

Survey of Coarse Woody Debris in 14 North Saanich Parks



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Acknowledgements

This survey was conducted in North Saanich parks which exist on the traditional, unceded territories of the W̱SÁNEĆ people, specifically the BOKÉĆEN (Pauquachin) and W̱SÍKEM (Tseycum) First Nations. Thank you to Sharon Hope for her guidance during this project and Steve Grossnickle for his shared expertise on the forests of British Columbia.

Abstract

Coarse woody debris (CWD) is defined as “*Sound and rotting logs and stumps...that provide habitat for plants, animals and insects and a source of nutrient for soil structure and development*” (Stevens, 1997). It contributes several vital services to the ecosystem including providing nutrients and energy to forest production, creating habitat for plants and animals, acting as a long-term carbon store, and creating structure for both terrestrial and aquatic ecosystems.

This survey of CWD in 14 North Saanich parks looked at the total volume of CWD per 100m² and the distribution of CWD across five classes of decomposition in each park. The results showed a wide range of volumes across the parks from 0.021 to 0.88 cubic metres per 100m², and three patterns of decay distribution. Stand age, disturbance history, and current park usage all contribute to the current state of CWD in North Saanich Parks.

When planning the management of North Saanich natural areas, CWD should be taken into consideration. Ecosystem management should include retaining as much CWD on site as possible, and planning future sources of CWD through wildlife tree retention. To support biodiversity in North Saanich, a diversity of habitat, ecosystem processes, and critical ecosystem components like CWD should be supported.

Introduction

Trees are the fundamental component of forests and contribute greatly to their ecosystems by stabilizing soil, storing carbon, creating habitat, and regulating temperature through shade. However, a tree's contributions do not end when it dies: the living phase is followed by a "deconstruction" phase when dead components are recycled back into the living forest (Stevens, 1997). Fallen trees, and pieces of trees, are called Coarse Woody Debris (CWD), officially defined as "*Sound and rotting logs and stumps...that provide habitat for plants, animals and insects and a source of nutrient for soil structure and development*" (Province of British Columbia, 1995) (**Figure 1.**). This definition is only a brief description of the numerous services CWD provides for centuries after the end of a tree's lifespan.

The ecological role of CWD in forests can be divided into four categories: productivity, habitat, carbon storage, and structure. Dead wood is a substantial source of energy, carbon, and nutrients for forest ecosystems, providing fundamental resources for forest productivity (Harmon et al., 1986). CWD is utilized by numerous organisms for shelter such as small mammals, arthropods, fungi, mosses and lichens, and plant seedlings (**Figure 2.**) (Stevens, 1997). Mature forests store a large amount of carbon in CWD which releases carbon slowly as it decays, sometimes for several hundred years (Stevens, 1997). Pieces of CWD on the forest floor provide structure to the surrounding habitat, increasing resistance to erosion and retaining soil moisture during periods of drought (B.C. Ministry of Forests, 1993).



Figure 1. *A fallen tree in RO Bull Park, a typical source of coarse woody debris along with fallen branches.*



Figure 2. *A piece of coarse woody debris in Green Park, providing habitat as a nurse log for plant seedlings.*

This report focuses on CWD found in several parks in North Saanich, British Columbia. The District of North Saanich is located on southern Vancouver Island in the traditional territories of the WSÁNEĆ First Nations. Before European colonization and logging, forests in southern Vancouver Island would have experienced occasional large-scale disturbance events like fire. A large amount of CWD would have been created at once by these events, but as stands grew and matured, CWD input to the ecosystem would eventually reach a steady rate even with the rate of decay (Stevens, 1997). In theory, a mature forest in the North Saanich area would have a diversity of CWD in the forest ranging from recently fallen to well-decayed logs.

Since European contact, forests in North Saanich have been logged for agricultural land, World War II industry, and clearing for residential developments (Hope, 2023). In contrast to a natural disturbance event, logging removes trees from the ecosystem and therefore CWD, along with the numerous services it provides.

