



DISTRICT OF WEST VANCOUVER
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COUNCIL REPORT

Date:	March 23, 2022
From:	Heather Keith, Manager, Environmental Protection
Subject:	Urban Forest Management Plan - Progress Update
File:	0332-04

RECOMMENDATION

THAT the report dated March 23, 2022 titled “Urban Forest Management Plan - Progress Update” be received for information.

1.0 Purpose

The purpose of this report is to provide an update to Council on the progress of the Urban Forest Management Plan (UFMP) and outline the next steps to complete the plan. Specifically this report provides an overview of the Phase 1 component, which includes the State of the Urban Forest report and the results of the LiDAR Tree Canopy Study.

2.0 Legislation/Bylaw/Policy

2.1 Legislation

Under Section 8 of the *Community Charter*, Council may by bylaw regulate, prohibit, and impose requirements relative to trees and the protection of the natural environment.

2.2 Bylaw

Tree Bylaw No. 4892, 2016 was adopted by Council in April 2016 and amended in December 2020 as a measure to regulate trees on private property.

Boulevard Bylaw No. 4886, 2016 regulates tree permitting on municipal boulevards.

2.3 Policy

Policy #02-70-199 Tree Work on District of West Vancouver Property outlines policies and processes to conduct tree work on District property, as requested by residents, and how the District manages hazardous trees.

3.0 Council Strategic Objective(s)/Official Community Plan

The Official Community Plan (Bylaw No. 4985, 2018) recognizes the value of the natural environment and provides high-level policies regarding strengthening existing environmental regulations and facilitating the

protection, restoration and enhancement of the community's natural assets, including trees. This includes:

- Policy 2.6.1: "Maintain all existing environmental development controls and update regulations, guidelines and practices as appropriate, with consideration to provincial and federal legislations, and best management practices".
- Policy 2.6.2: "Mitigate on-site and off-site environmental impacts through proactive land use, design, construction, and site restoration requirements, and seek no-net loss of riparian habitats and environmental assets".
- Policy 2.6.5: "Balance tree retention, replacement or compensation for their ecological value with consideration to access to sunlight and significant public views".
- Policy 2.6.13: "Identify ecologically important assets and develop a strategy to protect and manage these features and the associated ecosystem services they provide".
- Policy 2.6.16: "Protect the remaining old-growth forests in recognition of their ecological importance and values through appropriate regulations and education".
- Recognizing the impact that trees have on the form and character of the built environment with Development Permit Area guidelines promoting preservation of existing healthy trees, retention of mature trees and vegetation and planting of trees.

In addition, Objective 3.3 of Council's 2021-2022 Strategic plan is to "Develop an Urban Forest Management Plan".

4.0 Financial Implications

There are no financial implications with this report.

5.0 Background

5.1 Previous Decisions

At the September 28, 2020 Council meeting, staff provided Council with the results of the Tree Canopy Cover study comparing 2013 and 2018 canopy cover.

At this meeting, Council passed the following motions:

THAT staff:

1. Update "Interim Tree Bylaw No. 4892, 2016", with amendments to manage the tree canopy and improve permitting process for tree work.

2. Include a funding request in the 2021 budget to obtain LiDAR data to compare with the 2013 and 2018 data already acquired.
3. Include a funding request in the 2021 budget to develop an Urban Forest Management Plan.
4. Develop guidelines for the maintenance of hedges on private property.

5.2 History

To address Item (1) above, staff brought forward amendments to Interim Tree Bylaw No. 4892, 2016 on November 2, 2020, which were adopted, with the understanding that the updated Tree Bylaw No. 4892, 2016 will be reviewed on an ongoing basis as more information is acquired with respect to the state of the urban forest.

To address Items (2) and (3), Council approved budgets in 2021 to obtain LiDAR data to continue to assess tree canopy cover in 2021 and to develop an UFMP. The LiDAR data were collected in spring 2021. The development of the UFMP was initiated in September 2021 with Diamond Head Consultant Ltd. as the selected consultant to develop the plan.

The current report provides an update on the development of the Urban Forest Management Plan, including an overview of the State of the Urban Forest report and the results of the Tree Canopy Cover study using LiDAR data collected in 2018 and 2021.

6.0 Analysis

6.1 Background

The objective of the UFMP is to provide support tools and guidance, which will allow the District to:

- Establish a clear vision, methodology, and framework for managing the urban forest.
- Retain and plant trees on boulevards, parks, and environmentally-sensitive areas, municipal and private lands.
- Maintain and/or enhance the current tree canopy cover of the urban forest.
- Implement mitigation measures with respect to climate change.
- Promote and encourage the protection of “protected trees” as defined under the Tree Bylaw.
- Promote the protection of natural ecosystems, including rare species and rare ecosystems.
- Increase community understanding of, and support for, the urban forest.

- Promote the protection of healthy trees during development and construction.
- Encourage consultants and developers to design projects with the intent of preserving and protecting healthy trees and planting trees for future generations.

In order to meet these objectives, an understanding of the current state of the urban forest, management and operations, and staff and public knowledge, feedback, and goals is required.

6.2 Overview

The development of the Urban Forest Management Plan has three phases:

1. State of the Urban Forest report
 - a. Background review of current tree management and guiding policies
 - b. Forest mapping
 - c. Tree canopy cover study
2. Public Engagement
 - a. To educate to the public on the objectives of the plan
 - b. To collect feedback from the community on their urban forest values and preferences, satisfaction with services, their concerns with urban forest management and expected outcomes of the plan
3. Development of the Urban Forest Management Plan
 - a. Establish goals, recommendations, and targets based on the state of the urban forest

The State of the Urban Forest report is presented in draft format in **Appendix A** and will be finalized as an appendix in the UFMP as supporting information. The report provides detailed information on the following:

- An overview of why an urban forest is needed and its benefits to the District of West Vancouver.
- The distribution, condition, and importance of the urban forest in the community.
- A summary of the management of the urban forest in the District of West Vancouver.
- A description of the guiding policies, strategies, plans, and bylaws that frame urban forest management.

- A comparison of the District's urban forest and management program with that of municipalities of similar size.
- A rating of the current sustainability of the District's urban forest and management program based on a series of criteria and indicators.
- An overview of urban forest challenges and opportunities that will be considered in the Urban Forest Management Plan.

This council report provides a summary of the key findings from the State of the Urban Forest report and outlines the next steps in the development of the UFMP.

6.3 Discussion

The State of the Urban Forest report provides a broad overview of the urban forest, the challenges with respect to climate change, and a summary of the District's current operations for tree management. This background work will help to develop a plan to address the challenges, improve the state of the urban forest, and recommend actions and priorities to support the management of the forest for the next 15 years.

Tree Canopy Cover Study

The key findings from the tree canopy cover study are as follows:

- Between 2018 and 2021, canopy cover decreased by about 2% (an estimated 69 hectares) within West Vancouver's Urban Containment Boundary, which includes the newly cleared Rodgers areas. Scattered canopy cover loss across existing neighbourhoods accounted for 55 hectares, with the remaining 9 hectares concentrated within the Rodgers Creek area. The analyses of the data attempted to remove differences between years due to seasonality (2018 data collected in early May where there was more leaf-on whereas 2021 data were collected in early April when trees were entirely leaf-off); however, these differences still may have resulted in an overestimate of canopy cover loss between years.
- The total tree canopy cover has been relatively stable from 2018 to 2021 in most neighbourhoods across the District; however, there was statistically significant loss in the Rodgers Creek neighbourhood where land clearing occurred for the development of Areas 5 and 6. Significant canopy cover loss was also observed in three existing neighbourhoods primarily as a result of re-development on private land (Westmount, British Properties 19) and vegetation clearing along the Highway (Sunset Beach).

- The 'High' height class canopy cover (8 to 45 metres) makes up the largest proportion of the total tree canopy cover (62%) in 2021, followed by the 'Medium' height canopy cover (2 to 8 metres; 38%), while the 'Very High' canopy (>45 metres) represents only 1% of the total canopy cover. No statistically significant change in height classes was detected between 2018 and 2021 across existing neighbourhoods.
- Changes in height classes in Westmount 8, British Properties 19, and Sunset Beach 2 (neighbourhoods that experienced a statistically significant loss of canopy cover between 2018 and 2021) were measured primarily within the 'High' (8 to 45 metres) and 'Very High' (>45 m) canopy height classes, meaning that tree loss in those existing neighbourhoods was recorded primarily for trees taller than 8 metres.
- Native forest health challenges have been observed in recent years due to drought mortality, primarily impacting Douglas fir and Western red cedar; the Douglas-fir beetle; and wildfire damage. Large-scale Western hemlock decline due to the looper moth infestation has occurred in the Regional Capilano Watershed but staff and residents have observed similar impacts within the District's urban forest.
- Significant stands of tall trees in sensitive ecosystems dominate Cypress Falls Park and Nelson Canyon Park, especially within riparian corridors and in Lighthouse Park. Residential neighbourhoods including Cypress Park & Upper Caulfield also have significant clusters of tall trees.
- Canopy cover distribution is uneven across the District of West Vancouver, with more canopy cover found in the western neighbourhoods. The priority index value that will inform West Vancouver's Tree Equity Score in the Urban Forest Management Plan also indicates that areas in the urban core and some of the existing British Properties neighbourhoods have a higher need for canopy cover benefits based on their surface temperature and presence of more vulnerable populations.

District Tree Management and Operations

There are three departments at the District that support the management of the urban forest, including the Planning and Development Services, Parks, and Engineering departments. Based on a review of the tree

portfolio, the following key points will be reviewed during the development of the UFMP:

- Despite significant increases in permit and work order volumes, staffing for urban forest management and the implementation of tree bylaws/policies has been stable over recent years, with the exception of a recent hiring of a temporary arborist.
- Work volume for permits and service requests to manage trees have been steadily increasing over the last 5 to 7 years. Permit volumes managed by the Planning Department have been increasing for the watercourse development permit areas. Work orders related to tree issues have been increasing for both the Parks and Roads Departments in recent years.
- A core operating budget of \$258,000 was allocated to the Parks and Planning Departments for urban forest management in 2021 with additional budget granted on an as-needed basis for hazard tree work. Also in 2021, the Engineering Department's budget for contractors to carry out vegetation management for sightlines in the rights-of-ways was \$320,000.

Municipal Comparison Study

When comparing the District to other municipalities of similar size, the following was observed:

- West Vancouver's public tree population is unknown in terms of inventory and species.
- The District's canopy cover is higher compared to similar municipalities such as the District of North Vancouver and Langford.
- The District's operational budget is in the low range compared to other municipalities. West Vancouver's staffing for tree management is also limited compared to other municipalities.
- Unlike all comparison municipalities, the District does not have a budget for replacement planting. Comparison municipalities have reported annual planting between 50 and 200 replacement trees on public land.
- The District's tree maintenance approach is reactive whereas most comparable municipalities had a proactive pruning cycle for at least some of their trees, which also enables them to conduct more regular risk inspections.

- With the exception of one, all municipalities administer tree bylaws for the protection of public and private trees. The District's protected tree size is consistent with the District of North Vancouver but otherwise larger than comparison municipalities.

Sustainability Report Card

West Vancouver's urban forestry program and services have been evaluated using an urban forest sustainability model. The criteria are associated to each of the core urban forest services, including planning, planting, management, protection, and partnership although some of the performance indicators were adapted to respond to West Vancouver's local context. The evaluation of the tree management program for the District of West Vancouver resulted in a "fair" rating based on the following:

- The urban forest program performs well on criteria related to internal and external collaboration, community awareness, and policies to protect its urban forest. It displays leadership in its valorization of wood biomass in its parks.
- The lowest performance is related to tree planting criteria due to the absence of a formal planting or replanting program.
- More data on the public urban forest asset will be required to provide a full picture of the performance of West Vancouver's urban forest management program.
- The District's approach to tree and tree risk management ranks at a low performance due to its reactive versus proactive nature.

6.4 Next Steps

The findings outlined in the State of the Urban Forest report will inform the development of the Urban Forest Management Plan. Some of the key issues that were identified during phase 1 that will be considered during the development of the UFMP, include:

- Recommendations to stabilize canopy cover from the small decline recorded between 2018 and 2021 and consider approaches to address canopy loss on private land identified as a result of new or redevelopment in the Rodgers Creek area and other existing neighbourhoods.
- Responding to native forest health challenges related to climate change and pests and diseases identified by provincial data and observed by staff to ensure the long-term viability of the District's urban forest and significant trees stands and ecosystems.

- Improving the distribution of ecosystem services and canopy cover across the District and in under-served areas found predominantly in the urban core and eastern neighbourhoods.
- Recommendations on bylaws and policies revisions to reflect current best practices and evolving urban forest challenges.
- Recognizing the increasing demand for services and recommending improvements to the District's reactive urban forest management program.
- Informing recommendations based on findings from the report card and the current resourcing and demand for urban forest management services on public land to maximize benefits, minimize risks, and provide a satisfactory level of service at a sustainable cost.

The next step in the process to develop the UFMP is the public engagement phase. The objectives of the public engagement is to gain an understanding from the community on residents' visions, values, and preferences for an urban forest, their satisfaction with services, and their support for public/private land actions to maintain or grow tree canopy. During the public engagement, staff and the consultant will:

- Provide education regarding the state of the urban forest, current management practices, and the objectives of the UFMP.
- Collect community feedback on the UFMP objectives, any issues and concerns and identify gaps and challenges prior to the finalization of the UFMP.

Public engagement is planned for May 2022 with the expected completion of the UFMP by the end of the year.

6.5 Sustainability

Through the Natural Assets study, ecosystem services from the urban forest were found to deliver \$606.7 million dollars in total benefits. Trees provide a range of important ecosystem services to benefit the community including a clean water supply, shading (i.e., trees reduce heat gain in summer, heat loss in winter), carbon sequestration, stormwater management (i.e., reduce runoff, water filtration before entering watercourses, adds nutrients to the soil, provides wildlife habitat, and recreational and aesthetic benefits.

6.6 Public Engagement and Outreach

Staff will meet with the Communications Engagement Committee on April 6, 2022 to provide an overview on the engagement plan for the

development of the UFMP. Public engagement is expected to occur in May 2022 and include an online survey and meetings in a variety of forums to provide education on tree management as well as receive feedback on the plan objectives, priorities for urban forest management, and any other concerns that should be accounted for during the development of the UFMP.

6.7 Other Communication, Consultation, and Research

Significant public engagement occurred during the citizen-led Interim Tree Bylaw Working Group process, which was completed in 2018 in addition to the public engagement that occurred during the process to update the Official Community Plan in 2018.

Diamond Head Consultants met with all staff that work on the tree portfolio across the Planning, Engineering, and Parks departments to gain a better understanding of the management of trees in the District, how the Departments operate, and the successes as well as challenges that staff encounter. Staff engagement included individual interviews with Diamond Head and one staff workshop.

In addition, Diamond Head has completed this type of work for many municipalities in the lower mainland in order to be able to provide a science and knowledge-based perspective on the urban forest in the District of West Vancouver as a benchmark for planning over the long-term.

7.0 Options

7.1 Recommended Option

THAT the report dated March 23, 2022 titled “Urban Forest Management Plan - Progress Update” be received for information.

7.2 Considered Options

Council may request further information or provide alternate direction.

8.0 Conclusion

The State of the Urban Forest report is the first phase in the development of the Urban Forest Management Plan and provides an overview of the forest health, current management practices, challenges, and the District’ urban forest in comparison to other similar municipalities. This information will be used to establish a vision, goals, and targets to inform the management of West Vancouver’s urban forest for the next 15 years.

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Appendices:

A – State of the Urban Forest Report, prepared by Diamond Head Consultants Ltd.

District of West Vancouver Urban Forest Management Plan

STATE OF THE URBAN FOREST REPORT

DRAFT



ACKNOWLEDGMENTS

Diamond Head Consulting Ltd. (DHC) prepared this report for the District of West Vancouver. DHC acknowledges the participation and support of District departments and staff in preparation of this document.

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March 2022

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1 INTRODUCTION

The District of West Vancouver is valued by residents and visitors for its wealth of natural assets, from shoreline parks to the ornamental trees and gardens found throughout the District's neighbourhoods to the towering natural forest stands along creeks and in the Upper Lands forest.

The State of the Urban Forest Report provides an overview of West Vancouver's urban forest resource, including its extent and value, how it is managed, and how it is integrated into District policies and regulations. The report also compares West Vancouver's urban forest management program with other municipalities and assesses the program performance relative to sustainable urban forest management criteria.

The report will inform the development of the Urban Forest Management Plan (UFMP). It is organized into the following sections:

1. **Introduction** – provides an overview of why we need the urban forest and how it benefits West Vancouver.
2. **Urban Forest Resource** – highlights findings about the status of our urban forest in terms of its distribution, condition, and importance to our community.
3. **Municipal Urban Forest Program** – summarizes the urban forest services and program that the District of West Vancouver delivers.
4. **Enabling policies** – describes the guiding policies, strategies, plans, and bylaws that frame urban forest management.
5. **Peer city comparison** – compares the District's urban forest and management program with that of similar-sized municipalities.
6. **Urban forest sustainability report card** – rates the current sustainability of our urban forest and management program based on a series of criteria and indicators.
7. **Summary and next steps** – provides an overview of key report findings and urban forest challenges and opportunities that will be considered in the Urban Forest Management Plan.



Defining West Vancouver’s urban forest

The urban forest includes all trees, vegetation, soils, and associated natural processes found in existing and future neighbourhoods (i.e., below 1,200 feet in elevation) – this includes trees along boulevards, found within parks, on private properties, and in native forests (Figure 1).

For the purpose of this report, the urban forest is defined as all trees, vegetation, soils, and associated natural processes found in existing and future neighbourhoods within the Urban Containment Boundary. Figure 2 illustrates the urban forest study area within the District. This corresponds to land within the Urban Containment Boundary as modified by Metro Vancouver’s Special Study Area (Official Community Plan Schedule i, map 16) and includes both the District’s existing and future neighbourhoods.

Forests above 1,200 feet elevation within the Upper Lands, Cypress Provincial Park, and the regional watershed are excluded from the Urban Containment Boundary and are not considered part of West Vancouver’s urban forest in this report. Undeveloped lands below 1,200 feet are considered part of the urban forest and include areas designated for future development, such as Cypress Village.

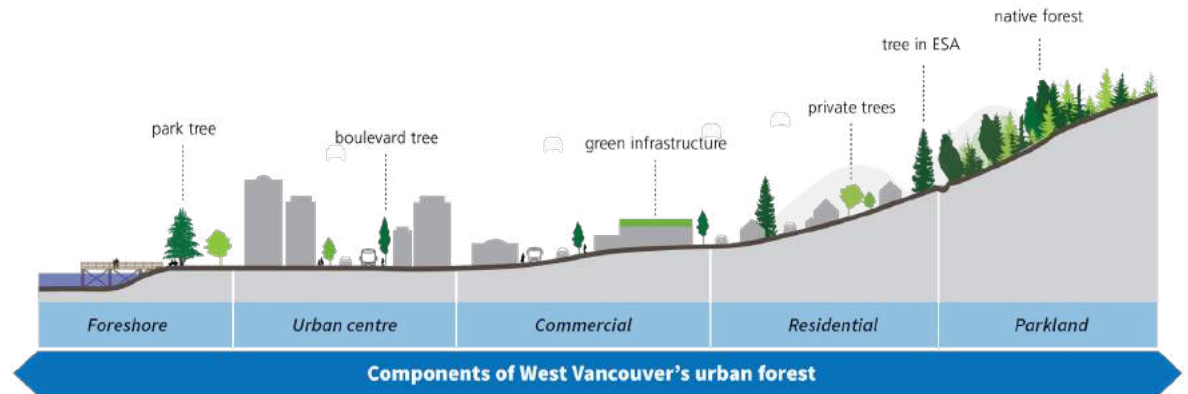


Figure 1. West Vancouver’s urban forest includes all trees, vegetation, soils, and associated natural processes in the District’s limits spanning the foreshore, urban centre, commercial, residential, and parkland areas.

