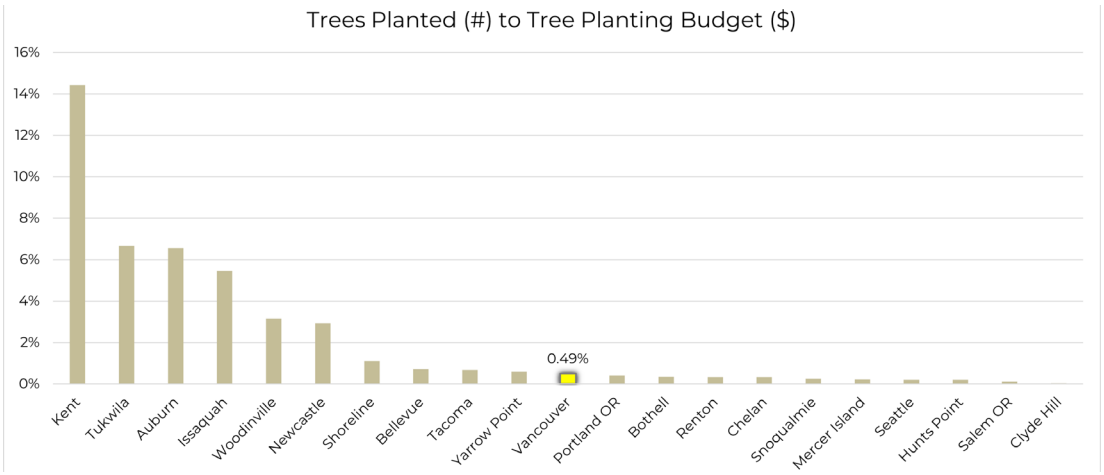

Total Budget (%) by Category
Tree Planting and Initial Care Budget
Tree Maintenance Budget
Tree Removal Budget
Management Budget
Clearance Budget
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Management Budget: 65%
Tree Removal Budget: 2%
Tree Maintenance Budget: 13%
Tree Planting and Initial Care Budget: 20%
Seattle
Bellevue
Portland OR
Tacoma
Kirkland
Salem OR
Vancouver
Renton
Mercer Island
Shoreline
Snoqualmie
Kent
Issaquah
Auburn
Chelan
Clyde Hill
Woodinville
Covington
Bothell
Newcastle
Tukwila
Yarrow Point
Hunts Point


Trees Planted in 2019 (#)
9,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
0
7,712
7,303
2,127
2,114
1,300
1,206
609
517
500
440
317
252
200
150
129
41
30
10
6
2
1
Bellevue
Portland OR
Issaquah
Seattle
Vancouver
Tacoma
Kent
Mercer Island
Tukwila
Auburn
Salem OR
Snoqualmie
Shoreline
Woodinville
Renton
Newcastle
Yarrow Point
Clyde Hill
Bothell
Hunts Point
Chelan


Trees Planted (#) Per-Capita
0.06
0.05
0.04
0.03
0.02
0.01
0.00
0.007
Issaquah
Bellevue
Yarrow Point
Tukwila
Mercer Island
Snoqualmie
Woodinville
Portland OR
Vancouver
Tacoma
Auburn
Hunts Point
Kent
Shoreline
Newcastle
Clyde Hill
Seattle
Salem OR
Renton
Chelan
Bothell


2019 Tree Management Activities (%)
Trees Planted
Trees Pruned
Trees Removed
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Trees Removed: 3%
Trees Pruned: 27%
Trees Planted: 70%
Seattle
Bellevue
Portland OR
Tacoma
Salem OR
Vancouver
Renton
Mercer Island
Shoreline
Snoqualmie
Kent
Issaquah
Auburn
Chelan
Clyde Hill
Woodinville
Covington
Bothell
Newcastle
Tukwila
Yarrow Point
Hunts Point





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.

Possible Planting Area - Total: The combination of PPA Vegetation area and PPA Impervious area. In this project no impervious areas were identifies as plantable.

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.

OCTOBER 2021

URBAN TREE CANOPY

ASSESSMENT

VANCOUVER, WASHINGTON

CITY OF Vancouver WASHINGTON

PLANIT GEO™
mapping a greener future