The Friends of North Saanich Parks (FNSP) is a non-profit, volunteer organization committed to supporting remaining natural spaces of North Saanich through restoration activities and ecological investigations. CWD is an important component of healthy forest ecosystems, and understanding the state of CWD in North Saanich Parks can help with understanding the overall health of their forests. This report aims to estimate

the quantity of CWD in 14 North Saanich Parks (**Figure 3.**). This report will then interpret the findings in the context of the parks, each with a unique combination of forest stand age and ecosystem type, and make recommendations for management of CWD. In order to protect natural ecosystems and biodiversity in the face of a changing climate, the management of forested parks must include consideration for CWD as a critical component to natural forest cycles.

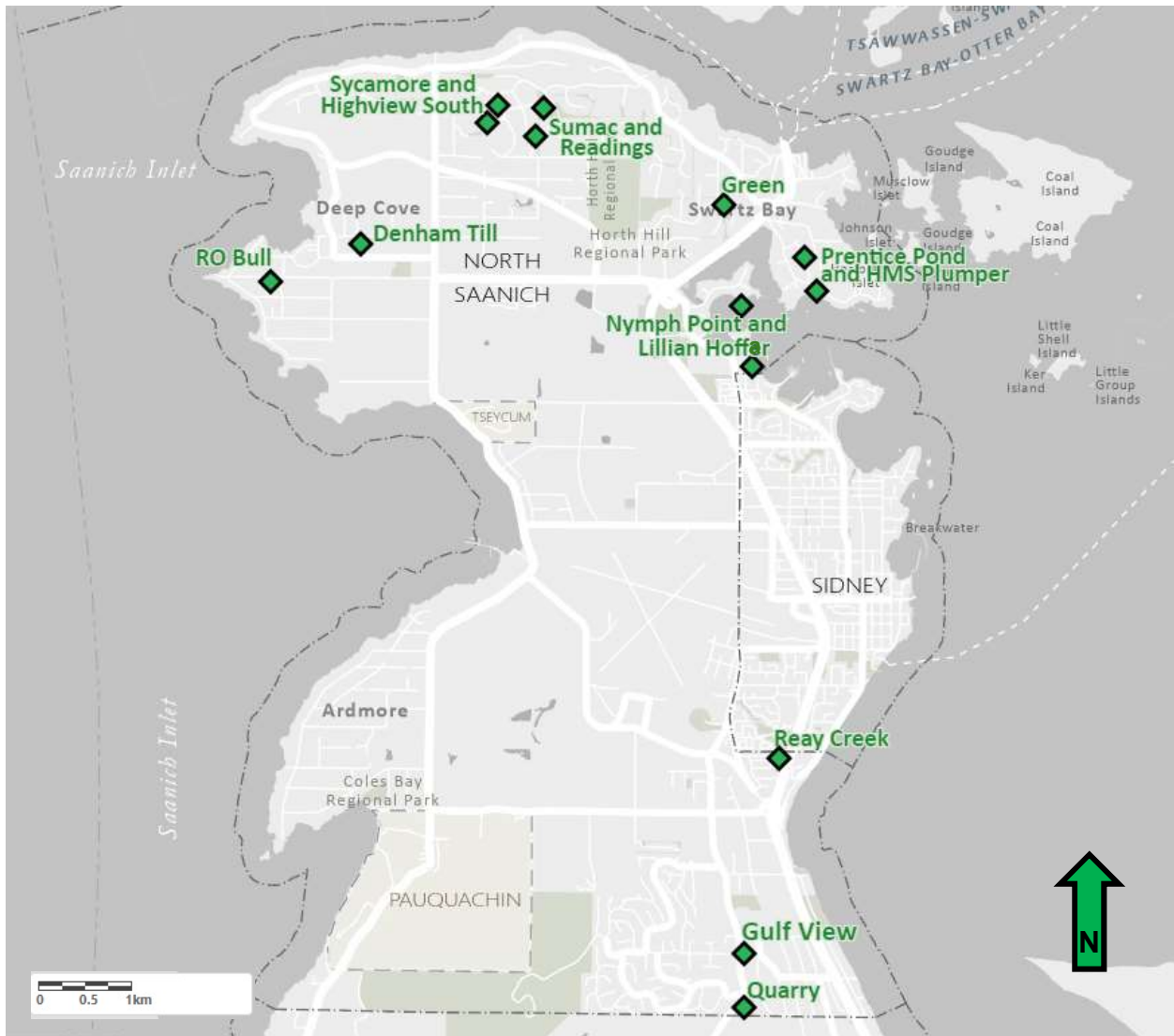


Figure 3. Map of the 14 parks surveyed for this report in North Saanich, BC. Map created online in the CRD Regional Map.