West Vancouver's urban forest

Included in study

- Urban Containment Boundary
- Existing neighbourhoods
- Undeveloped lands below 1,200 feet

Excluded from study

- Upper Lands
- Provincial/regional land
- District Boundary

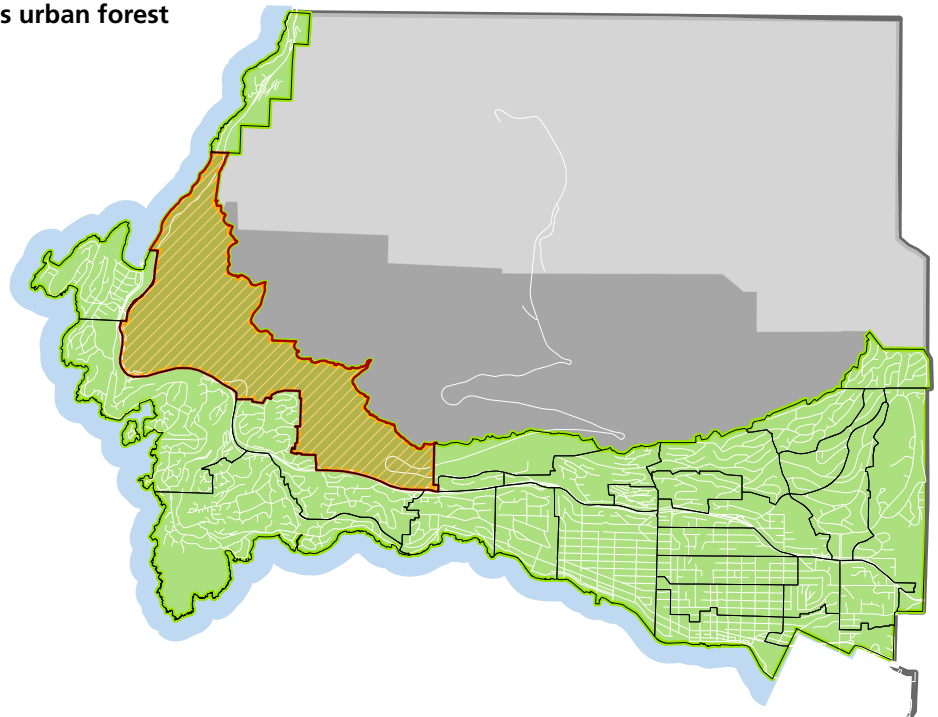


Figure 2. West Vancouver’s urban forest is located in existing and future neighbourhoods and connects natural areas from the foreshore to the Upper Lands.

Why manage the urban forest

The urban forest provides important benefits for the health and livability of the community. Those benefits, sometimes called **ecosystem services**, have been supported by substantial academic research and include providing habitat for wildlife, stabilizing steep slopes, storing and sequestering carbon, and cooling the District's streets (Figure 3)¹. Ecosystem services are often classified into four main categories:

1. **Cultural** – how the urban forest is valued by people including beautification, sense of place, mental and physical health, spirituality, recreation, and tourism.
2. **Regulating** – regulation of larger ecosystem processes such as pollination, air and water quality, storm water flow, shading, and cooling.
3. **Supporting** – processes that support the conditions to maintain life, essential to all existing ecosystem services including habitat, biodiversity, and enabling natural processes.
4. **Provisioning** – the direct products of trees and forests such as medicines, fruits, and nuts.

The urban forest is an asset that provides important benefits to our community, just like traditional engineered infrastructure assets such as roadways, pipes, and sewers. For example, trees and vegetation capture and filter stormwater runoff to recharge and replenish moisture in soils and creeks – without natural assets, water would become surface runoff and significantly increase the volume of water moving through the District's stormwater pipes. In the face of a District-declared climate emergency, protecting and growing a healthy urban forest, will be more critical than ever before to offset the impacts of anthropogenic climate change.

While trees provide numerous benefits, they can also create risk in the urban interface such as wildfire, windthrow, and storm damage. The Urban Forest Management Plan will provide a better understanding of the state of West Vancouver's urban forest and identify strategies to maximize the benefits and minimize the risks the urban forest poses to the community.

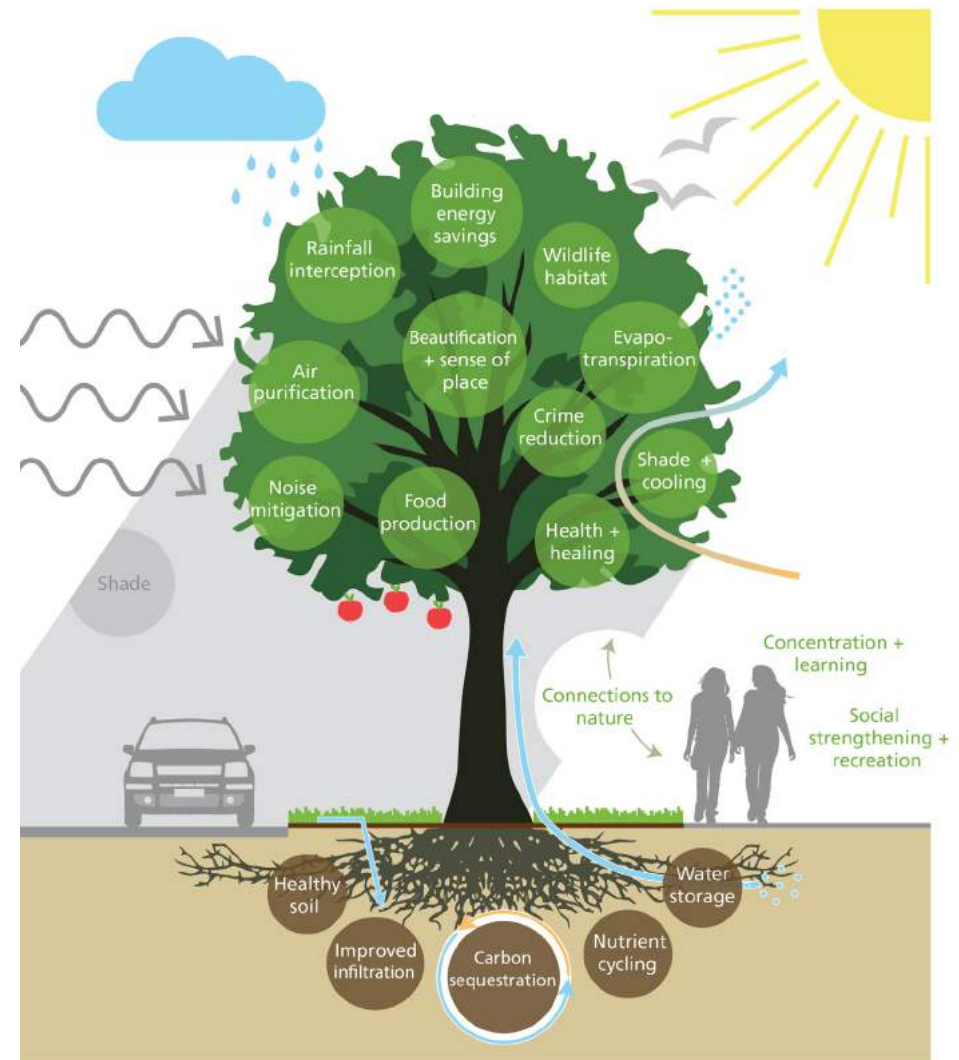


Figure 3. Some of the numerous benefits provided by the urban forest in West Vancouver.

¹ You can learn more about the academic research about the urban forest's ecosystem services on the Green Cities: Good Health website at <http://depts.Washington.edu/hhwb/>

How do we maximize tree benefits?

Similar to human-built infrastructure like roads or sewers, the urban forest is an asset that provides important services to West Vancouver. In 2019, the District of West Vancouver undertook a Natural Capital Asset study that quantified the value of many natural assets including the urban forest. Unlike hard infrastructure, natural capital assets generally appreciate over time as they grow, mature, and increase the size of their canopy and biomass.

Framing the management of West Vancouver's urban forest from an asset management standpoint requires planning for and managing existing assets to maximize the benefits and minimize the risks while providing a satisfactory level of service to the community at a sustainable cost. This report provides an overview of the District's knowledge of the state of its urban forest resource.

Who manages the urban forest?

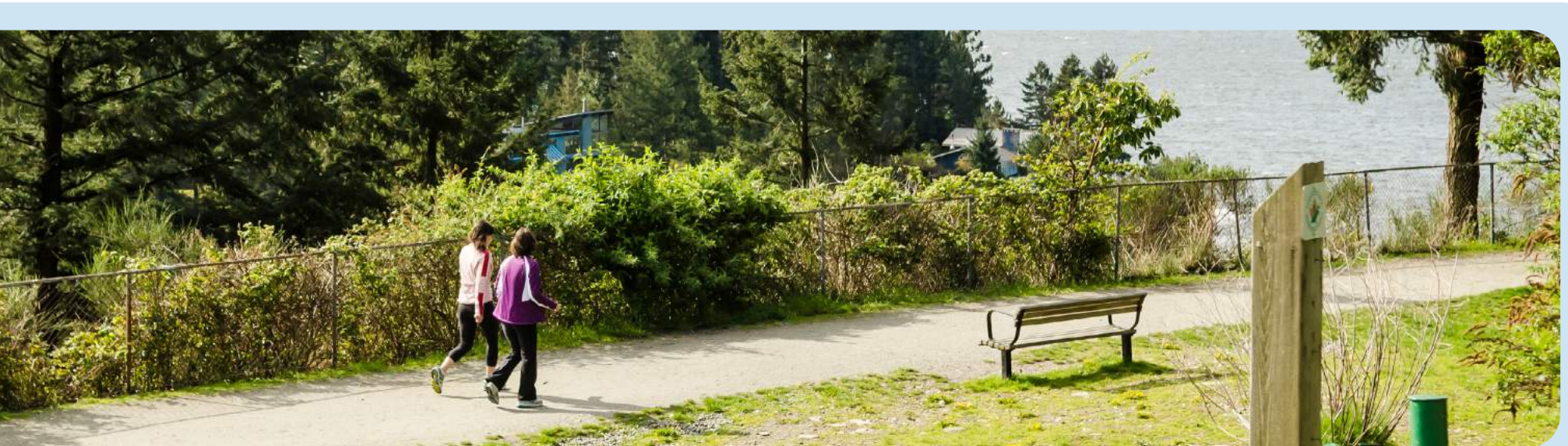
The urban forest spans both public and private land and, as a result, its management is a shared responsibility. In the natural world, ecological function, and connectivity flow across the landscape – biodiversity and other associated benefits are not limited by the bounds of governing jurisdictions and public and private trees share resources through underground root linkages.

The District manages trees on District land, such as those growing in parks and along road allowances. On private land and on public land that is not managed by the District, trees are managed by property owners and land managers. The District does regulate some private trees through the Tree Bylaw, which requires tree cutting permits for tree removal.

What is the Urban Forest Management Plan?

The District of West Vancouver is developing an Urban Forest Management Plan to guide the management of the urban forest for the next fifteen years. The strategic plan will include goals, objectives, and actions for trees on both private and public land that will be informed by community and staff engagement. Targets for canopy cover, planting initiatives, and strategies for mitigating additional tree canopy loss will fulfill the ongoing District objectives to mitigate environmental impacts, enhance ecological integrity and values, build long-term resilience, and preserve parks and trails as outlined in the Official Community Plan (OCP). The UFMP will be developed in three phases:

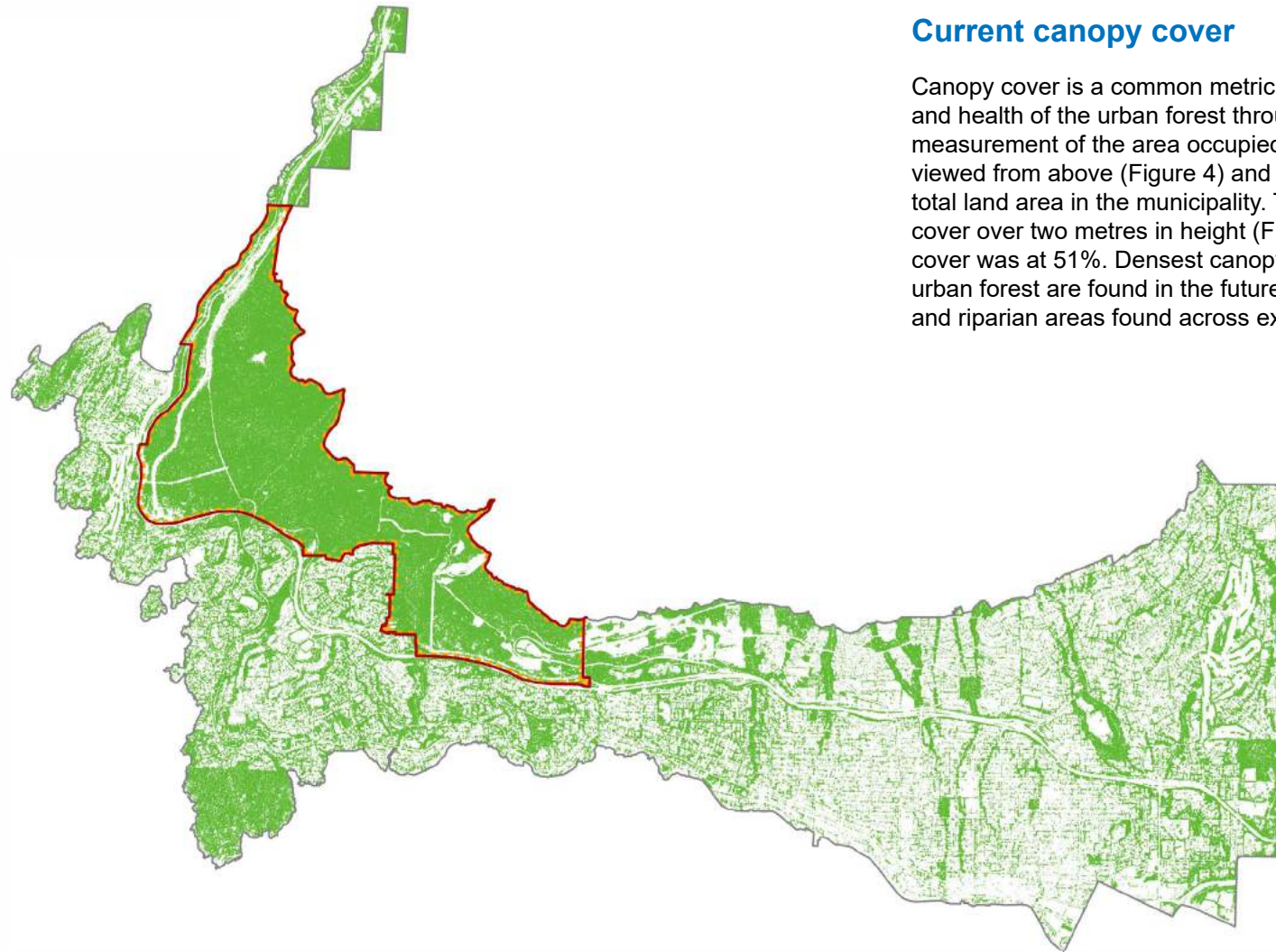
1. Background review and State of the Urban Forest report
2. Community engagement
3. Development of the Urban Forest Management Plan



2 URBAN FOREST RESOURCE

West Vancouver’s urban forest resource has undergone significant change over the last few centuries. What we now call the urban forest was once composed of towering old-growth forest and dense riparian ecosystems supporting salmon-bearing streams that have been stewarded by the

Squamish, Tsleil-Waututh, and Musqueam peoples since time out of mind. Today, native forests intermingle with non-native private and public trees in the urban interface to form West Vancouver’s urban forest. This section presents baseline metrics for West Vancouver’s urban forest.



Current canopy cover

Canopy cover is a common metric used in urban forestry to assess the extent and health of the urban forest through time and between jurisdictions. It is the measurement of the area occupied by tree crowns (upper leafy surface) when viewed from above (Figure 4) and is often expressed as a percentage of the total land area in the municipality. Tree canopy cover includes all canopy cover over two metres in height (Figure 5). In 2021, the urban forest canopy cover was at 51%. Densest canopy cover areas within West Vancouver’s urban forest are found in the future neighbourhoods as well as within parks and riparian areas found across existing neighbourhoods.

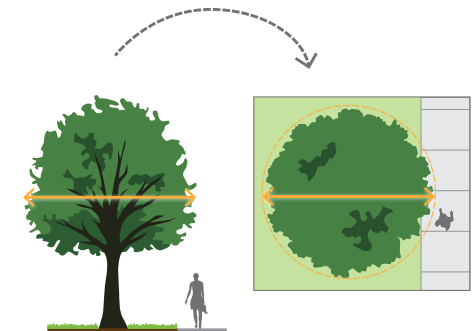


Figure 4. Canopy cover is the area occupied by tree crowns when viewed from above.




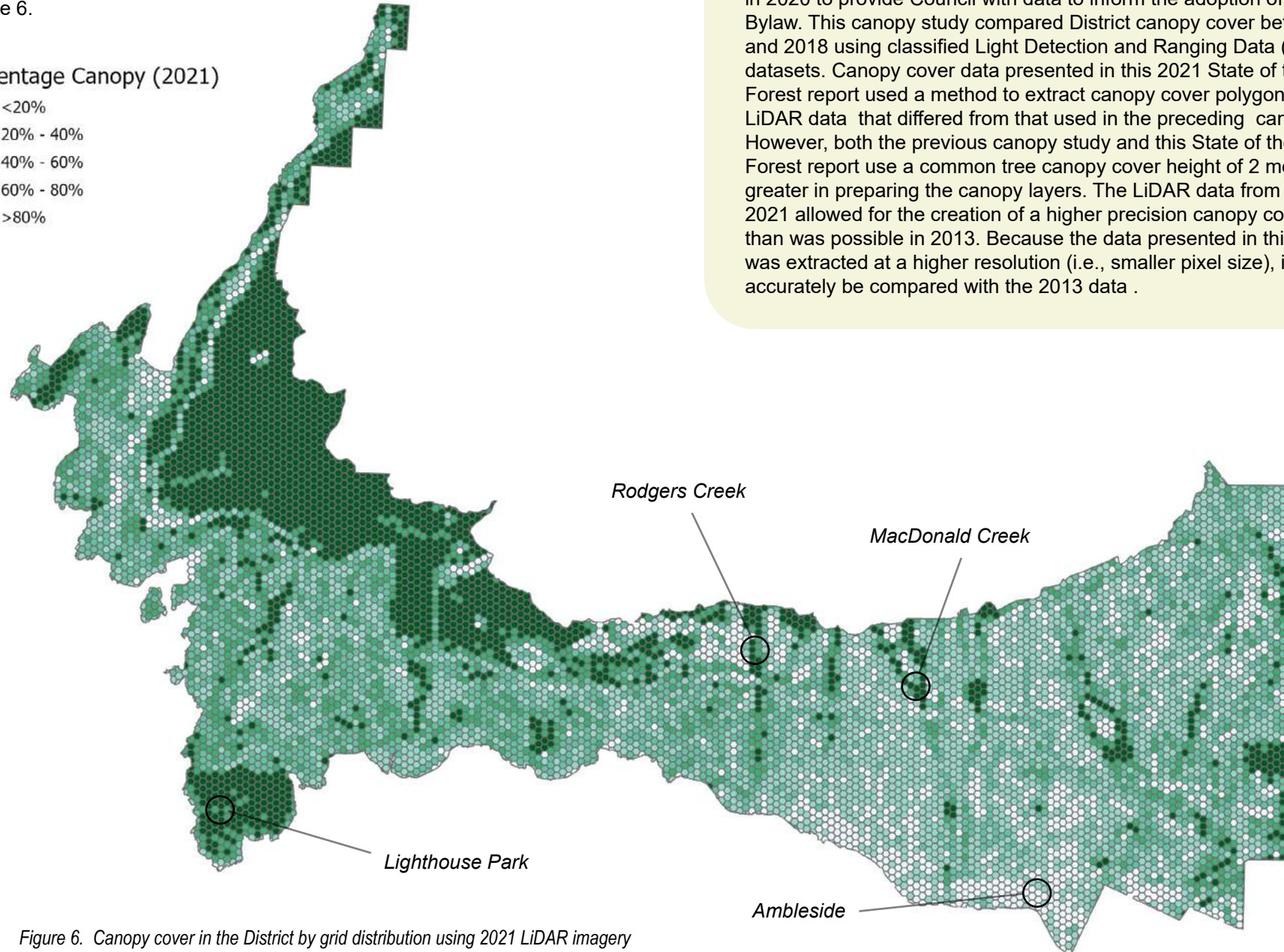
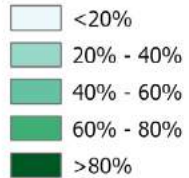
-  Undeveloped lands below 1,200 ft
-  Urban Containment Boundary
-  2021 Canopy Cover

Figure 5. Tree canopy cover (i.e., canopy cover of at least two metres in height) distribution across West Vancouver’s Urban Containment Boundary in 2021.

Current canopy cover continued

Urban forest canopy cover is highest in the undeveloped lands below 1,200 feet area and large parks such as Lighthouse Park or Whytecliff Park or alongside riparian corridors in existing neighbourhoods. Canopy cover is lowest within the urban core of Ambleside and Dundarave, as seen in Figure 6.

Percentage Canopy (2021)



Canopy cover data comparison with previous studies

A tree canopy study was conducted by the District of West Vancouver in 2020 to provide Council with data to inform the adoption of its Tree Bylaw. This canopy study compared District canopy cover between 2013 and 2018 using classified Light Detection and Ranging Data (LiDAR) datasets. Canopy cover data presented in this 2021 State of the Urban Forest report used a method to extract canopy cover polygons from the LiDAR data that differed from that used in the preceding canopy study. However, both the previous canopy study and this State of the Urban Forest report use a common tree canopy cover height of 2 metres or greater in preparing the canopy layers. The LiDAR data from 2018 and 2021 allowed for the creation of a higher precision canopy cover layer than was possible in 2013. Because the data presented in this report was extracted at a higher resolution (i.e., smaller pixel size), it cannot accurately be compared with the 2013 data.

Figure 6. Canopy cover in the District by grid distribution using 2021 LiDAR imagery

Canopy change (2018 – 2021)

Between 2018 and 2021, canopy cover decreased by about 2% (an estimated 69 hectares) within West Vancouver's Urban Containment Boundary (Figure 7). Scattered canopy cover loss across existing neighbourhoods accounted for 55 hectares, with the remaining 9 hectares concentrated within Rodgers Creek and undeveloped lands below 1,200 ft. The canopy loss detected was significant, however, the total area may be somewhat over-estimated due to LiDAR data collection differences between comparison years.

To look more closely at areas of canopy cover change, the UCB was divided into the BC Assessment Area neighbourhood boundaries to provide a greater level of detail consistent with the previous canopy cover study. For clarity, a map of the neighbourhoods is provided in Appendix B. Figure 8 on the following page illustrates the canopy gains and losses throughout the UCB summarized on a one-hectare grid. There are few pockets of significant canopy cover gain across West Vancouver's urban forest, although no neighbourhood reported significant canopy cover gain between 2018 and 2021. The highest and most concentrated canopy cover loss occurred in the Rodgers Creek neighbourhood where previously forested land is being developed into a new subdivision of housing.

In addition to Rodgers Creek, three existing neighbourhoods experienced statistically significant canopy loss: Westmount 8, British Properties 19, and Sunset Beach 2. In the Westmount 8 and British Properties 19 neighbourhoods as well as in other more localised areas of canopy loss, the canopy cover change appears to be primarily the result of redevelopment. In Sunset Beach 2, canopy loss is primarily the result of vegetation clearing under the powerlines.

Canopy cover change

Standard Error: 0.04

95% CI: [-1.8 -2.0]

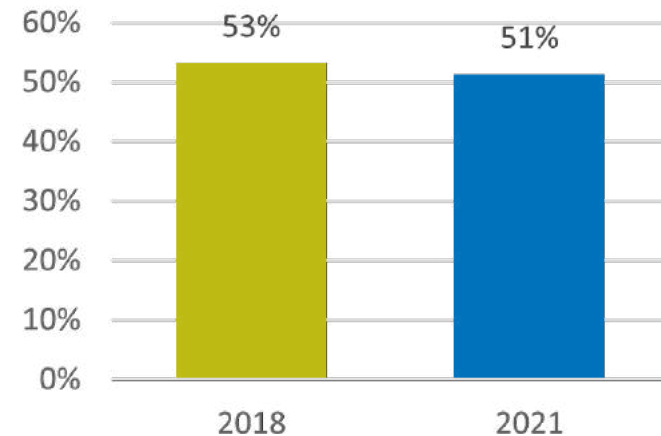


Figure 7. Canopy cover change in the Urban Containment Boundary between 2018 and 2021.

Assessing the impact of data seasonality on canopy change trends

LiDAR data collected in the spring before deciduous tree leaves are out (2021) can lead to underestimates of canopy cover compared to data collected leaf-on (2018). Statistical methods were employed for the comparison of the 2018 and 2021 canopy datasets to discern the proportion of missing canopy area attributable to seasonality of the 2021 LiDAR dataset. Change in the Urban Containment Boundary was analyzed using a Student's t-test approach to identify the proportion of canopy cover loss attributable to seasonal defoliation. It was determined that the loss of canopy area between 2018 and 2021 was attributable to real loss of canopy at a 95% confidence level.

Change was identified as statistically significant in subset areas based on standard error calculations which were used to rule out change resultant of the seasonality of the 2021 dataset (i.e., canopy loss related to an underestimation of canopy cover in the 2021 'leaf-off' dataset as compared to the 2018 'leaf-on' dataset).

Canopy change (2018 – 2021) continued

Examples of canopy cover loss are shown for neighbourhoods that experienced significant canopy cover loss between 2018 and 2021 in Figure 8. For those examples, canopy cover is shown as:

- Canopy cover (2021)
- Canopy loss (2018 to 2021)
- Canopy gain (2018 to 2021)

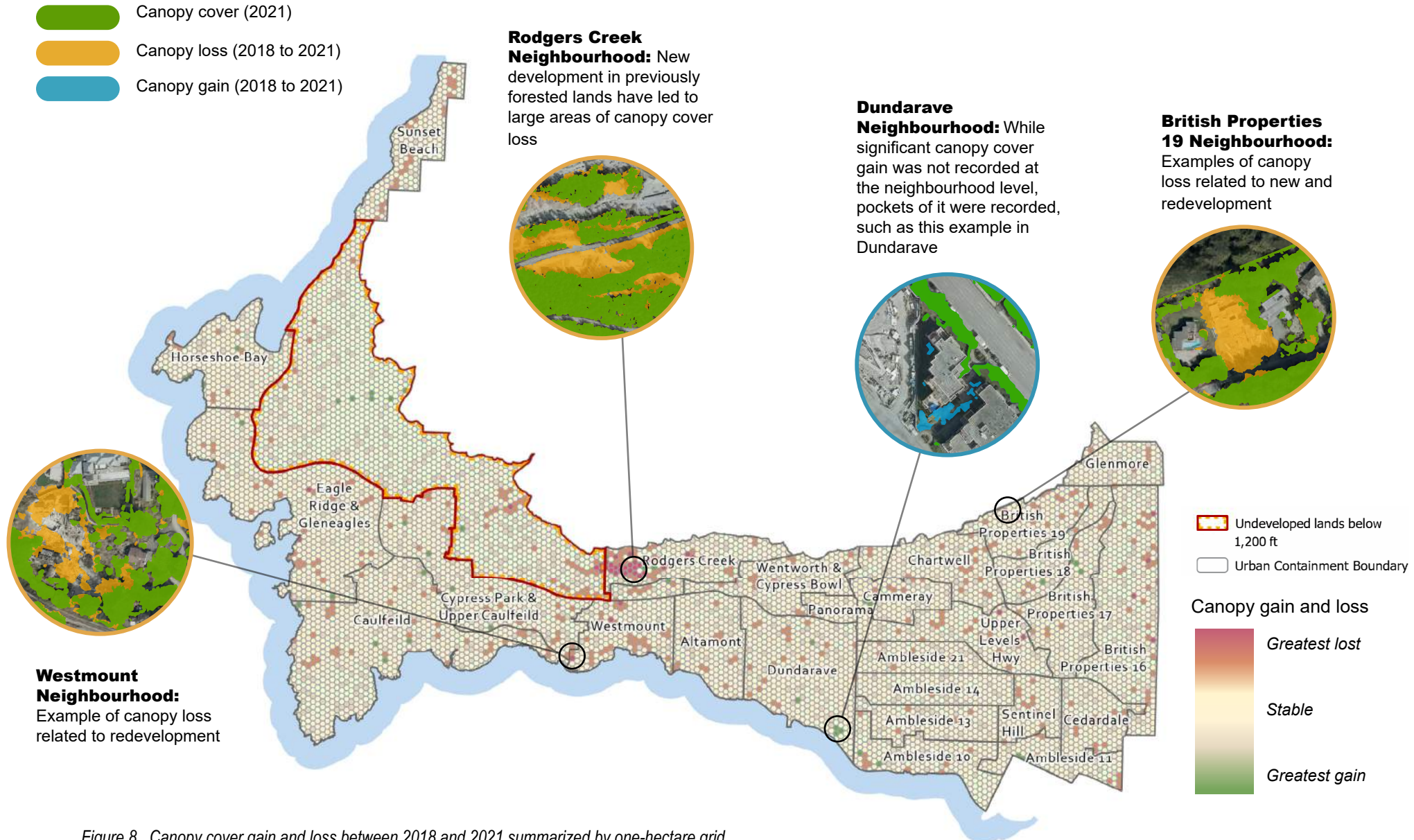


Figure 8. Canopy cover gain and loss between 2018 and 2021 summarized by one-hectare grid.

Native Forest Health Changes

Challenges to the health of West Vancouver’s native forest due to changes to the climate, pests, and diseases have been observed over recent years. The Province of BC’s Aerial Overview Survey is a fly-over survey conducted across the province to identify the location and severity of forest health impacts [1]. The 2018 and 2019 surveys identified four larger areas across the District experiencing drought mortality in Douglas-fir and western redcedar as well as the presence of Douglas-fir beetle and fire damage (Figure 9).

Outside of the urban forest and Urban Containment Boundary, hemlock looper moths have affected native western hemlock forests within the

Regional Capilano Watershed and similar impacts may continue to increase within the District’s native forest stands. In 2018, a low severity Douglas-fir beetle outbreak combined with drought-related decline was detected from the Province of BC’s Aerial Overview Survey in the Upper Lands forest and the Rodgers Creek area north of Cypress Bowl Road. According to the provincial survey, the outbreak area affected Douglas-fir and western redcedar trees between the Highview Lookout and Cypress Provincial Park Picnic Area along Cypress Bowl Road. The decline of western redcedar is being observed throughout the coastal region due to increasing drought events during the summer months.

The 2019 Provincial Aerial Overview Survey identified a drought-related decline in western redcedar within the District-managed Lighthouse Park and canopy loss was observable between 2018 and 2021 using LiDAR data. Though the amounts of decline observed were trace, the increasing length of drought-related events during hot summer months is projected to continue to increase pressure on our native and culturally significant tree. Significant decline has already been observed on Vancouver Island and along the coastline of British Columbia.

The 2018 survey also identified a forest area significantly impacted by a wildfire in a small forest area in Whyte Lake Park. The District of West Vancouver has undertaken work to identify areas of wildfire risk and implement measures such as a development permit areas and fuel management on public lands.

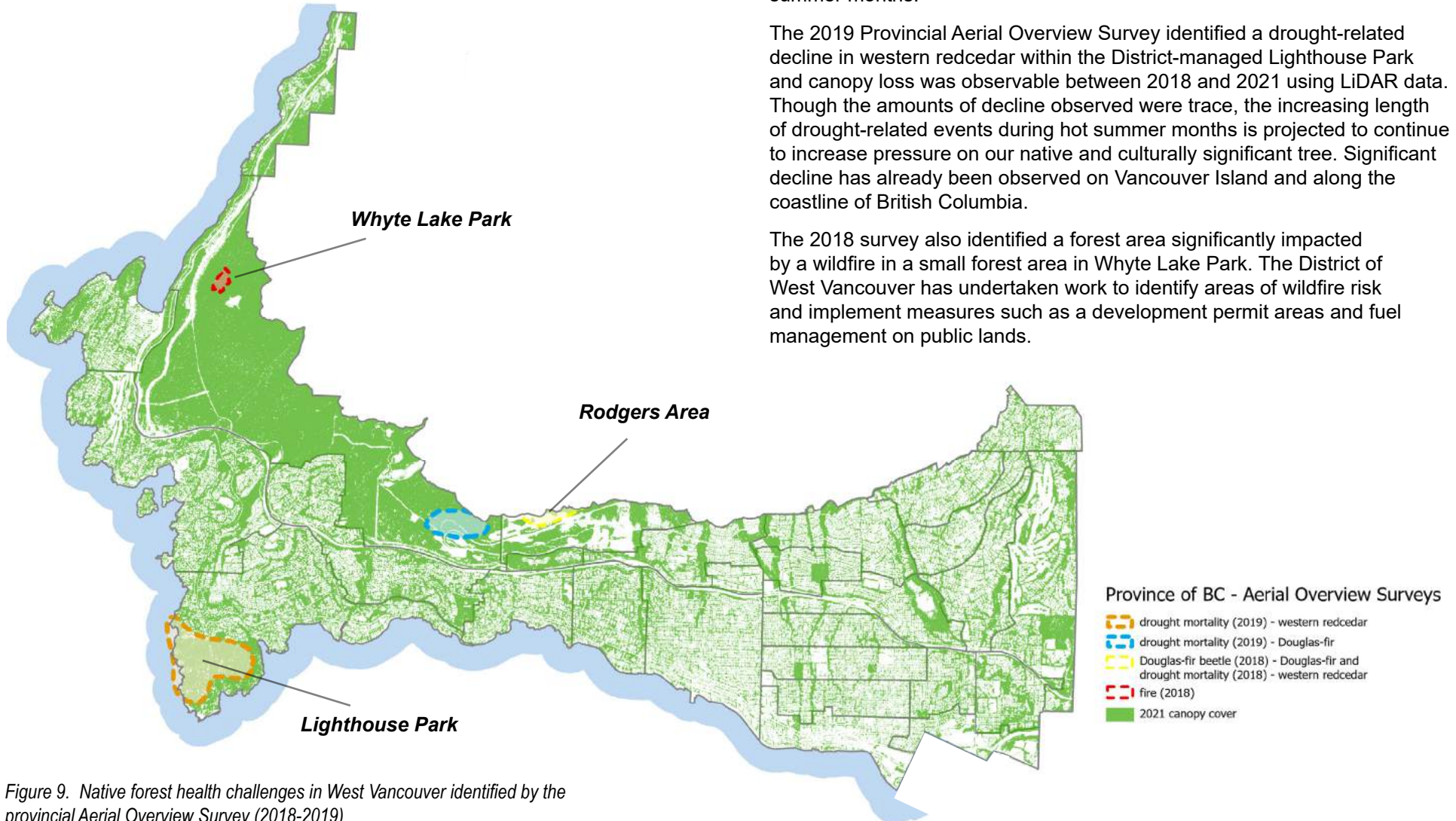


Figure 9. Native forest health challenges in West Vancouver identified by the provincial Aerial Overview Survey (2018-2019)

Neighbourhood canopy cover

The District’s western neighbourhoods generally have a higher canopy cover than neighbourhoods in the east. The neighbourhoods of Sunset Beach, Caulfeild, Horseshoe Bay, and Cypress Park & Upper Caulfeild are above the UCB average canopy cover of 51% (Figure 10). Caulfeild has the largest proportion of canopy cover overall, a significant proportion of which is found on District land, particularly in Lighthouse Park. Neighbourhoods in the urban core contain the lowest canopy cover, with the canopy cover in lower Ambleside sitting at only 19%, 32% below the UBC average (see Ambleside 10 in Figure 11 on the following page).

many West Vancouver neighbourhoods remained relatively stable, a few neighbourhoods experienced significant canopy cover loss including **Rodgers Creek, Westmount, and British Properties 19**. Rodgers Creek experienced the most canopy loss due to forest clearing related to new development in Area 6, while canopy cover loss in Westmount and British Properties 19 appears to be primarily the result of redevelopment. The denser urban core neighbourhoods of Ambleside and Dundarave are some of the lowest canopy cover neighbourhoods in the District and had the most stable canopy cover overall between 2018 and 2021.

According to LiDAR canopy data, no neighbourhood experienced significant canopy cover gain between 2018 and 2021. While canopy cover in

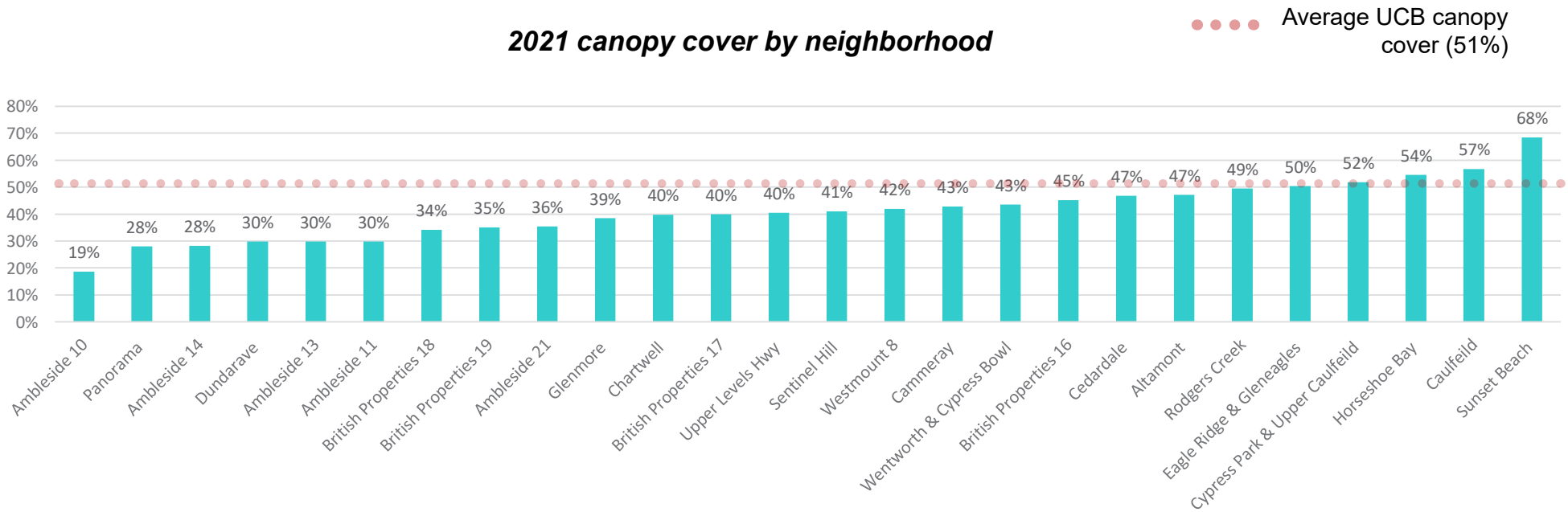


Figure 10. 2021 canopy cover by District neighbourhood, from least to most canopy cover.

Neighbourhood canopy cover continued

Canopy Percent

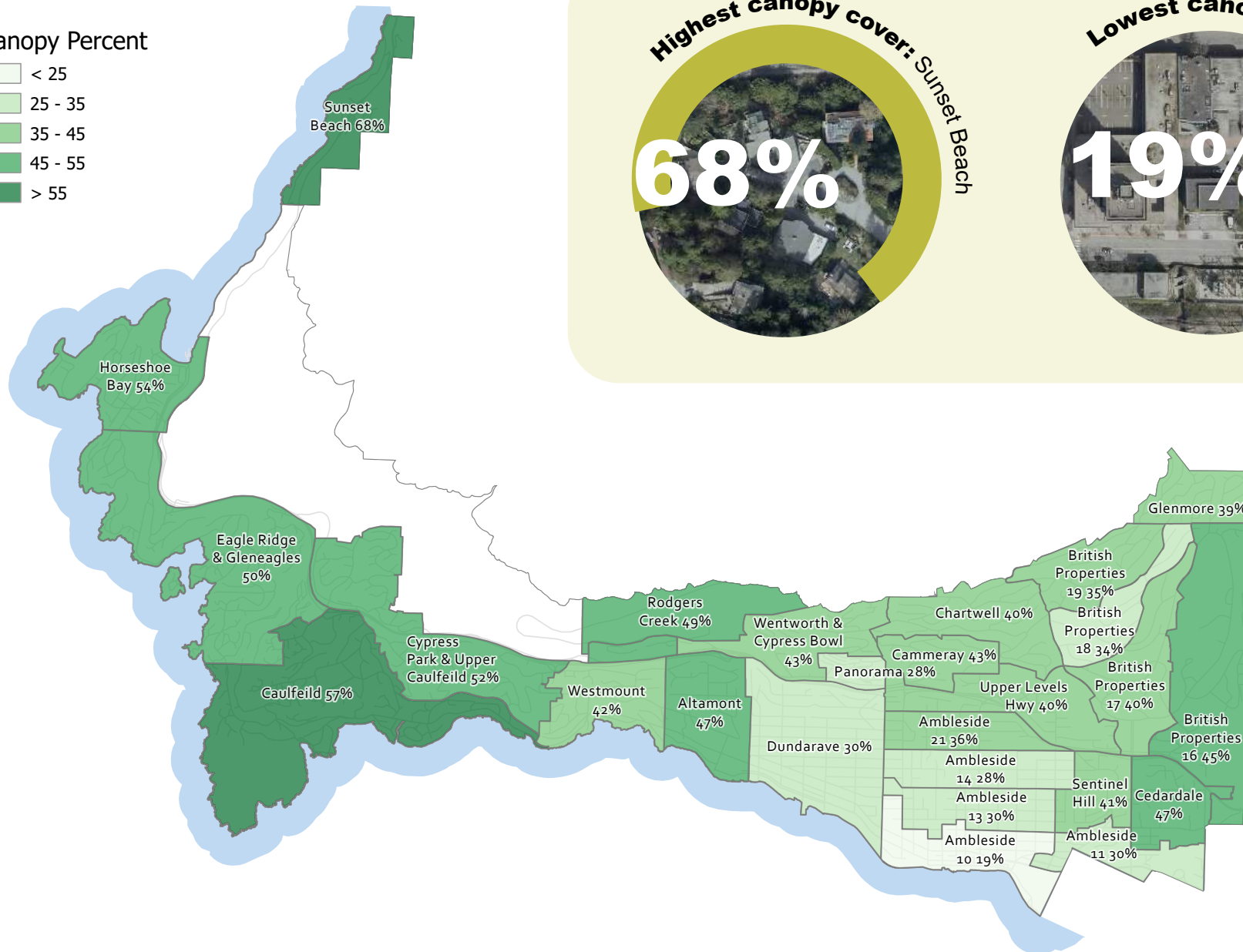
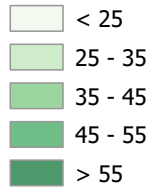


Figure 11. 2021 canopy cover by District neighbourhood. Existing neighbourhoods were subdivided into the BC Assessment Area neighbourhood boundaries to provide a greater level of detail consistent with the previous canopy cover study.