Methods

Background information on each of the parks was collected from previous reports published on the Friends of North Saanich website (Hope, 2023; and Christensen, 2023), aerial photographs from the British Columbia government database, and informational interviews with residents of North Saanich.

CWD was surveyed in the 14 parks from June 3rd to June 6th. Prior to surveying, plots were established in at least one area of each park deemed to be representative of the typical vegetation, topography, and hydrology. In parks with multiple, unique ecosystem types, multiple plots were established in each type. Green Park, Lillian Hoffar Park, and Reay Creek Park all have significant shifts in ecosystem type and required two surveys each, while the remaining parks were well-represented by just one. Each survey plot was one 400m², 20x20m square or broken into two 200m² plots to avoid disturbances like foot trails and ephemeral streams.

Ecosystem data was first collected for each plot including canopy cover, plant species present, slope and aspect, and topography. Each piece of measurable CWD was photographed and measured if it met the criteria established in the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (2010). Measurable CWD matched the following characteristics:

- Dead woody material (fallen trees or branches) located above the soil and larger than 7.5 cm in diameter
- Not self-supporting (ie. stumps and still-rooted snags) but can be suspended on other trees
- Cut logs if determined to be of local origin

Diameter was measured at the smallest (to 7.5cm) and widest end of each piece using a standard diameter-at-breast-height measuring tape (**Figure 4.**). Length between diameter measurements was taken using a standard 30m measuring tape (**Figure 5.**). If

a piece of CWD fell partially outside the plot, diameter and length were only measured for what fell within the plot.

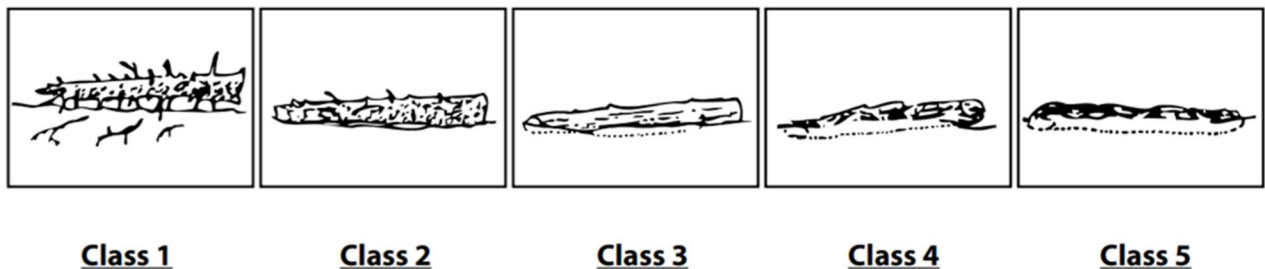


Figure 4. DBH tape being used to measure the diameter of a piece of CWD in Highview South Park.



Figure 5. Standard 30m measuring tape being used to measure the total length of a piece of CWD in Denham Till Park.

The size of CWD, species, contact with the ground and environmental factors like moisture and temperature all influence the rate at which a fallen tree decomposes (B.C. Ministry of Forests, 1993; Stevens, 1997) and make it difficult to estimate a piece’s age. Instead, “decay class” is used to describe a piece’s state of decomposition. Decay class was estimated following the criteria in the Field Manual for Describing Terrestrial Ecosystems 2nd Edition (2010) and assigned a value from 1 to 5, with 1 being the least decayed to 5 being extensively decayed (**Figure 6.**). Anything beyond a 5 decay class is considered “ghost coarse woody debris” and is too difficult to be accurately measured.



Class 1

Class 2

Class 3

Class 4

Class 5

Figure 6. The typical appearances of coarse woody debris in each of 5 decay classes. A decay class of 1 is a recently fallen tree or tree branch with little sign of decomposition, while a decay class of 5 is well decomposed. Figure taken from the Field Manual for Describing Terrestrial Ecosystems 2nd Editions (2010), Section 7 page 9.