Canopy cover by ownership

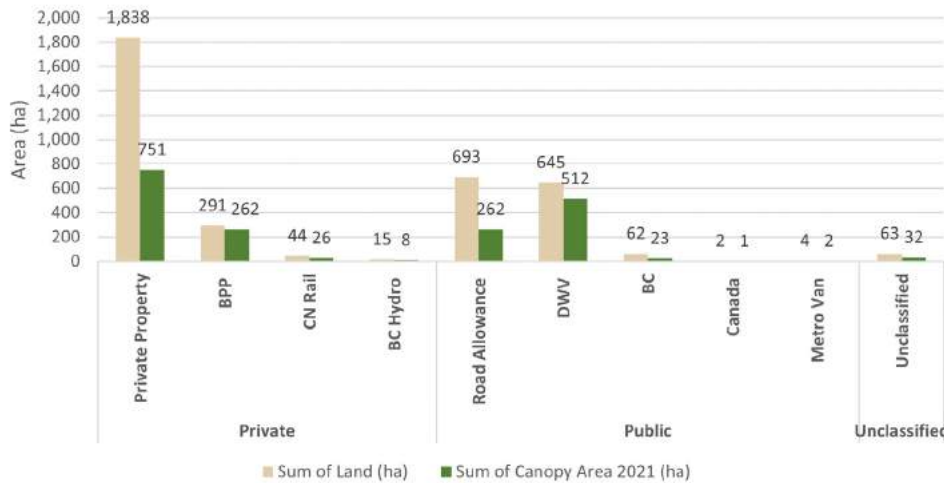
Many stakeholders are responsible for managing the urban forest across public and private land within the Urban Containment Boundary. Privately-owned land accounts for 60% of the land base and the remaining 40% is publicly owned and managed primarily by the District of West Vancouver, along with other levels of government. Figure 12 provides an overview of the land, canopy area, and canopy cover percentage of publicly and privately-owned land in West Vancouver.

Overall, canopy cover on private land is at 48% compared to 57% on public lands. Yet, there is more canopy cover area provided on private land because 60% of the District is privately-owned (Figure 12). Land owned by British Pacific Properties (BPP), in the Future Neighbourhood area, and District-

owned land have the highest proportion of canopy cover of all ownership categories at 90% and 79% canopy cover, respectively (Figure 12). For BPP lands, much of the canopy is found in the forested lands for the undeveloped future neighbourhood area.

Between 2018 and 2021, canopy cover on public land was relatively stable. However, a loss of canopy cover was detected on private lands. This indicates that the canopy cover loss detected within the Urban Containment Boundary between 2018 and 2021 has predominantly occurred on private land.

Land and canopy area ownership



Canopy cover by ownership

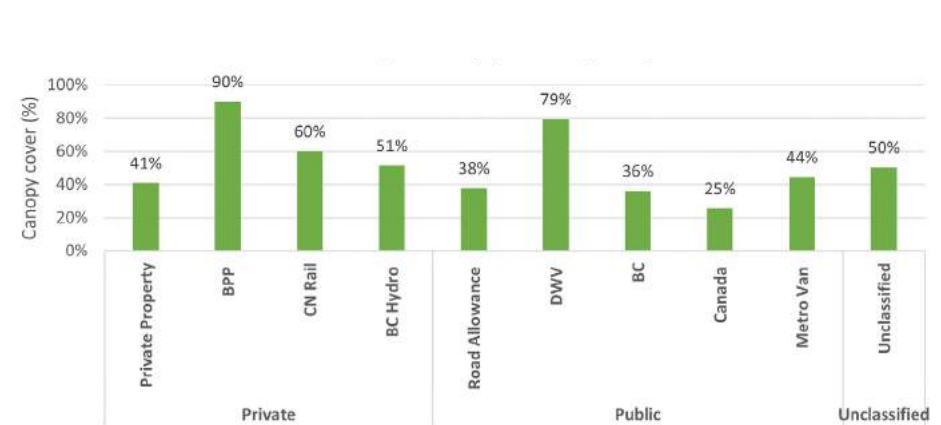


Figure 12. (Left) land and canopy area by ownership within the UCB and (right) 2021 canopy cover by ownership within the UCB.

District of West Vancouver trails received 5.5 million visits in 2020 alone.

The District manages public trees within an extensive park and trail system and has seen increased demand in some of its most popular trails between 2019 and 2020. Overall, trail use has increased by just short of one million park users between 2019 and 2020 alone.



Canopy cover height

West Vancouver's canopy cover includes canopy contributions from all trees greater than two metres in height. A breakdown of canopy cover by height was completed through a previous District canopy cover study to provide context for the Tree Bylaw within existing neighbourhoods. The analysis provided estimates of the proportion of total canopy that fell within distinct height classes.

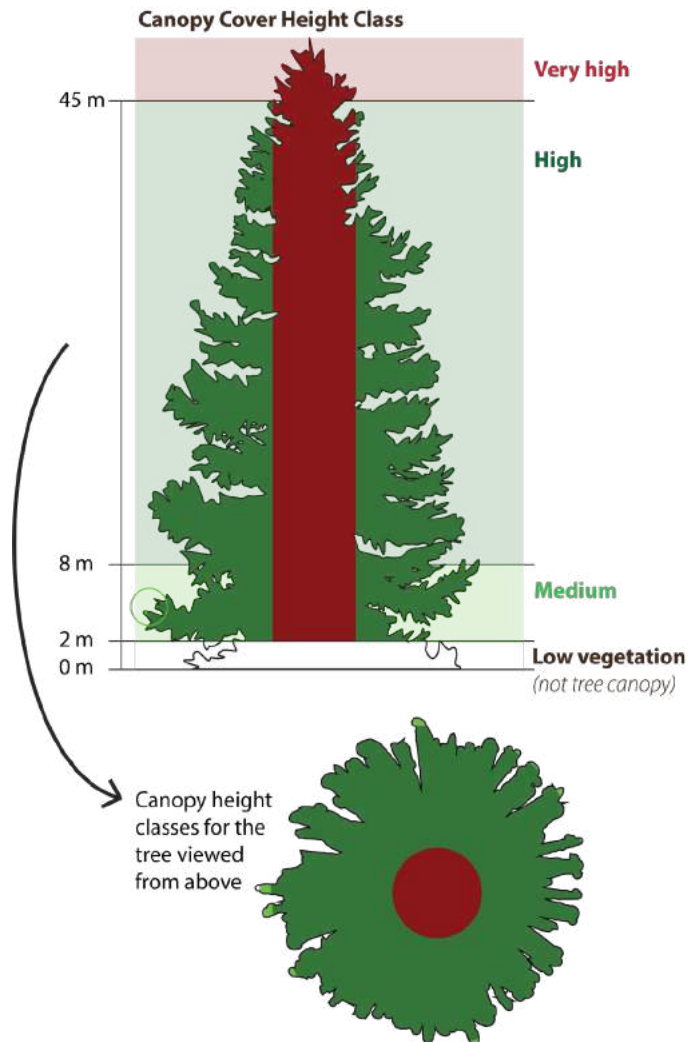


Figure 13. Example of canopy cover height classes for a single tree.

'Medium', 'high', and 'very high' canopy cover, as measured in 2021 across existing neighbourhoods, is mapped in Figure 14 for existing neighbourhoods within the Urban Containment Boundary. Overall:

- **'High'** canopy cover (8-45 metres) makes up 62% of West Vancouver's canopy cover
- **'Medium'** canopy (2-8 m) makes up another 38%
- **'Very high'** canopy (>45 m) makes up 1%.

Limitations of the analysis:

This height analysis does not provide an estimate of the canopy area provided by individual trees that reach the 'medium', 'high', or 'very high' height class. Rather, it provides the proportion of total canopy cover that falls within each height class, as measured across the District. As a result, individual trees that reach the 'high' or 'very high' canopy height class are likely to also support canopy cover in one or more of the lower height classes.

Figure 13 illustrates an example of a very tall tree. This tree's canopy cover, which is a representation of the tree as observed from above, would identify a small area of 'very high' canopy and 'medium' canopy, with most of the canopy falling within the 'high' canopy cover class. The loss of that single tree would be recorded as loss of 'very high', 'high', and 'medium' height canopy cover, respectively.

In future studies, methods to segment canopy cover by individual trees could allow the District to better understand the contribution of canopy cover by trees of various heights. Individual trees could be assigned a height class based on the tallest canopy found within the tree (i.e., 'very high' for the example in Figure 13). Reporting on tree height as opposed to canopy height would provide a better understanding of the canopy cover contribution from trees of various heights classes to inform future updates to tree regulations in West Vancouver.

Canopy cover height continued

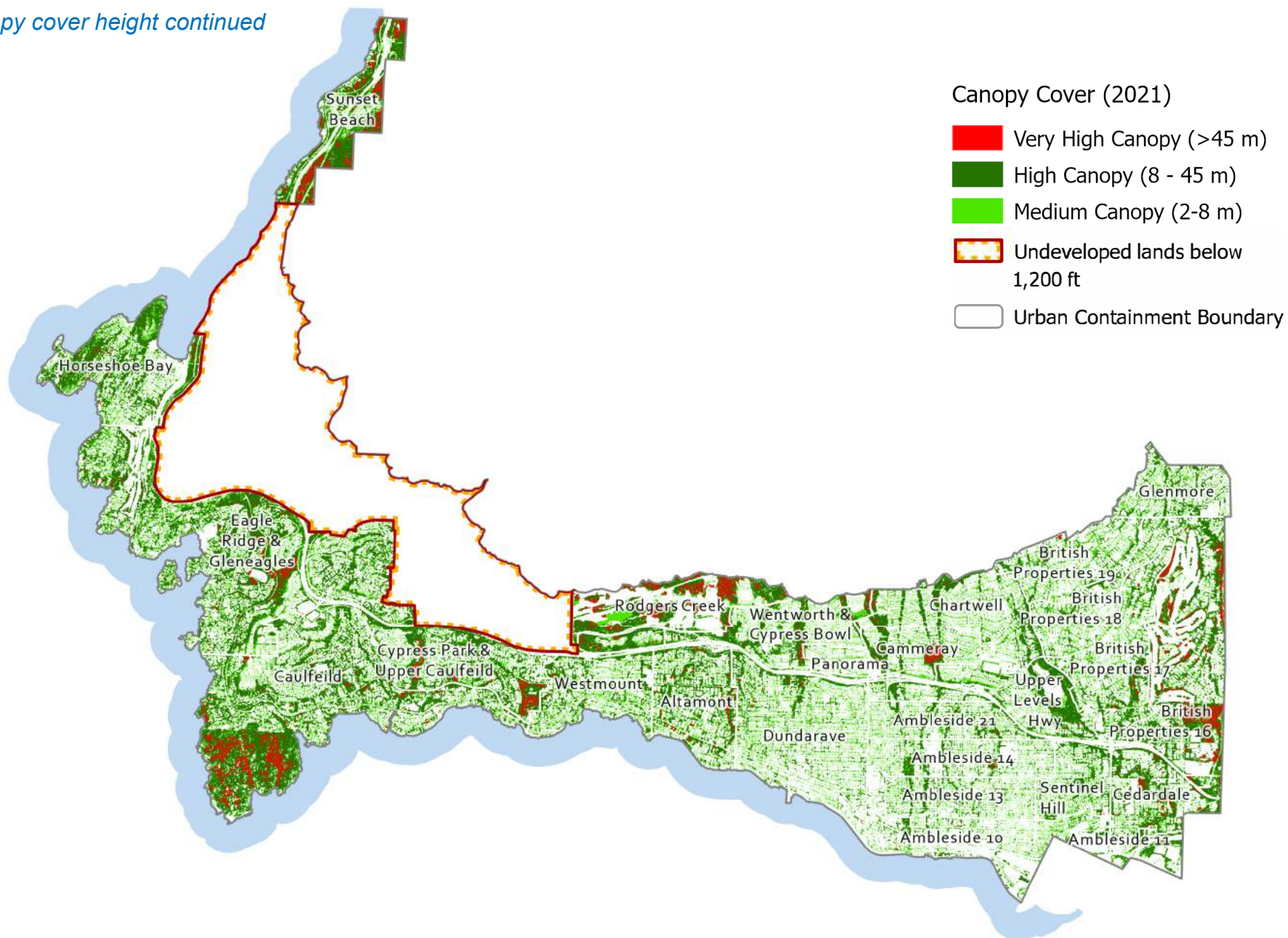


Figure 14. The distribution of 2021 canopy cover within existing neighbourhoods for 'medium', 'high', or 'very high' canopy cover. 'Low' vegetation cover (below 2 metre height) is not considered tree canopy and was excluded from this study.

Canopy cover height continued

Figure 15 provides an overview of the relative proportion of each canopy cover height class for existing neighbourhoods in West Vancouver. The neighbourhoods of Sunset Beach 2, British Properties 16, and Caulfield 4 provide the greatest area of very high canopy cover. Neighbourhoods in the urban core such as Ambleside and Dundarave have higher proportions of medium height canopy cover.

Proportion of neighbourhood canopy cover by height class (2021)

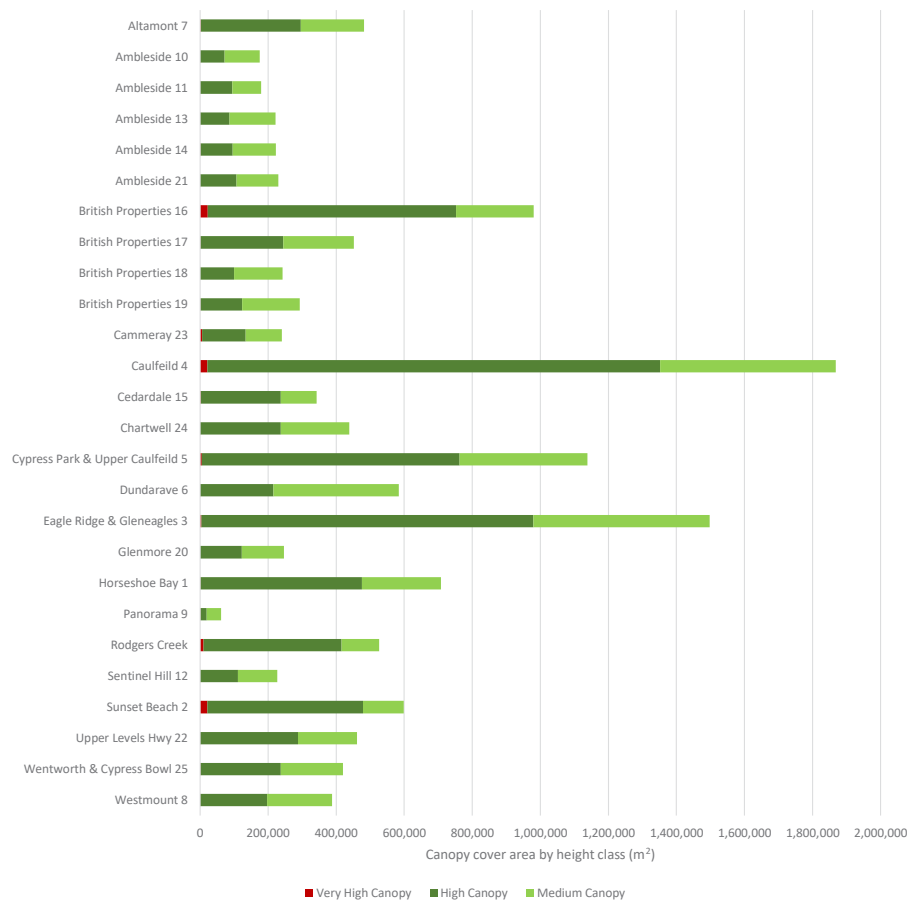


Figure 15. Canopy cover area by height class across West Vancouver neighbourhoods, as defined by BC Assessment.

Where statistically significant loss of canopy cover was not recorded in the canopy change analysis between canopy measurements, changes in canopy area for medium or high canopy height classes likely denote the growth of trees into taller classes. **Between 2018 and 2021, no significant change in height classes was detected for the existing neighbourhoods and very high canopy cover was found to be stable.**

At the neighbourhood level, Rodgers Creek Area lost a statistically significant amount of medium and high canopy cover as a result of forest clearing for new development. In other existing neighbourhoods where statistically significant canopy cover loss was recorded between 2018 and 2021 (Westmount 8, British Properties 19, and Sunset Beach 2), significant changes in very high and high canopy were recorded (Figure 16).

Statistically significant change of canopy height

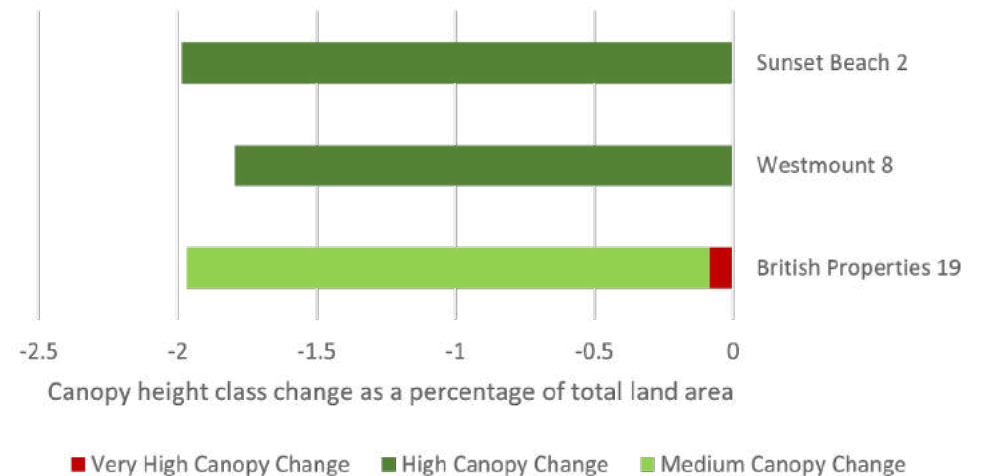


Figure 16. Percentage change of height class as a proportion of total existing neighbourhood canopy cover in neighbourhoods that experienced canopy cover loss between 2018 and 2021.

Significant forest stands

Native forest ecosystems are important components of the urban forest and provide the most significant ecosystem services to the community. Because older tree stands usually include taller trees, canopy cover height data can provide insights about the age for natural forest stands found across the urban forest.

Canopy cover height remains an imperfect metric because tree height is also influenced by site conditions but can nonetheless provide good insight about the distribution of significant forest stands.

Figure 17 identifies all trees taller than 45 metres captured in the 2021 LiDAR data across West Vancouver and overlays them with the regional Sensitive Ecosystem Inventory (SEI). Metro Vancouver’s SEI identifies habitats throughout the Metro Vancouver region using aerial imagery and field sampling – pairing the tall trees and sensitive ecosystems provides a high-level snapshot of the distribution of significant forested ecosystems.