Using data collected from the survey, volume of each piece of CWD was calculated using Smalian's formula for volume (Waddell, 2002):

$$V_{m3} = \frac{(\pi/8)(D_S^2 + D_L^2)l}{10,000}$$

Where V is volume in cubic metres, D_S is the small-end diameter in centimetres, D_L is the large-end diameter in centimetres, and l is the total length in metres. This formula assumes all CWD follows the same cylindrical shape and a certain level of volume error must be expected. The results of this survey are a rough estimation only.

The volumes were totaled for each park and converted to a standard volume per 100m². Total volumes per decay class were also calculated for each park for comparison of the distribution of CWD decomposition.

Results

Total Volume per Area of CWD

The total volume of CWD in each park ranged from 0.021 cubic metres per 100m² in Gulf View Park to 0.88 cubic metres per 100m², 41 times more, in Sumac Park. Based on volume alone, the parks fell into three categories: >0.75m³, 0.20-0.75 m³, and <0.20 m³. Most parks fell into the last category with very little CWD present. **Figure 7.** below shows the estimated volume of CWD per 100m² in each of the 14 parks. Parks with multiple ecosystem types and multiple surveys are presented as separate entries.

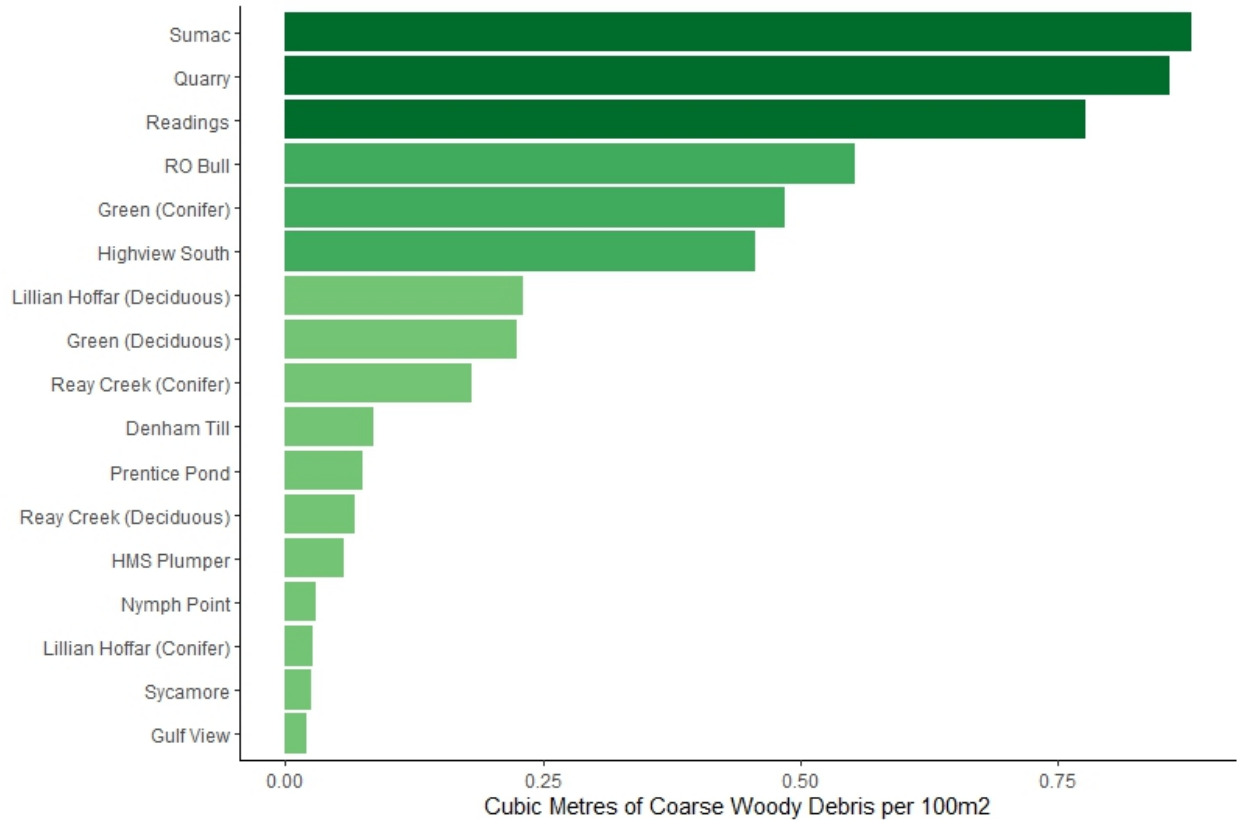


Figure 7. The estimated amount of coarse woody debris (CWD) in each surveyed park, presented in cubic metres per 100m². The parks can be arranged into three groups based on the amount of CWD found: Sumac, Quarry, and Readings Parks (>0.75m³, dark green); RO Bull, Green (Coniferous stand), and Highview South (0.20-0.75m³, green); and Lillian Hoffar, Green (Deciduous stand), Reay Creek, Denham Till, Prentice Pond, HMS Plumper, Nymph Point, Sycamore, and Gulf View Parks (<0.20m³, light green).

Distribution of CWD by Decay Class

The second aspect of data analysis involved the distribution of CWD volume across 5 decay classes in each park. Like total volume, the distribution of CWD across decay classes varied widely between the 14 park. However, the following three patterns were chosen for discussion.

Figure 8. shows the volume per decay class for Highview South Park and HMS Plumper Park. Both parks were in the lowest category for total volume per 100m² but had CWD present in all 5 decay classes. Green (Conifer), Prentice Pond, RO Bull, and Reay Creek (Conifer and Deciduous) all had similar patterns of decay class distribution.

These 6 parks represent a wide variety of ecosystems and forest stand ages, making it difficult to interpret the shared pattern. Highview South is a dry park located at the crest of Cloake Hill while Prentice Pond is a wet site in a depression on Curteis Point. Prentice Pond is also a young forest stand while RO Bull holds some of the oldest trees in the 14 parks surveyed (Hope, 2023).

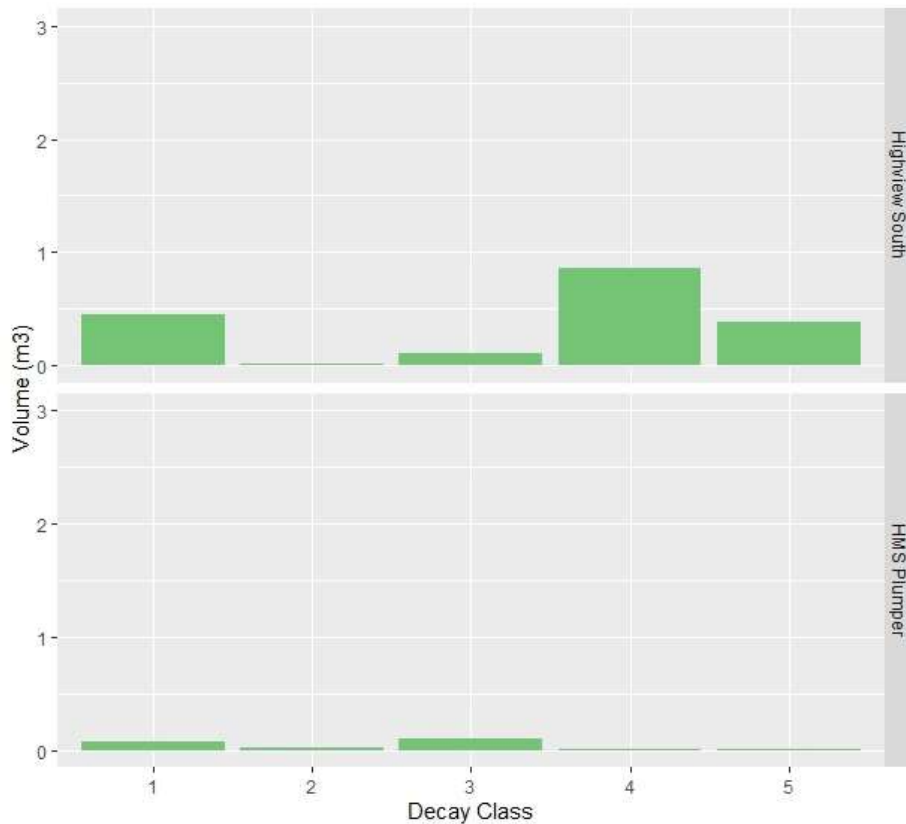


Figure 8. The volume of CWD per decay class for Highview South Park and HMS Plumper Park.