In West Vancouver, tall trees and significant mature forest stands dominate Cypress Falls Park and Nelson Canyon Park areas, particularly along riparian forest corridors, as well as within Lighthouse Park. Some of the riparian forests in residential neighbourhoods such as Cypress Creek in the Cypress Park & Upper Caulfeild neighbourhood also have significant clusters of tall trees.

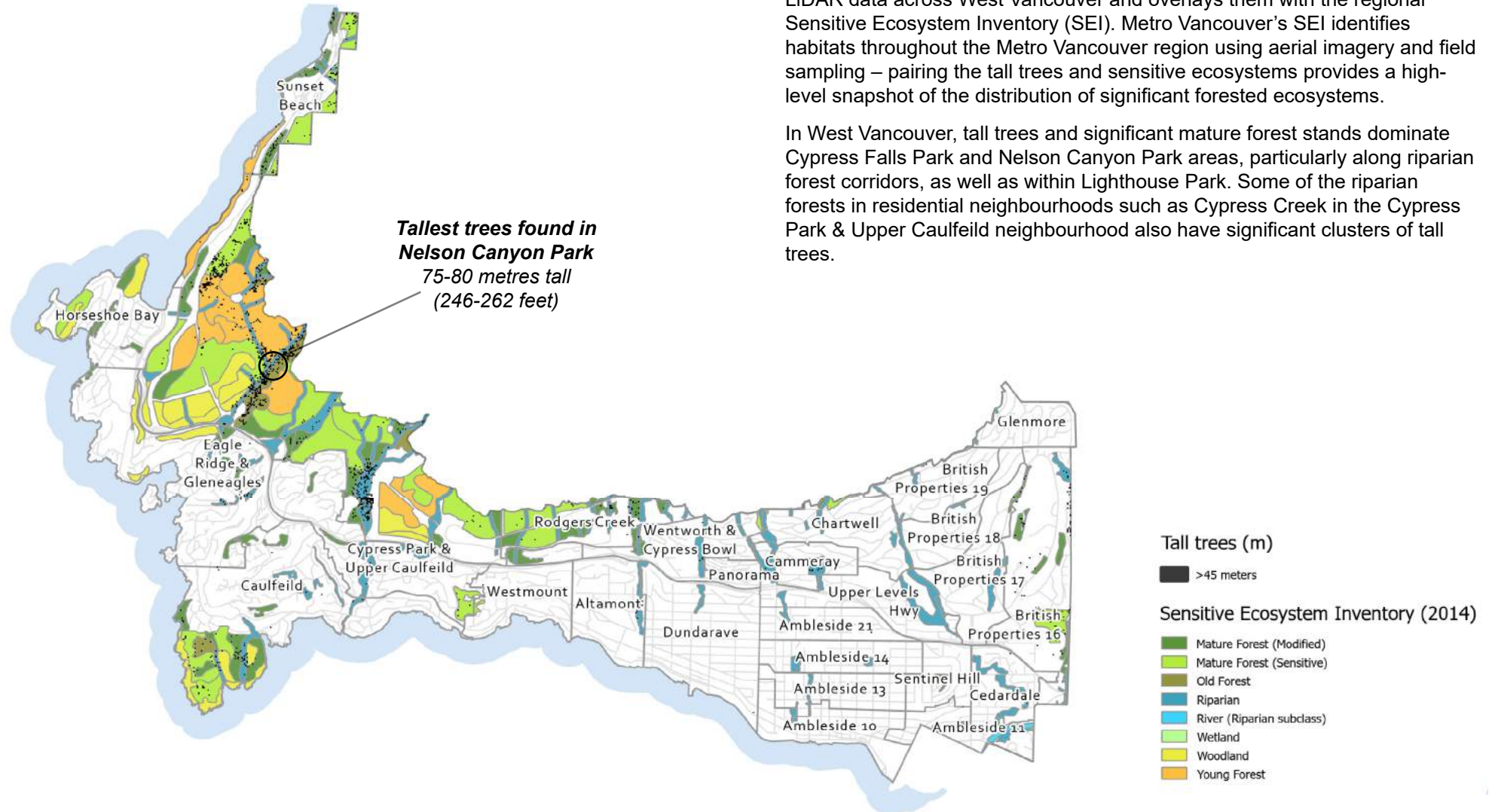


Figure 17. Significant forest stands were identified throughout West Vancouver’s urban forest based on the presence of tall trees using height information from the 2021 LiDAR data combined with Metro Vancouver’s Sensitive Ecosystem Inventory (2014 update).

Ecosystem services

In the District's 2019 study on natural capital, the urban forest was found to deliver an estimated 606.7 million dollars in total benefits for services that include clean water supply and filtration, stormwater management, clean air, carbon sequestration, habitat, and recreation (Table 1). Numerous intangible benefits are equally as important as the monetarized services, such as providing aesthetic value to the community, strengthening social connections, and establishing a spiritual connection with the land.

According to the 2019 Natural Capital data, annual urban forest benefits based on the 2018 canopy cover data range from 6.4 to 18.2 million dollars, which is equivalent to \$0.33 to \$0.94 per square metre of canopy cover. In comparison, the District allocated a \$578,000 recurring operating budget (excluding staff wages) to manage its urban forest in 2021, which equates to approximately \$0.03 per square metre of canopy cover.

Table 1. Annual and cumulative values of services provided for West Vancouver urban forests from the District's Natural Capital Inventory (in thousands).

Ecosystem service	Low annual estimate (Thousands CAD)	High annual estimate (Thousands CAD)	Low estimate perpetuity (Thousands CAD)	High estimate perpetuity (Thousands CAD)
Clean water supply and filtration	\$4,555	\$11,513	\$151,837	\$383,773
Stormwater management	\$1,478	\$3,610	\$49,265	\$120,319
Clean air	\$31	\$1,192	\$1,028	\$39,741
Carbon sequestration	\$95	\$419	\$3,152	\$13,977
Habitat	\$8	\$70	\$274	\$2,330
Recreation	\$275	\$1,396	\$9,181	\$46,524
Total	\$6,442	\$18,200	\$214,737	\$606,662

Tree equity

Not everyone experiences the same benefits from the District's urban forest, particularly in the provision of climate regulating services such as cooling and shade during hot summer days, stormwater mitigation, and capturing pollutants. Certain populations are more vulnerable to climate change including households with lower income, minority groups, seniors and children, and those unemployed.

The American Forest's Tree Equity Score is one metric that helps municipalities assess the extent of equitable distribution of tree canopy cover and associated benefits to all residents in the community [2]. The Tree Equity Score is derived from a Priority Index value, a metric that prioritizes the need for tree canopy in a given census dissemination area to achieve equity in the distribution of the urban forest's ecosystem services [3]². The priority index is derived from income, age, race, and employment combined with land surface temperature which results in a priority index from 0 to 1 where 1 indicates the highest inequity and 0 indicates the lowest inequity.

Figure 18 below illustrates the Priority Index per census dissemination area within the District of West Vancouver. Scores are highest in the urban core (Ambleside) and within some of the existing British Properties neighbourhoods which indicate the need for more tree canopy in those neighbourhoods. Scores are lower in general in western census dissemination areas including within the Eagle Ridge & Gleneagles and Horseshoe Bay neighbourhoods which indicates a lower priority for more canopy cover.

The Priority Index will be used along with a gap in canopy cover measure based on the difference in current canopy cover and a target that accounts for the land use and population density to calculate a Tree Equity Score for each census dissemination area in West Vancouver. The Tree Equity Score will be presented in the Urban Forest Management Plan to inform priorities for planting and canopy growth and improve the distribution of and access to ecosystem services.

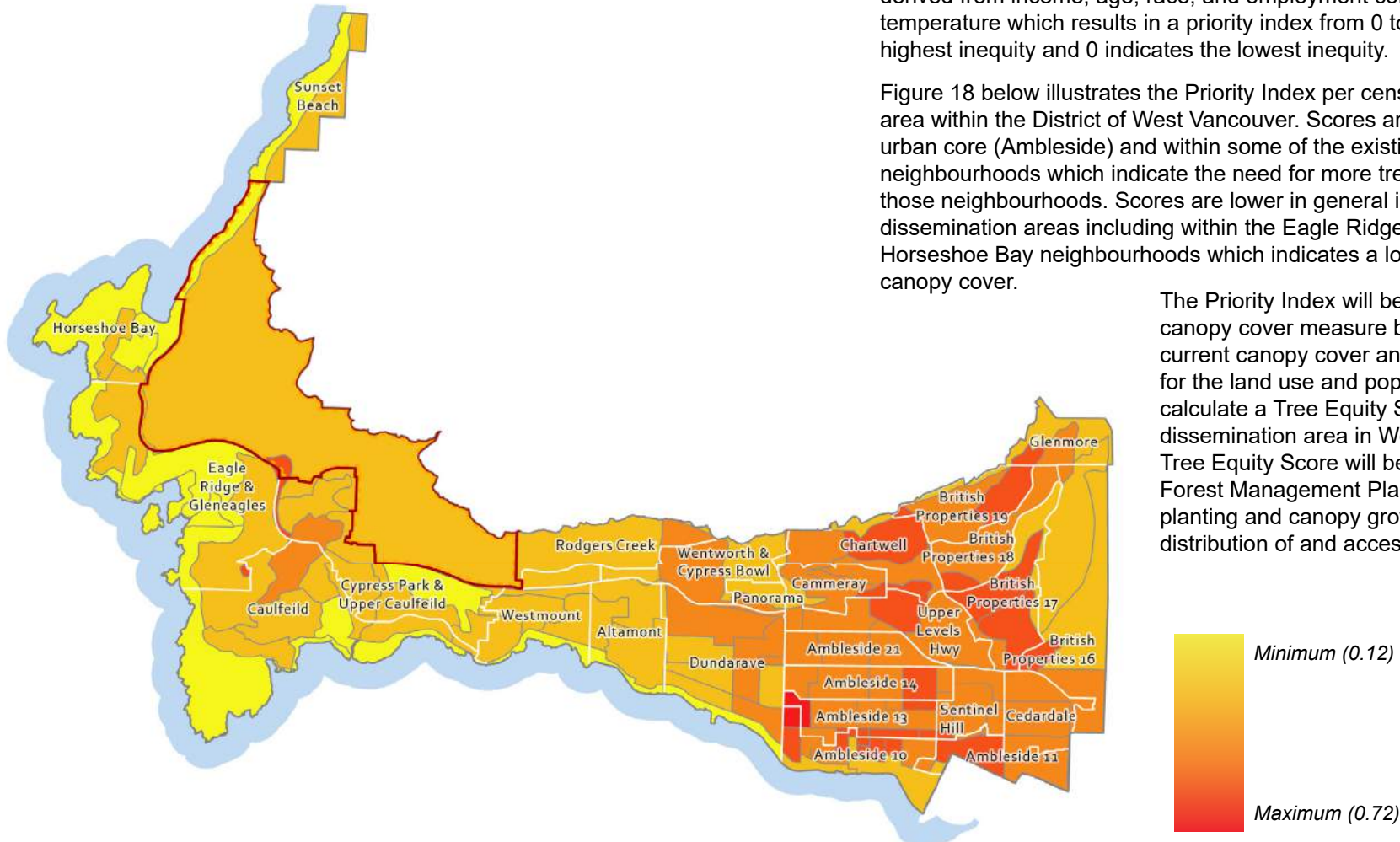


Figure 18. The Priority Index score, adapted from the American Forest's methodology, measured for census dissemination areas across West Vancouver is shown with neighbourhood boundaries for reference. The lightest colours show areas where there is less of a need for tree planting and darker colours show where there is a greater need.

2 Dissemination areas are relatively stable geographic units with an average population of 400 to 700 used in the Canadian Census .

Key findings on the urban forest resource

- **Canopy cover** has been fairly stable from 2018 to 2021, with the most significant loss coming from the Rodgers Creek neighbourhood where new development is being constructed on previously forested land. Some canopy cover loss was also observed in existing neighbourhoods primarily as a result of redevelopment on private land.
- **Native forest health** challenges have been observed in recent years due to drought mortality (most impacting Douglas-fir and western redcedar), the Douglas-fir beetle, and wildfire damage. Large-scale western hemlock looper decline was observed outside the District's Urban Containment Boundary in the Regional Capilano Watershed and a similar impact has been reported by staff within the District's urban forest.
- **'High' canopy cover** (8-45 metres) makes up the largest proportion of total 2021 tree canopy cover (62%), followed by 'medium' height canopy cover (2-8 m; 38%), while 'very high' canopy (>45 m) represents only 1% of total canopy cover. No statistically significant change in height classes was detected between 2018 and 2021 across existing neighbourhoods.
- **Changes in height classes** in Westmount 8, British Properties 19, and Sunset Beach 2 (neighbourhoods that experienced a statistically significant loss of canopy cover between 2018 and 2021) were measured primarily within the 'high' (8 to 45 m) and 'very high' (>45 m) canopy height classes, meaning that tree loss in those existing neighbourhoods was recorded primarily for trees taller than 8 metres.
- **Significant stands** of tall trees in sensitive ecosystems dominate Cypress Falls Park and Nelson Canyon Park, especially within riparian corridors and in Lighthouse Park. Residential neighbourhoods such as Cypress Park & Upper Caulfield and British Properties (16), among other neighbourhoods, also have clusters of tall trees.
- **Ecosystem services** provided by West Vancouver's urban forest were found to amount to 606.7 million dollars in total benefits for the provision of a clean water supply, stormwater management, clean air, carbon sequestration, habitat, and recreation.
- **Canopy cover distribution** is uneven across West Vancouver, with more canopy cover found in the western neighbourhoods. The priority index value that will inform West Vancouver's Tree Equity Score in the Urban Forest Management Plan also indicates that areas in the urban core and some of the existing British Properties neighbourhoods have a higher need for canopy cover benefits based on their surface temperature and presence of more vulnerable populations.

Future canopy cover studies

Limitations from the canopy cover data | Limitations of this canopy cover study and its comparability with the 2020 study are primarily related to changes in methodology and data seasonality. Changes in the methodology used to extract canopy cover data presented in this State of the Urban Forest report and an increase in the resolution of canopy cover data mean that the two studies cannot be accurately compared.

In addition, differences in the seasonality of the LiDAR data are expected to have influenced trends in canopy cover in both studies. LiDAR data collected in the spring before deciduous tree leaves are out (2013 and 2021) can lead to underestimates of canopy cover compared to data collected leaf-on (2018). To account for the effects of leaf-on/leaf-off data on this comparative analysis, statistical methods were employed in an effort to parse out canopy area differences attributable to seasonal defoliation rather than actual canopy area change. It would however be preferable to collect LiDAR data at a consistent time of year to reduce error.

Recommendations for future canopy cover studies | The canopy cover data presented in this report will set a robust, high-resolution baseline to monitor canopy cover over time. Future canopy cover studies should acquire LiDAR data collected leaf-on and maintain a consistent resolution (i.e., 0.5 metre pixel size).



3 MUNICIPAL URBAN FOREST PROGRAM

The management of West Vancouver's urban forest is shared between the departments of Planning, Parks, and Engineering (Figure 19). The Planning Department's Environmental Protection branch administers permits for public trees growing in street boulevards (Boulevard Bylaw) and private tree permits (Tree Bylaw and Environmental Development Permit Areas) as well as review of the design of new developments and their impact on trees. The Parks Department's Environment and Ecosystems branch manages street trees found in Business Improvement Areas, trees in parks, and trees in the Hollyburn Ridge cabin area. The Engineering Department's Roads branch responds to vegetation clearance requests for trees and hedges in boulevards and rights-of-way, and the Utilities group responds to emergency work for public trees in the boulevard when it impacts utilities in the rights-of-way. The Engineering Department also works with the Planning Department to review development applications concerning the location of service utilities and impacts on trees.

In total, approximately 1.5 full-time equivalent Parks staff manage the District's urban forest program in parks and trails and approximately 3 full-time equivalent staff manage tree work under the Tree and Boulevard Bylaws, tree work in environmental Development Permit Areas, and maintenance requests for boulevard trees, with \$258,000 allocated in operating budget for tree contractor services. The Engineering roads and utilities groups manage sightlines maintenance requests and emergency work within the city rights-of-way with 1.5 full-time equivalent staff and approximately \$320,000 in operating budget. In recent years, additional budget has been granted on an as-needed basis for the Parks Department to carry out tree removals for dead and dying trees hemlock and Western redcedar as a result of the western hemlock looper and drought impacts as well as to carry out reactive risk inspections upon residents' requests. Additional budget has also been required for the Planning Department to handle hazard tree maintenance requests on boulevards.

Additional staff are involved in other types of permit review and vegetation clearance, as shown on Figure 19. In 2021, the Roads branch spent a higher budget on contractors to do vegetation clearance on the rights-of-way than was allocated in operating budget to the Parks Department to manage the urban forest. A comparison of West Vancouver's urban forest program with other municipalities is provided in section five.





	Staffing <i>(full-time equivalent staff: FTE)</i>	Budget	Natural Areas Trees	Street trees	Landscaped Park trees	Private trees
Planning <i>(Environmental Protection)</i>	1 FTE arborist + 1 FTE temporary	\$108,000 operational budget		Boulevard trees permits & maintenance requests (except in BIAs)		Bylaw protected trees permits
	0.5 FTE Env. protection officers + 0.5 FTE manager					Bylaw protected trees & replacement requirements in DPAs
Parks <i>(Environment & Ecosystems)</i>	1 FTE forester + 0.5 FTE manager	\$150,000 operational budget \$50,000 additional operational budget for 2021 (hemlock/redcedar tree removals)	Maintenance	BIA street trees maintenance	Maintenance	Hollyburn cabin area maintenance
	Direction/horticulture 0.25 FTE				Occasional replacement planting	Caulfield covenants tree removal approvals
Engineering <i>(roads)</i>	≈1.5 FTE	\$320,000 operational budget (slashing and sightline tree cutting)		Sightline maintenance requests (boulevards & ROWs)		
Utilities	≈0.1 FTE			Respond to emergency work (utilities interference)		

Figure 19. Urban forest management responsibilities and resources across departments

Permits for Tree Cutting

The District’s Planning Department manages permits for the cutting and removal of trees on private land and public road allowances/boulevards. Staff have noted a significant increase in the number of inquiries for tree work from residents in recent years, which are not tracked unless there is a permit application. A second temporary arborist was hired in 2021 to help manage the volume of permit requests.

Data on the annual number of tree removal permits issued shows an increase in the number of permits issued to remove trees in watercourse development permit areas from 2017 to 2021 (Figure 20). Meanwhile, permits for the removal of other private trees and municipal trees have remained somewhat stable.