Figure 9. shows the volume per decay class for Sycamore Park and Gulf View Park. In contrast to the previous parks discussed, Sycamore and Gulf View only have very undecomposed CWD in Class 1 and 2. Denham Till, Lillian Hoffar (Conifer and Deciduous), and Nymph Point Parks all had similar patterns and all five parks fall into the category with the least volume of CWD per area.

There are many potential interpretations for why these parks have small volumes and very undecomposed CWD. Sycamore and Gulf View for example, are both young stands (<70 years old) (Hope, 2023) in dry locations, meaning there has been less time for CWD input following logging and decomposition rates are expected to be slower (Stevens, 1997). While Denham Till's forest stand is slightly older at ~100 years old (Hope, 2023), it also predates when forests are expected to start inputting more CWD after a disturbance (Stevens, 1997). Nymph Point has older trees (~200 year old *Pseudotsuga menziesii*) on a nutrient-rich shell midden (Hope, 2023) but is smaller park with fewer trees to contribute to CWD input.

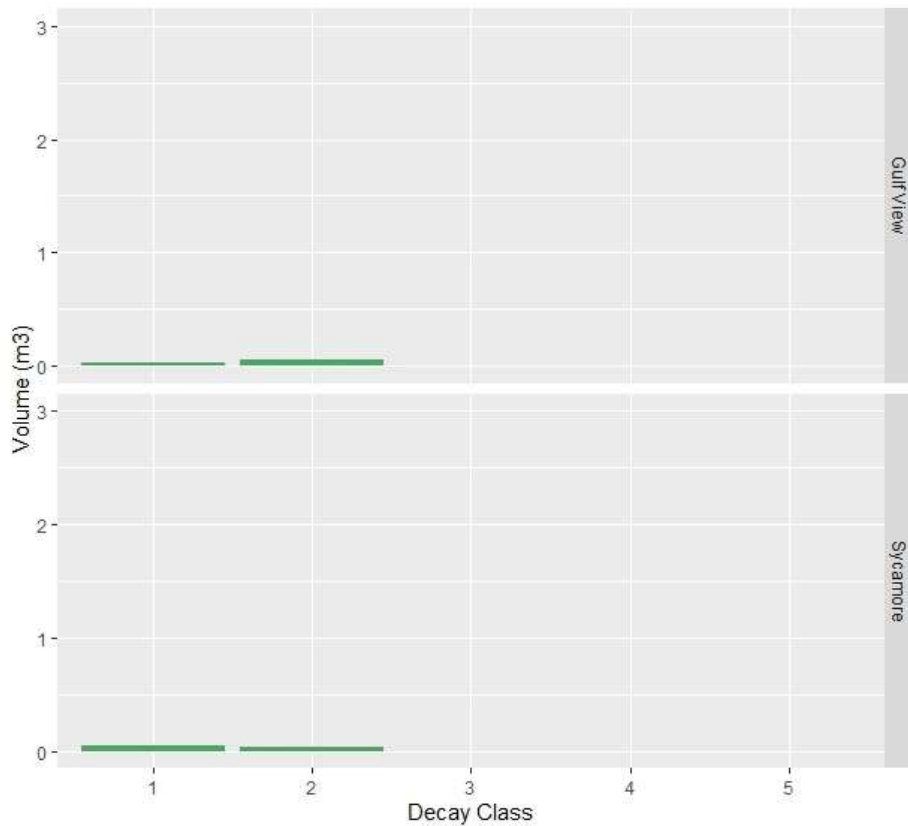


Figure 9. The volume of CWD per decay class for Gulf View Park and Sycamore Park.

Figure 10. shows the volume per decay class for Quarry Park and Sumac Park, two of the three parks with the highest volume of CWD per 100m². Readings Park, the final park with the highest volume, had a decay class pattern very similar to Sumac Park.