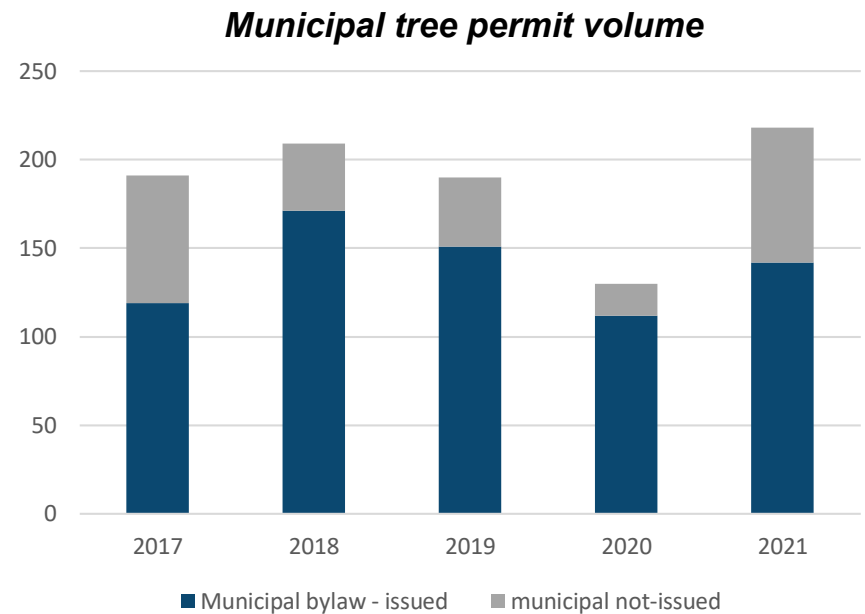
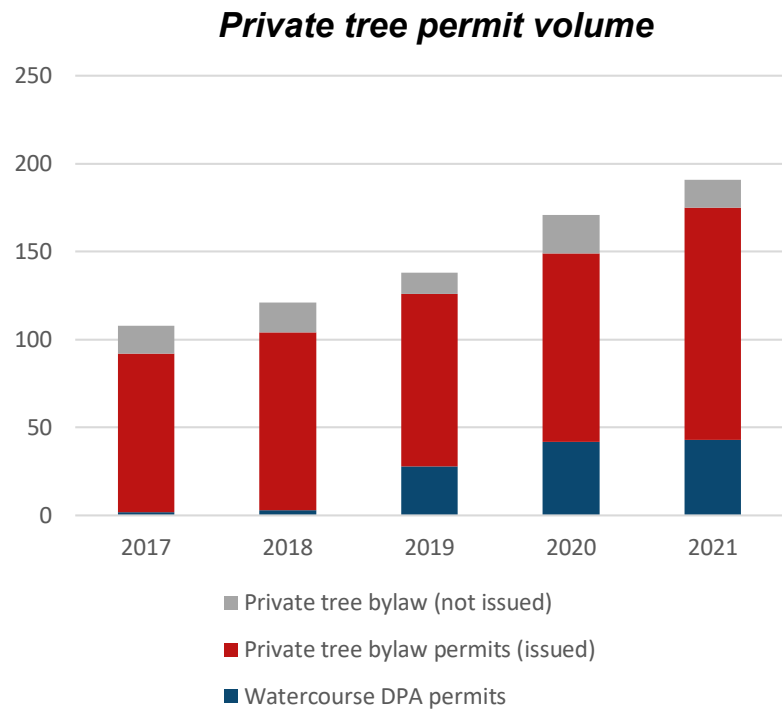


Figure 20. Permit volume issued for private and public tree removals over the last four years, respectively

Tree Management

The District of West Vancouver tracks requests for service through a system of work orders in some of its departments. The Planning Department manages hazard tree maintenance requests in boulevards on a reactive basis and data on number of requests is not available. The Engineering and Parks Departments respond to tree maintenance requests through a work order system, where Engineering provides call out response and vegetation clearance for sightlines within road allowances and Parks manages public trees in parks and on streets within the Business Improvement Areas. While more work orders are handled by Parks than Engineering annually, work orders primarily related to a tree issue have been steadily increasing since 2015 for both parks and road allowance trees (Figure 21).

For the Parks Department, the increase in requests for service since 2015 has been particularly due to work orders for hazardous trees and fallen trees while requests for tree maintenance and trees in general have been relatively stable. For the Engineering Department (roads and utilities branches), the increase in service requests since 2015 has been particularly due to an increase in requests for cleaning of tree debris. While crews respond to requests throughout the year, a large proportion (34% on average between 2015 and 2021) occur in the fall and have increased over the past few years (Figure 22). Staff have noted that the impact of extreme weather events and drought appear to have contributed to this increased demand for tree-related service calls.

Annual tree related work orders by department

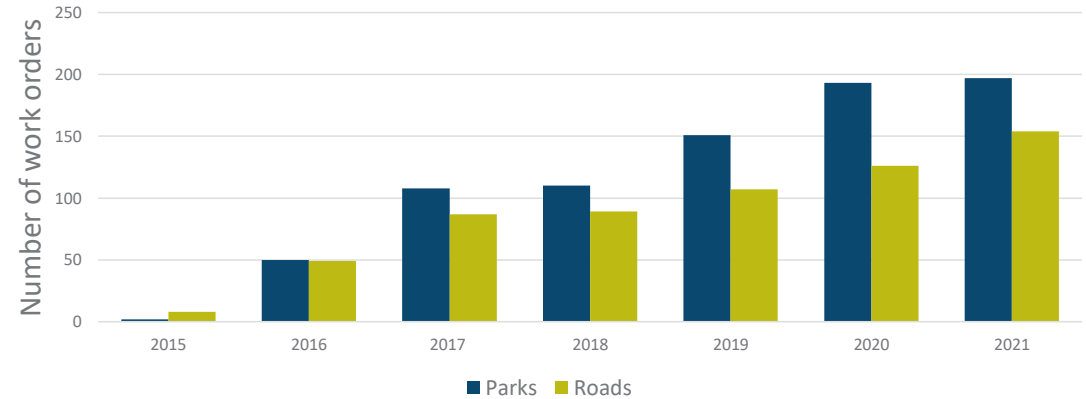


Figure 21. Tree related work orders assigned to Parks and Engineering Departments annually

Annual tree related work orders by month

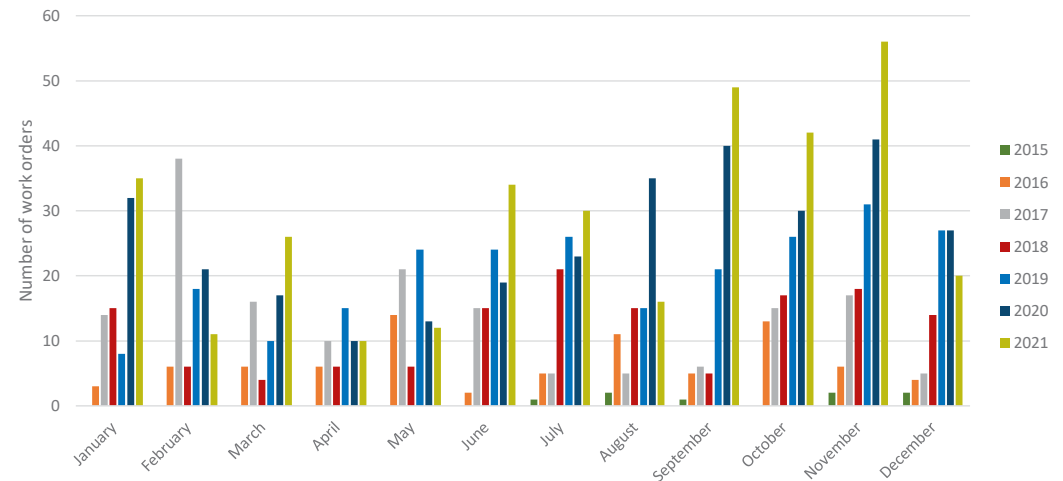
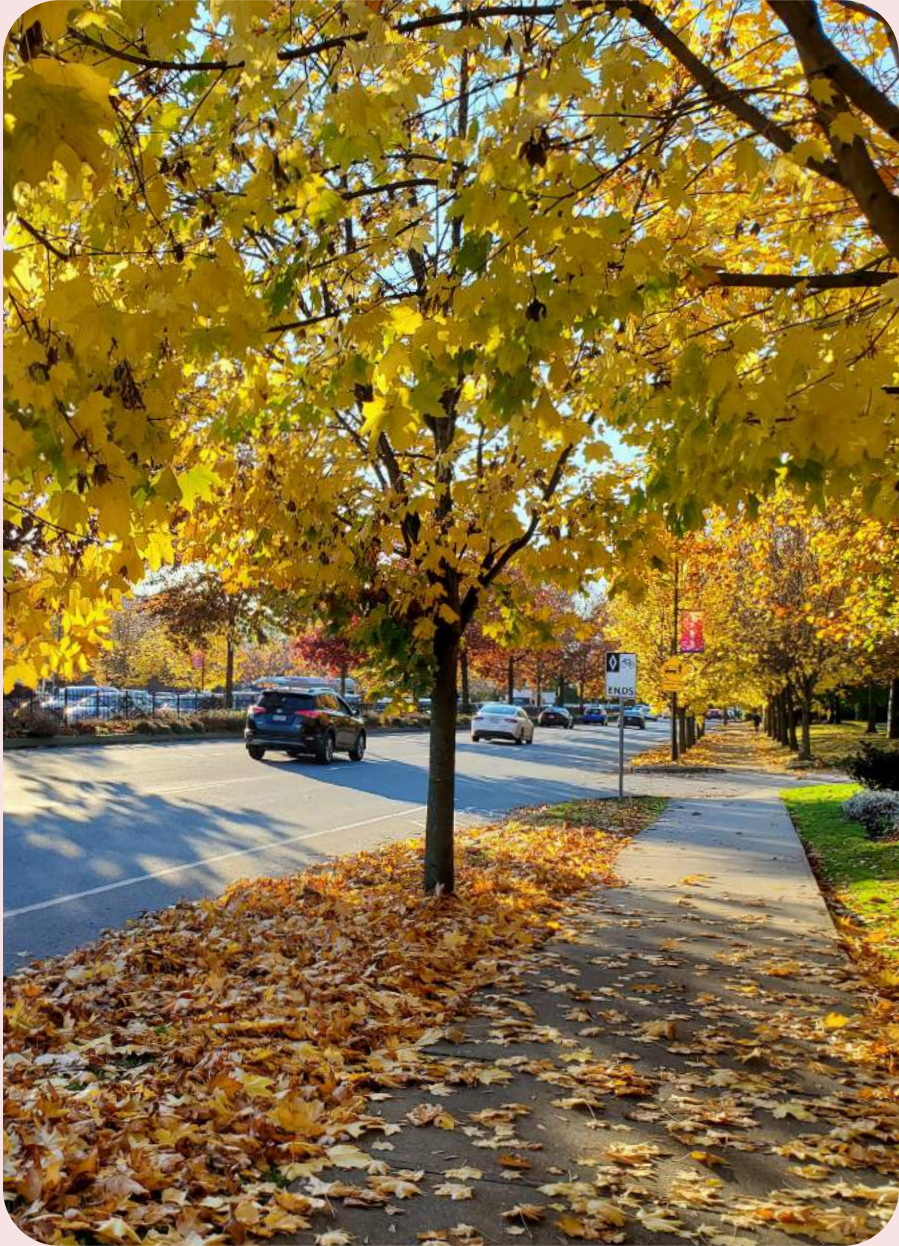


Figure 22. Tree related work orders by month for Parks and Engineering Departments annually

Key findings on the urban forest program

- Despite significant increases in permit and work order volumes, **staffing** for urban forest management and the implementation of bylaws has been stable over recent years, except for the recent hiring of a temporary arborist.
- **Work volume** for permits and service requests to manage trees have been steadily increasing over the last 5 to 7 years. Permit volumes managed by the Planning Department have been increasing for the watercourse development permit areas. Work orders related to tree issues have been increasing for both Parks Department and Roads Branch over recent years.
- A core **operating budget** of \$258,000 was allocated to the Parks and Planning Departments for urban forest management in 2021 with additional budget granted on an as-needed basis. Also in 2021, the Engineering Department's budget for contractors to carry out vegetation management for sightlines in the rights-of-ways was \$320,000.



4 ENABLING POLICIES

Section four outlines the policies that enable urban forest management in West Vancouver and discusses the bylaws that regulate it. The Urban Forest Management Plan will integrate within the District’s existing policy framework to meet key environmental objectives that ultimately will support meeting baseline targets such as cutting GHG emissions by 75% in 2041, as set in West Vancouver’s Official Community Plan.

Regulating trees in West Vancouver

Urban forest management activities on public and private trees are guided and regulated by several plans, bylaws, policies, and guidelines (Figure 23). An extensive background review of relevant West Vancouver plans and policies was conducted to inform the development of the Urban Forest Management Plan in the following categories:

1. **Guiding policies** provide broad direction and support of the Urban Forest Management Plan by providing key directions that build the foundation for development and inform the UFMP. Guiding policies and plans can support tree preservation and canopy growth through setting a vision and policy guidance.
2. **Associated strategies** and plans complement the Urban Forest Management Plan. They guide key components that impact the urban forest such as wildfire protection. Associated strategies and plans can support, both directly and indirectly, the goals outlined in the Urban Forest Management Plan.
3. **Bylaws and other policy tools** regulate and enforce guiding policies and associated strategies and plans by outlining key requirements and metrics for work around trees.

This report section provides an overview of how guiding policies, associated strategies and plans, bylaws, and other policy tools interact with urban forest management.

Guiding policies

Overarching policies and plans provide the framework for planning and governance in West Vancouver. Their environmental policies will guide overall strategic goals set within the Urban Forest Management Plan.

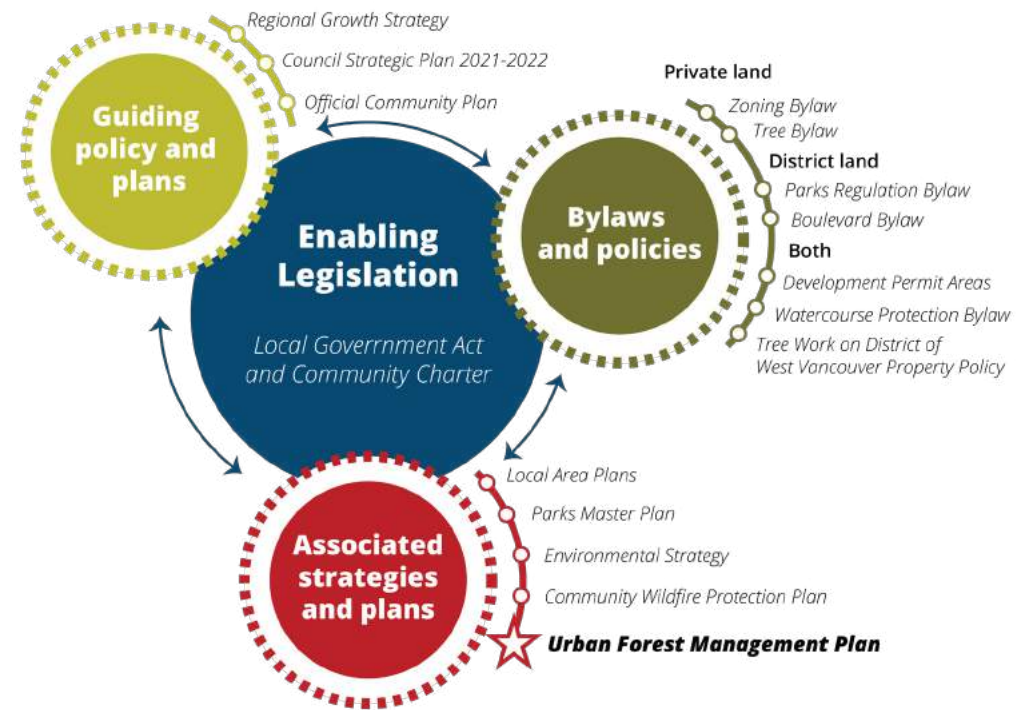


Figure 23. Framework of guiding policies and plans, associated strategies and plans, and bylaws and policies regulating trees in the District

Official Community Plan (2018)

The Official Community Plan (OCP) is a comprehensive long-term District policy tool that supports the Urban Forest Management Plan by setting values for the preservation of the environment for current and future generations with an environmental objective to protect natural systems and reduce greenhouse gas emissions. The OCP includes a range of environmental policies that provide a framework for environmental protection and restoration to mitigate environmental impacts, enhance ecological values, build resiliency, and preserve parks and trails. The Urban Forest Management Plan will support the implementation of the OCP by establishing benchmarks and targets for tree protection and replacement and by recommending improvements to policy guidelines related to the urban tree canopy.

Council Strategic Plan 2021-2022

West Vancouver’s Strategic Plan sets Mayor and Council’s goals and objectives to accomplish over a two-year period. The 2021-2022 Strategic Plan sets out an objective to develop an Urban Forest Management Plan under its ‘Climate Change and Nature’ goal.

Associated strategies and plans

Associated strategies and plans inform the Urban Forest Management Plan or are relevant for its scope and implementation.

Environmental Strategy (2005)

Supporting the OCP, the District’s Environmental Strategy provides a framework and implementation plan to address a series of environmental priorities by setting eleven key objectives, including an objective to balance views and sunlight access with forest retention and replacement. The Strategy addresses urban forest protection by setting two critical actions: creating a tree management policy and including forest management considerations in all Parks and Open Spaces Plans for the Upper Lands forest and smaller urban forests throughout existing neighbourhoods.

Parks Master Plan (2012)

West Vancouver’s Parks Master Plan outlines an implementation plan for park management. It identifies several challenges with respect to urban park trees including tree removal for view blockage, illegal tree removal in parks, and tree removal along trails. The Plan recommends a review of the District’s tree policy to address identified pruning and removal challenges.

Local Area Plans (Marine Drive and Horseshoe Bay)

Implemented under the Official Community Plan, Local Area Plans (LAPs) provide more detailed, site specific guidelines for land use and development for specific neighbourhoods. Strategies to accommodate growth, plans for greenspace connectivity, and recommendations for securing public space amenities will drive the available planting space for trees on District land and private property for these local areas.

The Horseshoe Bay LAP includes a principle to “celebrate and work with nature” and highlights the importance of tree retention and the planting of an urban forest that maintains the natural character of the neighbourhood. The Marine Drive LAP acknowledges the importance of street trees along the corridor and the use of trees to screen private land uses along it. The Urban Forest Management Plan will support existing and future LAPs by providing urban forest benchmarks and targets and recommending ways to improve tree retention, planting, and maintenance on public and private land.

Community Wildfire Protection Plan (2019)

The District’s Community Wildfire Protection Plan (CWPP) guides wildfire risk management and sets forest management recommendations for forest stands located within the wildland urban interface. The plan makes several recommendations that will require tree and vegetation pruning and removal on public and private land to mitigate wildfire risk in the interface. The Urban Forest Management Plan will support the CWPP by recommending tree protection and management measures that account for wildfire risk mitigation needs in West Vancouver’s interface.

Wildfire Hazard Development Permit Area

The District adopted a wildfire hazard development permit area in 2020, which guides development within the forest interface to protect the community from the spread of wildfires. In order to mitigate wildfire, pruning or removal of highly flammable coniferous trees is often recommended. The Urban Forest Management plan will also support this policy by recommending tree protection, replanting, and management measures that account for wildfire risk mitigation needs while maintaining tree canopy cover in West Vancouver’s interface areas.

Bylaws and other policy tools

Bylaws and policies serve to regulate and enforce the guiding policies, strategies, and plans in the public and private realm. Figure 24 summarizes how the bylaws and policies regulate tree planting, retention, removal, and maintenance on public and private lands in West Vancouver. The bylaws and policies reviewed include:

- Zoning Bylaw, including the recently adopted Coach House Guidelines
- Tree Bylaw
- Parks Regulation Bylaw
- Boulevard Bylaw
- Tree Work on District of West Vancouver Policy
- Environmental Development Permit Areas (OCP guidelines)
- Creeks Bylaw

The Urban Forest Management Plan will recommend updates to District bylaws where relevant to align them with best practices, other District bylaws, and findings from this State of the Urban Forest report’s data analysis.

More details on the bylaws and policies directly regulating trees are provided below.

Trees in Forest Stands and Naturalized Areas

Trees in Urban Areas



Private Forest

District Forest

District Street and Park Trees

Private yard trees

Tree Planting

Several **Development Permit Areas** encourage the replanting of native vegetation and trees. The **Watercourse Protection Bylaw** requires the re-vegetation of disturbed areas.

The **Watercourse Protection Bylaw** requires the re-vegetation of disturbed areas.

The **District Tree Policy** may require that new vegetation or trees be planted as replacement to account for the future removal of non-hazardous re-topped trees.

The **Tree Bylaw** required the planting of one replacement tree for every protected tree removed.

Tree Retention and removal

The **Environmental Development Permit Areas** protect trees to maintain ecological functions, in riparian areas, and on steep slopes and allow tree removals to build a single-family home, to provide reasonable light, air, and view access, or to avoid tree hazards. The **Wildfire Development Permit Area** may require tree removals and replacement to address wildfire hazard. The **District Tree Policy** sets out the process to apply for the removal of trees in Environmentally Sensitive Areas, in the Caulfeild Land Use Contract, or in covenant areas. The **Watercourse Protection Bylaw** requires retention of vegetation where possible and replanting for sediment and erosion control. The **Zoning Bylaw** requires a landscaping plan to detail trees retained, removed, and/or replaced.

The **Parks Regulation Bylaw** prohibits park users from damaging or removing park trees.
The **Watercourse Protection Bylaw** requires retention of vegetation where possible for sediment and erosion control.

The **Boulevard Bylaw** regulates the removal of trees found in District boulevard for risk management or where their pruning or removal is not inconsistent with the neighbourhood character.
The **Parks Regulation Bylaw** prohibits park users from damaging or removing park trees.

A **Tree Cutting Permit** is required to remove protected trees under the **Tree Bylaw** and the removal must meet the criteria for removal detailed in the bylaw.
The **Zoning Bylaw** sets a maximum impermeable and un-vegetated permeable cover surfaces for front yards. It also requires landscape plans that include trees for retention, removal, and replacement with development.

Tree Maintenance

The **Tree Bylaw** enables the pruning of protected trees with a Tree Cutting Permit using acceptable practices. The **District Tree Policy** sets out the process to apply for the pruning of trees in Environmentally Sensitive Areas, in the Caulfeild Land Use Contract, or in covenant areas. The **Wildfire Development Permit Area** requires that new buildings be located at least 10 m away from the forest interface.

The **District Tree Policy** details the procedure for the inspection and mitigation of hazard trees on District lands and for residents to apply for non-hazardous work on District trees.

The **Boulevard Bylaw** enables the District to require trees planted by residents to be limbed to maintain sight lines where necessary.
The **District Tree Policy** details the procedure for the inspection and mitigation of hazard trees on District lands and for residents to apply for non-hazardous work on District trees.

The **Tree Bylaw** enables the pruning of protected trees with a Tree Cutting Permit using acceptable practices.
The **Wildfire Development Permit Area** requires pruning of trees overhanging roofs or under eaves and of lower branches of conifers within the development permit area.

Figure 24. Summary of West Vancouver policy tools currently regulating planting, retention, removal, and maintenance of the urban forest in naturalized and urban area on public and private land

Tree Bylaw

The District's Tree Bylaw regulates the cutting and removal of protected trees on private land. The Tree Bylaw is an important regulation to control canopy cover because most of West Vancouver's urban forest is found on private land. The bylaw requires a tree cutting permit to remove trees that are 75 cm diameter at breast height or more, trees in watercourse protection areas, some protected native trees greater than 20 cm diameter, trees with an active nest or that provides habitat for a protected species, and heritage trees listed under the **Community Heritage register**

Protected trees can be removed when they are hazardous, within an approved building envelope, or a driveway or garage. Those last two acceptable reasons to remove protected trees highlight the importance of the Zoning Bylaw, which sets the regulations around the size and siting of the building envelope, driveway, and garage, for tree retention in West Vancouver.

The Tree Bylaw requires a replacement tree for every protected tree removed that is not hazardous. Tree protection measures are required to protect retained trees during construction.

Boulevard Bylaw

The District's Boulevard Bylaw regulates all trees on public boulevards with a diameter at breast height greater or equal to five centimetres. The Bylaw specifies pruning requirements for trees obstructing site lines and how residents can apply to prune or remove District trees in alignment with the District's Tree Work on District of West Vancouver Property Policy.

Tree Work on District of West Vancouver Property Policy

The Policy outlines the detailed processes for tree work on District trees and privately owned trees in tree covenant or environmentally sensitive areas. On public land, the policy outlines the process for inspection and mitigation of hazard trees on District property that is carried out on a reactive basis (upon request or notification) due to resourcing limitations. The policy also specifies the process for handling resident requests for tree work on non-hazardous District trees including the public notification process, permit fee, and other requirements. On private land, the policy complements the Tree Bylaw by outlining the permit fees and requirements for tree work carried out on private property trees located in Environmentally Sensitive Areas, the Caulfield Land Use Contract, other Covenant Areas, or other Tree Management Areas.

Other Reports

Upper Lands Ecological Inventory, 2021

The Upper Lands is a 6,000-hectare area of forest on the south-facing slopes of Cypress Mountain owned by the District of West Vancouver. The Upper Lands Ecological Inventory is intended to guide development informed and included an aquatic and terrestrial ecosystems inventory completed in 2020 and 2021. The Inventory also provides information to guide the establishment of ecological conservation activities and identifies the presence of rare and sensitive species, sensitive forest ecosystems, and culturally significant trees within the Upper Lands. The Urban Forest Management Plan will acknowledge those findings and make recommendations for the management of Upper Lands' urban forest found in the Urban Containment Boundary below 1,200 feet.

West Vancouver's Natural Capital Assets – A Preliminary Inventory, 2019

The report provides the results of the natural capital inventory which provides ecosystem service values for the larger forest and urban forest areas of West Vancouver, based on the results from the Howe Sound Ecosystem Analysis. The report set a series of actions shared with Council, including the use of LiDAR to investigate forest assets, planning forest sensitive neighbourhoods, preparing for climate change, and protecting trees on private land.

The West Vancouver Tree Book

The book was published in 1980 to respond to residential property owners' concerns over the preservation of views and light access. The book addresses these concerns by providing a comprehensive trees and large shrubs species selection list sorted by site condition and trees attributes. A list of common trees to avoid planting for the protection of views and light access is also included.

Interim Tree Bylaw Working Group Final Report

The Interim Tree Bylaw Working Group was established in 2017 and appointed community members to recommend options for the development of a tree bylaw based on a review of options and engagement with the community. The Working Group submitted its final report to the District in 2018 which, alongside recommendations from District staff, led to the adoption of the Tree Bylaw.

The Working Group noted a few values of importance to community members related to tree regulations, including maintaining existing views, protecting mature trees and vegetation through development, avoiding property damage and safety issues from large trees, encouraging appropriate pruning and maintenance measures, and minimizing the bureaucracy in the

implementation of the new bylaw. In addition to recommendations specific to the Tree Bylaw, the Working Group recommended that the District creates an Urban Forest Management Plan and an education program to support the bylaw implementation.

Coach House Design Guidelines

The Neighbourhood Character Working Group led to the adoption of new Coach House Design Guidelines in the fall of 2021. Infill design guidelines often result in tree removals with the construction of new buildings. However, the guidelines incorporate considerations for the retention of existing mature vegetation and trees and the planting of new trees and vegetation. The permit review process will be an important step to maximize tree retention where appropriate.

Key findings on West Vancouver's policies

Some of the key policy gaps identified for consideration in the project's next steps include:

- The establishment of more specific **targets and benchmarking** information to support the District's guiding policies.
- The implementation of initiatives associated with the **Community Wildfire Protection Plan** will impact the urban forest along the interface between forest stands and West Vancouver's neighbourhoods. Recommendations for the management of the urban forest in the interface will need to account for wildfire risk mitigation.
- Adjustments to the **Zoning Bylaw and Tree Bylaw** may be identified to improve outcomes for tree retention and replacement over time for new development.
- Updates may be recommended to clarify and streamline the implementation of the **Tree Policy and Boulevard Bylaw** and respond to current best practices.
- **Species guidance** provided in bylaws and resources such as the West Vancouver Tree Book will require updating to ensure that trees appropriate to the planting site and changing climate are being planted across the municipality.



5 PEER CITY COMPARISON

Benchmarking West Vancouver against other municipalities that share similarities with the District helps to understand how various levels of services, resourcing, and management approaches affect urban forest programs. In Table 2, West Vancouver is compared with four municipalities in southern British Columbia that share one or multiple of the following similarities:

population size, density, a large land base, or a forested landscape with large parks. All municipalities are within the Pacific Maritime ecozone. The comparison is divided into four themes of urban forest management: planning, planting, management, and protection.

Table 2. Municipal comparison of urban forestry programs

Description	West Vancouver	District of North Vancouver	Port Moody	Maple Ridge	Langford	Oak Bay
Context						
Population (2021)		88,168	33,535	90,990	46,584	17,990
Density (people/km ²)	506	548.8	1,297	339.7	1,124	1,710
Land area (km ²)	87 (or 55 km ² excluding Cypress provincial park and the Capilano watershed)	535	26	267 (including Golden Ears provincial park)	40	11
Planning						
Canopy cover within the UCB	51% (2021)	47% (2019)	53% (2019)	46% (2019)	53% (City-wide; 2019)	35% (City-wide; 2011)
Public tree population (inventoried street and park trees)	Unknown	Unknown	5,500	Unknown	5,000	10,000 (plus park trees)
Approximate annual operational urban forestry budget (Excluding tree planting + wages)	\$258,000 ¹	~\$800,000	\$100,000	\$250,000 - \$300,000	\$100,000	\$205,000
Budget average per person	\$6.07	~\$5.82	\$2.98	\$3.04 - 3.65	\$2.83	\$11.40

¹ The operational budget reported for West Vancouver includes sums allocated to the Planning and Parks departments which manage the main of urban forest services.

Description	West Vancouver	District of North Vancouver	Port Moody	Maple Ridge	Langford	Oak Bay
Urban forest staff (tree bylaw implementation + tree management)	2 FTE arborists 1 FTE forester 1 FTE support + Bylaw staff support	4 FTE arborists (incl. 2 field arborists) 1 FTE support 1.5 FTE bylaw staff	2 FTE arborists 2.25 FTE support	2 FTE arborists 2 FTE support + 1.5 FTE bylaw staff	<1 FTE	1 FTE arborists 0.75 FTE support 1.2 FTE seasonal staff (planting + watering)
Tree inventory	No	No	Yes	No	Yes	No
Planting						
Annual replacement tree planting budget	No dedicated budget	~\$300,000	\$15,000	\$25,000	\$100,000	\$25,000 (\$13,000 dedicated budget plus reserve funds)
Planting program	Occasional park tree replacement + restoration plantings Developer-provided new plantings	Replacement plantings Developer-provided new plantings	Replacement plantings Developer-provided new plantings Natural areas restoration	Replacement plantings (approx. \$500/tree) Developer-provided new plantings (approx. 300 trees/year)	Replacement plantings Developer-provided new plantings	Replacement plantings Developer-provided new plantings
Annual boulevard tree planting rate	Varies by year	Unknown	~50 trees ~500 natural areas trees	~50 trees	Unknown	150-200 trees
Management						
Pruning	Reactive; mostly contracted out	Proactive street tree pruning (annually <10 years; every 3 years >10 years)	Reactive; contracted out	Proactive (3-years for young tree and 5-year cycle for all street trees); fully contracted out	Proactive; fully contracted out	Proactive; internal
Risk management approach	Reactive	Proactive (3-year cycle)	Reactive except proactive along trails	Reactive except proactive street tree inspections by Engineering	Reactive except proactive in parks and trails	Proactive visual inspections with cyclical pruning
Risk management policies/programs	Tree Policy, CWPP fuel reduction program	Dangerous Tree Bylaw	Tree Management Policy	Infrastructure Inspection Policy	-	-

Description	West Vancouver	District of North Vancouver	Port Moody	Maple Ridge	Langford	Oak Bay
Disposal stream	Wood reclamation at the District mill	Unknown	Chipping	Brush chipping program (Ridge Meadows Recycling Society)	Unknown	Unknown
Urban forest strategy or management plan	Yes (in progress)	No	Yes (in progress)	No	No	Yes
Protection						
Bylaw(s) for private tree protection	Yes	Yes	Yes	Yes	No	Yes
Protected tree size	Greater than 75 cm DBH on private land; 10 cm or greater in riparian areas	75 cm or greater DBH	10 cm or greater	20 cm or greater DBH on City property or Conservation area; 50 cm DBH in urban, urban reserve, and rural lots less than 0.5 ha; 70 cm DBH in rural lots greater than 0.5 ha	N/A	30 cm or greater or specific species greater than 4 cm or height above point of germination >1 metre

Key findings from the peer city comparison

- West Vancouver's public **tree population** is unknown and its **canopy cover** is in the higher range of comparison municipalities, similar to the District of North Vancouver and Langford.
- The District's operational **budget is in the higher range** among comparison municipalities, with the District of Oak Bay having the highest budget relative to the size of its land base and most proactive management program. West Vancouver's **staffing is lower** than most comparison municipalities, particularly for tree management and when considering the size of West Vancouver's urban forest.
- Unlike all comparison municipalities, the District does not have a budget for **replacement planting**. Comparison municipalities have reported planting between 50 and 200 replacement trees on public land annually.
- The District's tree pruning approach is **reactive** whereas most comparable municipalities had a proactive pruning cycle for at least some of their trees, which also enables them to conduct more regular visual risk inspections. The District practices for wood reclamation at a District mill are unique compared to other municipalities.
- All municipalities except for Langford administer **tree bylaws** for the protection of public and private trees. The District's protected tree size is consistent with the District of North Vancouver but otherwise larger than comparison municipalities.

6 URBAN FOREST SUSTAINABILITY REPORT CARD

West Vancouver’s urban forestry program and services have been evaluated within an urban forest sustainability model first proposed by Clark, Matheny, Cross, & Wake in 1997 and recently updated by Leff in 2016 [4,5]. These models define a set of performance indicators to establish the current and optimal state of urban forest programs. The criteria are associated to each of

the core urban forest services: planning, planting, management, protection, and partnership. Some of the performance indicators were adapted to respond to West Vancouver’s local context. The report card below provides a summary of the assessment of each indicator against an optimal outcome. A description of the criteria and indicators can be found in Appendix C.



Legend

Poor
Fair
Good
Optimal

Qualitative indicator	Rating
PLANNING	
Awareness of the urban forest as a community resource	GOOD
Interdepartmental and Municipal agency cooperation	GOOD
Clear and defensible urban forest canopy assessment and goals	FAIR
Relative tree canopy cover	GOOD
Municipality-wide urban forest management plan	POOR
Municipal infrastructure asset management	FAIR
Municipal-wide biodiversity or green network strategy	FAIR
Municipal urban forest program capacity	POOR
Urban forest funding to implement a strategy	FAIR
PLANTING	
City tree planting and replacement program, design, planning and implementation	POOR
Development requirements to plant trees on private land	FAIR
Streetscape and servicing specifications and standards for planting trees	POOR
Equity in planting program delivery	POOR
Forest restoration and native species planting	FAIR
Selection and procurement of stock in cooperation with nursery industry	POOR
Ecosystem services targeted in tree planting projects and landscaping	POOR

MANAGING

Tree inventory	POOR
Knowledge of trees on private property	GOOD
Natural areas inventory	GOOD
Age diversity (size class distribution)	No data
Species diversity	No data
Species suitability	No data
Publicly owned tree species condition	POOR
Maintenance of intensively managed trees	FAIR
Emergency response planning	POOR
Tree risk management	POOR
Pest and disease management	FAIR
Waste biomass utilization	OPTIMAL

PROTECTING

Policy or regulations regulating the protection and replacement of private and District trees	GOOD
Policy or regulations for conservation of sensitive ecosystems, soils, or permeability on private property through development	GOOD
Internal protocols guide municipal tree or sensitive ecosystem protection	FAIR
Standards of tree protection and tree care observed during development/by local arborists and tree care companies	FAIR
Cooperation with utilities on protection (and pruning) of City trees	POOR

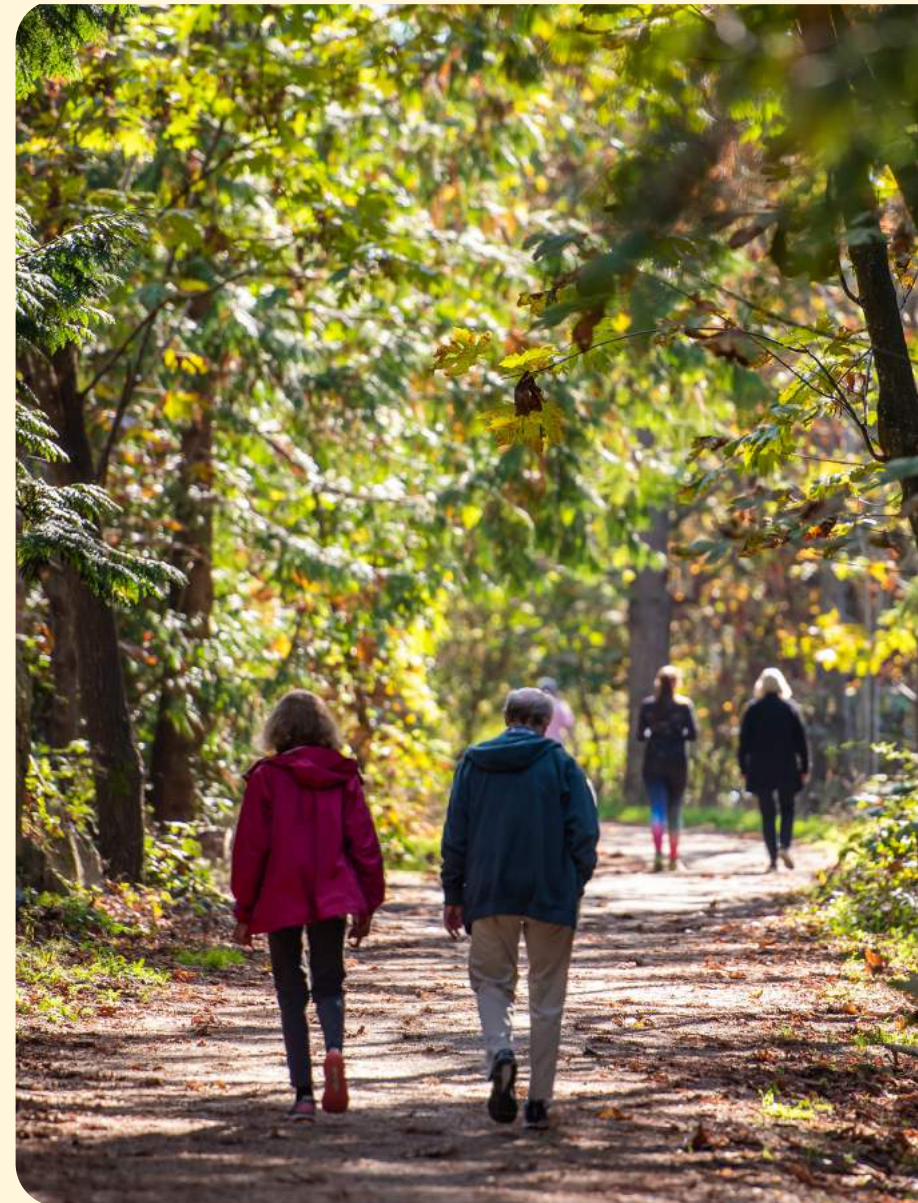
PARTNERING

Citizen involvement and neighbourhood action	FAIR
Involvement of large and private land and institutional land holders (e.g., schools)	FAIR
Urban forest research	FAIR
Regional collaboration	GOOD

Key findings from the sustainability report card

The program's evaluation suggests that:

- West Vancouver's urban forest program **performs well** on criteria related to internal and external collaboration, community awareness, and policies to protect its urban forest. It displays leadership in its valorization of wood biomass in its parks.
- The District's **lowest performance** is related to tree planting criteria due to the absence of a formal planting or replanting program.
- **More data** on the public urban forest asset will be required to provide a full picture of the performance of West Vancouver's urban forest management program. The District's approach to tree and tree risk management ranks at a low performance due to its fully reactive nature.



7 SUMMARY AND NEXT STEPS

The findings outlined in this report will inform the development of the Urban Forest Management Plan. Some of the key issues that will be considered in the Plan include:

- Stabilize **canopy cover** from the small decline recorded between 2018 and 2021 and consider approaches to address canopy loss on private land identified as a result of new or redevelopment in the Rodgers Creek area and other existing neighbourhoods.
- Respond to native forest health challenges related to **climate change and pests and diseases** identified by provincial data and observed by District staff to ensure the long-term viability of West Vancouver's urban forest and significant trees stands and ecosystems.
- Improve the **distribution of ecosystem services and canopy cover** across the District and in under-served areas found predominantly in the urban core and eastern neighbourhoods.

- Recommend **bylaws and policies** revisions to reflect current best practices and evolving urban forest challenges.
- Recognize the increasing demand for services and recommend improvements to the District's reactive **urban forest management program**. Inform recommendations based on findings from the report card and the current resourcing and demand for urban forest management services on public land to maximize benefits, minimize risks, and provide a satisfactory level of service at a sustainable cost.



The Urban Forest Management Plan will explore those challenges and opportunities and establish a vision, goals, and targets to inform the management of West Vancouver's urban forest for the next 15 years.



APPENDIX A - REFERENCES

- 1 Province of BC. (n.d.). Aerial Overview Surveys. Available at: www2.gov.bc.ca/gov/content/industry/forestry/managing-our-forest-resources/forest-health/aerial-overview-surveys
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- 3 Statistics Canada. (2022). (table). Census Profile. 2021 Census. Statistics Canada Catalogue no. 98-316-X2021001. Ottawa. Released February 9, 2022.
- 4 Clark, J.R., Matheny, N.P., Cross, G., & Wake, V. (1997). A model of urban forest sustainability. *Journal of ARboriculture*, 17-30.
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APPENDIX B - BRITISH COLUMBIA ASSESSMENT NEIGHBOURHOODS

-  Undeveloped lands below 1,200 ft
-  Neighbourhoods



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APPENDIX C - URBAN FOREST SUSTAINABLE CRITERIA & INDICATORS

The table provides a description of criteria for sustainable urban forest management divided under the themes to plan, plant/grow, manage, protect, and partner for the urban forest. Each criterion is assigned an indicator shown in the highlighted cells based on the current state of West Vancouver's urban forest program.

Assessment criteria	Objective	Indicators for urban forestry performance			
		Poor	Fair	Good	Optimal
PLAN					
Awareness of the urban forest as a community resource	<i>The urban forest is recognized as vital to the community's environmental, social, and economic well-being.</i>	General ambivalence or negative attitudes about trees, which are perceived as neutral at best or as the source of problems. Actions harmful to trees may be taken deliberately.	Trees are widely acknowledged as providing environmental, social, and economic services but are not widely integrated in corporate strategies and policies.	Trees are widely acknowledged as providing environmental, social, and economic services and urban forest objectives are integrated into other corporate strategies and policies.	Urban forest recognized as vital to the community's environmental, social, and economic well-being. Widespread public and political support and advocacy for trees, resulting in strong policies and plans that advance the viability and sustainability of the entire urban forest.
Interdepartmental and Municipal agency cooperation on urban forest strategy implementation	<i>Ensure all relevant municipal departments and agencies cooperate to advance goals related to urban forest issues and opportunities.</i>	Little cooperation and conflicting among departments and/or agencies often leading to poor outcomes for trees.	Common goals but limited cooperation among departments and/or agencies and mixed outcomes for trees.	Municipal departments, affected agencies and urban forest managers recognize potential conflicts and reach out to each other on an informal but regular basis.	Formal interdepartmental working agreements or protocols for all projects that could impact municipal trees.
Clear and defensible urban forest canopy assessment and goals	<i>Urban forest policy and practice is driven by comprehensive goals municipality-wide and at the neighbourhood or land use scale informed by accurate, high-resolution assessments of existing and potential canopy cover.</i>	No assessment or goals.	Low-resolution and/or point-based sampling of canopy cover using aerial photographs or satellite imagery – and limited or no goal setting.	Complete, detailed, and spatially explicit, high-resolution Urban Tree Canopy (UTC) assessment based on enhanced data (such as LiDAR) – accompanied by comprehensive set of goals by land use and other parameters.	The City has a complete, detailed, and spatially explicit high-resolution Urban Tree Canopy (UTC) assessment accompanied by a comprehensive set of goals, all utilized effectively to drive urban forest policy and practice municipality-wide and at neighbourhood or smaller management level.

Assessment criteria	Objective	Indicators for urban forestry performance			
		Poor	Fair	Good	Optimal
Relative tree canopy cover	<i>Achieve desired degree of tree cover, based on potential or according to goals set for entire municipality and for each neighbourhood or land use.</i>	The existing canopy cover for entire municipality is <50% of the desired canopy.	The existing canopy is 50%-75% of desired.	The existing canopy is >75%-100% of desired.	The existing canopy is >75%-100% of desired - at the individual neighborhood level as well as overall municipality.
Municipality-wide urban forest management plan	<i>Develop and implement a comprehensive urban forest management plan for public and private property.</i>	No plan.	Existing plan limited in scope and implementation.	Recent comprehensive plan developed and implemented for publicly owned forest resources, including trees managed intensively (or individually) and those managed extensively, as a population (e.g., trees in natural areas).	Strategic, multi-tiered plan with built-in adaptive management mechanisms developed and implemented for public and private resources.
Municipal infrastructure asset management	<i>Integrate green infrastructure assets into the municipal asset management system to support valuing and accounting for natural assets in the City's financial planning to build climate resilient infrastructure.</i>	No recognition of value of natural or human-made elements that provide ecological and hydrological functions (green infrastructure).	Local government recognizes the value of green infrastructure but does not yet have information to include them in an asset management system.	Green infrastructure assets have been partially or fully inventoried and some assets are included in an asset management system, with the intent to ultimately capture all assets in the consolidated financial statements of the municipality.	Green infrastructure assets are inventoried and included in an asset management system and on the consolidated financial statement of the municipality
Municipal-wide biodiversity or green network strategy	<i>Acquire and restore publicly-owned natural areas in pursuit of meeting municipal-wide biodiversity and connectivity goals.</i>	No or very limited planning and stewardship of natural areas.	Area specific management plans focused on management, restoration, and protection of natural areas.	Municipal-wide urban forest, parks or natural areas strategy guiding management, restoration, and protection of the existing natural areas network.	Biodiversity strategy or equivalent in effect to manage, restore and existing and acquire future natural areas network throughout the municipality.

Assessment criteria	Objective	Indicators for urban forestry performance			
		Poor	Fair	Good	Optimal
Municipal urban forestry program capacity	<i>Maintain sufficient well-trained personnel and equipment – whether in-house or through contracted or volunteer services – to implement municipality-wide urban forest management plan</i>	Team severely limited by lack of personnel and/or access to adequate equipment. Unable to perform adequate maintenance, let alone implement new goals.	Team limited by lack of staff and/or access to adequate equipment to implement new goals.	Team able to implement many of the goals and objectives of the urban forest management plan.	Team able to implement all of the goals and objectives of the urban forest management plan.
Urban forest funding to implement a strategy	<i>Maintain adequate funding to implement the urban forest strategy.</i>	Little or no dedicated funding.	Dedicated funding but insufficient to implement the urban forest strategy or maintain new assets as they are added to the inventory.	Dedicated funding sufficient to partially implement the urban forest strategy and maintain new assets as they are added to the inventory.	Sustained funding to fully implement the urban forest strategy and maintain new assets as they are added to the inventory.
PLANT/GROW					
City tree planting and replacement program design, planning and implementation	<i>Comprehensive and effective tree selection, planting and establishment program that is driven by canopy cover goals and other considerations according to the UFS.</i>	Tree replacement and establishment is ad hoc.	Some tree planting and replacement occurs, but with limited overall municipality-wide planning and insufficient to meet replacement requirements.	Tree replacement and establishment is directed by needs derived from an opportunities assessment and species selection is guided by site conditions, tree health and climate adaptation considerations.	Tree planting and replacement is guided by strategic priorities and is planned out to make progress towards targets set for canopy cover, diversity, tree health and climate adaptation within the timeframe of the strategy.
Development requirements to plant trees on private land	<i>Ensure that new trees are required in landscaping for new development or, where space is lacking, there is an equivalent contribution to tree planting in the public realm.</i>	Landscaping requirements do not address trees on private land.	Developments are generally required to provide replacement but the outcomes are often in conflict with public trees and other infrastructure due to space limitations and not connected to meeting canopy cover targets.	Developments are required to provide replacement trees or, where space is not adequate according to soil volume available, provide cash-in-lieu for equivalent tree planting on public land. The requirement is not connected to meeting canopy cover targets.	Developments are required to provide a minimum density of trees per unit measure or, where space is not adequate according to soil volume available, provide adequate cash-in-lieu for equivalent tree planting on public land. Planting density is determined based on meeting a municipal-wide canopy cover target.

Assessment criteria	Objective	Indicators for urban forestry performance			
		Poor	Fair	Good	Optimal
Streetscape and servicing specifications and standards for planting trees	<i>Ensure all publicly owned trees are planted into conditions that meet requirements for survival and maximize current and future tree benefits.</i>	No or very few specifications and standards for growing sites.	Specifications and standards for growing sites exist but are inadequate to meet urban forest goals.	Specifications and standards exist and are adequate to meet urban forest goals but are not always achieved.	All trees planted are in sites with adequate soil quality and quantity, and with sufficient growing space to achieve their genetic potential and life expectancy, and thus provide maximum ecosystem services.
Equity in planting program delivery	<i>Ensure that the benefits of urban forests are made available to all, especially to those in greatest need of tree benefits.</i>	Tree planting and outreach are not determined equitably by canopy cover or need for benefits.	Planting and outreach includes attention to low canopy neighborhoods or areas.	Planting and outreach targets neighborhoods with low canopy and a high need for tree benefits.	Equitable planting and outreach at the neighbourhood level are guided by strong citizen engagement in identified low-canopy/high-need areas.
Forest restoration and native species planting	<i>Encourage the appreciation of climate suitable native vegetation by the community and ensure native species are widely planted to enhance native biodiversity and connectivity</i>	Voluntary use of climate suitable native species on publicly and privately-owned lands.	The use of climate suitable native species is encouraged on a site-appropriate basis in public and private land development projects.	Policies require the use of climate suitable native species and management of invasive species on a site-appropriate basis in public and private land development projects but are not integrated across all policy or guided by a connectivity analysis.	Policies require the use of climate suitable native species and management of invasive species on a site-appropriate basis in public and private land development projects and through tree bylaw.
Selection and procurement of stock in cooperation with nursery industry	<i>Diversity targets and climate adaptation/mitigation objectives guide tree species selection and nurseries proactively grow stock based on municipal requirements.</i>	Species selection is not guided by diversity targets or climate adaptation/mitigation objectives.	Species selection is guided by diversity and climate adaptation/mitigation but required stock is rarely available from nurseries and acceptable substitutes reduce diversity.	Species selection is guided by targets for diversity and climate adaptation/ mitigation and required stock or acceptable substitutes are usually available from nurseries.	Species selection is guided by targets for diversity and climate adaptation/ mitigation and required stock is secured ahead of the planned planting year from contract or in-house nurseries.

Assessment criteria	Objective	Indicators for urban forestry performance			
		Poor	Fair	Good	Optimal
Ecosystem services targeted in tree planting projects and landscaping	<i>Incorporate ecosystem services objectives into public and private tree planting projects to improve urban tree health and resilience, carbon sequestration, stormwater management and cooling.</i>	Ecosystem services not considered in planting projects or intentionally designed into vegetated landscapes	Ecosystem services, such as stormwater interception, occasionally incorporated into City or private land planting projects and landscape designs.	Guidelines in place for planting projects and landscape designs on public and private land to deliver specific ecosystem services.	Ecosystem services targets are defined for the urban forest and policy requires planting project and landscape designs on public and private land to contribute to meeting targets.
MANAGE					
Tree inventory	<i>A current and comprehensive inventory of intensively managed trees to guide management, including data such as age distribution, species mix, tree condition and risk assessment.</i>	No inventory.	Partial inventory of publicly-owned trees in GIS.	Complete inventory of intensively managed street and park trees in GIS but inconsistently updated.	The municipal tree inventory is complete, is GIS-based, supported by mapping, and is continuously updated to record growth, work history and tree condition.
Knowledge of trees on private property	<i>Understand the extent, location, and general condition of privately-owned trees.</i>	No information about privately owned trees.	Aerial, point-based or low-resolution assessment of tree canopy on private property, capturing broad extent.	Detailed Urban Tree Canopy analysis of the urban forest on private land, including extent and location, integrated into a municipality-wide GIS system	The City has an i-Tree Eco analysis of private trees as well as detailed Urban Tree Canopy analysis of the entire urban forest integrated into a municipality-wide GIS system.
Natural areas inventory	<i>A current and comprehensive inventory of sensitive and modified natural ecosystems and their quality mapped to Provincial standards to provide standardized ecological information to support decision-making.</i>	No inventory of natural areas.	Natural areas inventoried in GIS but not recently updated and attribute information not to a standard that can support decision-making.	Natural areas inventoried in GIS and with standard and complete attribute information to support decision-making but not updated in the last 5 years.	Natural areas inventoried in GIS and with standard and complete attribute information to support decision-making and updated in the last 5 years.
Age diversity (size class distribution)	<i>Provide for ideal uneven age distribution of all “intensively” (or individually) managed trees – municipality-wide as well as at neighbourhood level</i>	Even-age distribution, or highly skewed toward a single age class (maturity stage) across entire population.	Some uneven distribution, but most of the tree population falls into a single age class.	Total tree population across municipality approaches an ideal age distribution of 40% juvenile, 30% semi-mature, 20% mature, and 10% senescent.	Total population approaches that ideal distribution municipality-wide as well as at the neighborhood level.

Assessment criteria	Objective	Indicators for urban forestry performance			
		Poor	Fair	Good	Optimal
Species diversity	<i>Establish a genetically diverse population across the municipality as well as at the neighbourhood scale</i>	Five or fewer species dominate the entire tree population across municipality.	No single species represents more than 10% of the total tree population; no genus more than 20%, and no family more than 30%.	No single species represents more than 5% of total tree population; no genus more than 10%; and no family more than 15%.	At least as diverse as “Good” rating (5/10/15) municipality-wide - and at least as diverse as “fair” (10/20/30) at the neighborhood level.
Species suitability	<i>Establish a tree population suited to the urban environment and adapted to the overall region</i>	Fewer than 50% of all trees are from species considered suitable for the area.	>50%-75% of trees are from species suitable for the area.	More than 75% of trees are suitable for the area.	Virtually all trees are suitable for the area.
Publicly owned tree species condition	<i>Current and detailed understanding of condition and risk potential of all publicly owned trees that are managed intensively (or individually)</i>	Condition of urban forest is unknown.	Sample-based tree inventory indicating tree condition and risk level.	Complete tree inventory that includes detailed tree condition ratings.	Complete tree inventory that is GIS-based and includes detailed tree condition as well as risk ratings.
Maintenance of intensively managed trees	<i>Maintain all publicly owned intensively managed trees for optimal health and condition in order to extend longevity and maximize current and future benefits</i>	Intensively managed trees are maintained on a request/reactive basis.	Intensively managed trees are maintained on a request/reactive basis. Limited systematic (block) pruning and/or immature trees are structurally pruned.	All intensively managed trees are systematically maintained on a cycle determined by workload and resource limitations. All immature trees are structurally pruned.	All mature intensively managed trees are maintained on an optimal pruning cycle. All immature trees are structurally pruned.
Emergency response planning	<i>A response plan guides call-out procedures, resources available and the clean-up response for extreme weather and earthquake.</i>	Response plan not documented or not current.	Response plan is documented and includes call-out procedures, roles and responsibilities but lacks details to prioritize hazards and clean-up.	Response plan includes call-out procedure, roles and responsibilities, and criteria for prioritizing tree hazards and removing debris is in place.	A comprehensive response plan is in place and a response drill occurs annually.

Assessment criteria	Objective	Indicators for urban forestry performance			
		Poor	Fair	Good	Optimal
Tree risk management	<i>Comprehensive tree risk management program fully implemented, according to ANSI A300 (Part 9) "Tree Risk Assessment" standards, and supporting industry best management practices.</i>	No coordinated tree risk assessment or risk management program. Response is on a reactive basis only.	Some areas within the municipality are prioritized for risk assessment and management. Little annual budget is available to develop a more proactive inspection program.	Priority areas of the City are inspected on a regular schedule and operational standards and budgets are in place for responding to and managing tree risks within an appropriate timeframe.	A comprehensive risk management program is in place, with all public lands inspected on defined schedules and operational standards and budgets in place for responding to and managing tree risks within an appropriate timeframe.
Pest and Disease Management	<i>An Integrated Pest Management (IPM) plan guides treatment responses to existing and potential pest, disease and invasive species threats to the urban forest.</i>	No integrated pest management plan and no pest management.	No integrated pest management plan and reactive pest management.	An integrated pest management plan is in place and implemented.	A comprehensive pest management program is in place, with detection, communication, rapid response and IPM practiced.
Waste biomass utilization	<i>Biomass is utilized for high value uses.</i>	A closed system diverts all urban wood and green waste through reuse and recycling.	Wood waste from the urban forest is not utilized.	Wood waste from the urban forest is utilized as mulch or biofuel.	Wood waste from the urban forest is utilized as mulch or biofuel and sometimes high value pieces are milled and stored for later use or sold on to local value-added industries.
PROTECT					
Policy or regulations regulating the protection and replacement of private and District trees	<i>Secure the benefits derived from trees on public and private land by enforcement of municipality-wide policies and practices including tree protection.</i>	No or very limited tree protection policy.	Policies in place to protect public trees and employ industry best management practice.	Policies in place to protect public and private trees with enforcement but lack integration with other municipal policy to enable effective tree retention.	Urban forest strategy and integrated municipal-wide policies that guide the protection of trees on public and private land, and ensure they are consistently applied and enforced.

Assessment criteria	Objective	Indicators for urban forestry performance			
		Poor	Fair	Good	Optimal
Policy or regulations for conservation of sensitive ecosystems, soils, or permeability on private property through development	<i>Secure the benefits derived from environmentally sensitive areas by enforcement of municipality-wide policies in pursuit of meeting biodiversity and connectivity goals.</i>	No or very limited natural areas protection policy.	Policies in place to protect privately-owned natural areas without enforcement.	Development Permit Areas in place to protect privately-owned natural areas with enforcement but lack integration with other municipal policy to enable effective tree retention.	Biodiversity strategy or equivalent and integrated municipal-wide policies that guide privately-owned natural area protection and ensure they are consistently applied.
Internal protocols guide municipal tree or sensitive ecosystem protection	<i>Ensure all relevant municipal departments follow consistent tree or ecosystem protection protocols for capital design and construction activities.</i>	No protocols guiding municipal tree or ecosystem protection for capital design and construction activities.	Informal and inconsistent processes followed for municipal tree or ecosystem protection for capital design and construction activities.	Established protocols for municipal tree or ecosystem protection for capital design and construction activities but outcomes are inconsistent or sometimes unachievable.	Established protocols for municipal tree or ecosystem protection for capital design and construction activities are consistently followed and outcomes are successful.
Standards of tree protection and tree care observed during development or by local arborists and tree care companies	<i>Consulting arborists and tree care companies understand municipal-wide urban forest goals and objectives and adhere to high professional standards.</i>	Limited understanding or support for tree protection requirements.	General understanding or support for tree protection requirements but large variation in the quality of information and services provided.	General understanding or support for tree protection requirements and generally consistent quality of information and services provided.	Advocacy for tree protection requirements, engagement with City staff on improving processes and standards, and generally consistent quality of information and services provided to high professional standards.
Cooperation with utilities on protection (and pruning) of City trees	<i>All 3rd party utilities employ best management practices and cooperate with the City to advance goals and objectives related to urban forest issues and opportunities.</i>	Utilities take actions impacting urban forest with no municipal coordination or consideration of the urban forest resource.	Utilities inconsistently employ best management practices, rarely recognizing potential municipal conflicts or reaching out to urban forest managers and vice versa.	Utilities employ best management practices, recognize potential municipal conflicts, and reach out to urban forest managers on an ad hoc basis – and vice versa.	Utilities employ best management practices, recognize potential municipal conflicts, and consistently reach out to urban forest managers and vice versa.

Assessment criteria	Objective	Indicators for urban forestry performance			
		Poor	Fair	Good	Optimal
PARTNER					
Citizen involvement and neighbourhood action	<i>Citizens and groups participate and collaborate at the neighbourhood level with the municipality and/or its partnering NGOs in urban forest management activities to advance municipality-wide plans</i>	Little or no citizen involvement or neighborhood action.	Community groups are active and willing to partner in urban forest management, but involvement and opportunities are ad hoc.	Several active neighborhood groups engaged across the community, with actions coordinated or led by municipality and/or its partnering NGOs.	Proactive outreach and coordination efforts by the City and NGO partners result in widespread citizen involvement and collaboration among active neighbourhood groups engaged in urban forest management.
Involvement of large private land and institutional land holders (e.g., schools)	<i>Large private landholders to embrace and advance municipality-wide urban forest goals and objectives by implementing specific resource management plans.</i>	Large private landholders are generally uninformed about urban forest issues and opportunities.	Landholders manage their tree resource but are not engaged in meeting municipality-wide urban forest goals.	Landholders develop comprehensive tree management plans (including funding strategies) that advance municipality-wide urban forest goals.	As described in “Good” rating, plus active community engagement and access to the property’s forest resource.
Urban forest research	<i>Research is active and ongoing towards improving our understanding of the urban forest resource, the benefits it produces, and the impacts of planning, policy, design and management initiatives.</i>	No urban forest research.	Isolated academic or professional research occurs in the municipality’s urban forest.	The municipality supports and has input on academic or professional research occurring in its urban forest and knowledge transfer occurs.	The urban forest is a living laboratory - in collaboration with public, private, NGO and academic institutions - integrating research and innovation into managing urban forest health, distribution, and abundance.
Regional collaboration	<i>There is cooperation and interaction on urban forest plans among neighbouring municipalities within the region, and/or within regional agencies.</i>	Municipalities have no interaction with each other or the broader region for planning or coordination on urban forestry.	Some neighboring municipalities and regional agencies share similar policies and plans related to trees and urban forest.	Some urban forest planning and cooperation across municipalities and regional agencies.	Widespread regional cooperation resulting in development and implementation of regional urban forest strategy.

A blue-tinted photograph of a forest. In the foreground, a wooden boardwalk leads into the woods. Several white, stylized tree cutouts are placed on the boardwalk. The background is filled with tall, thin trees and dense foliage.

**District of West
Vancouver**

The logo for West Vancouver, featuring a blue wavy line above the text "west vancouver" in a blue, lowercase, sans-serif font.

west vancouver