Despite having a similar amounts of CWD by volume, Quarry and Sumac have very different distributions of decay classes. Sumac is considered a mature forest site (~100 years old) (Hope, 2023) with rich soil conditions (Christensen, 2023b), a multi-storied canopy, and snags. Historically, Sumac would have been logged in the late 19th to early 20th century, as evidenced by springboard notches in remaining old-growth stumps (Christensen, 2023b), with more logging events likely. Quarry was a historic quarry site closed in 1926 (Hope, 2023) without the indicators of soil richness or moisture seen in Sumac. The site has shallow soils (Hope, 2023) and considerable wind disturbance from the southwest. While Sumac had an abundance of CWD in various states of decay (Figure 11.), the survey found only two large, very decayed logs in Quarry with the remaining CWD found in the form of recent, undecomposed windthrow (Figure 12).

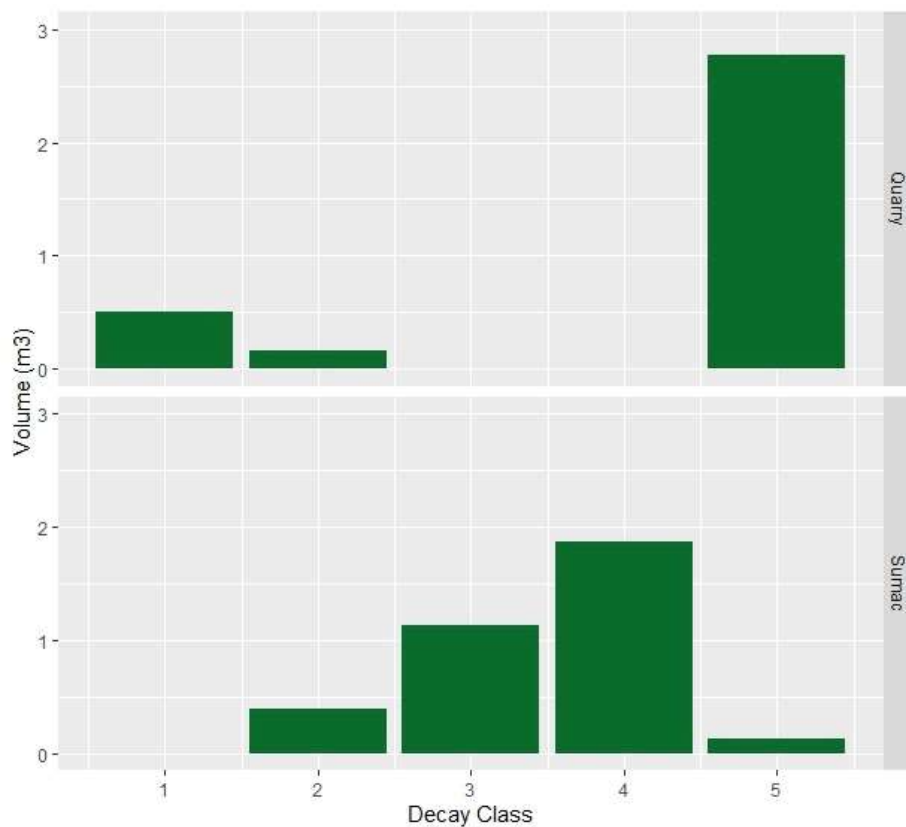


Figure 10. *The volume of CWD per decay class for Quarry Park and Sumac Park.*



Figure 11. *Large volume of CWD in Sumac Park in a diversity of decay classes.*



Figure 12. *CWD in Quarry Park. By volume it is almost the same as Sumac Park, but most is found within two large logs while the rest is undecomposed windthrow.*

These two park illustrate how understanding CWD in North Saanich parks involves looking at both the amount and diversity of CWD. Sumac Park show a more diverse assortment of CWD, and snags within the plot represent sources of future CWD. Quarry, on the other hand, holds most of its volume in the two class 5 pieces without a diversity of CWD in lower classes or snags to replace it.

Recommendations for CWD Management

CWD is an important component of forest ecosystems, providing nutrients and energy, habitat for plants and animals, landscape structure, and long-term carbon storage (Stevens, 1997). While undisturbed, mature forests would be expected to have a healthy amount of CWD and a wide diversity of decay classes, forests affected by human activities like logging do not follow the same patterns.

Protecting the biodiversity of species also involves protecting the diversity of habitats, ecosystem process, and vital components like CWD. When managing for CWD, consideration should be taken for both the total volume in a park and having a diversity

of decay classes present. Because North Saanich Parks are highly used and enjoyed by residents, any plan should strive to balance ecological and human benefits in these areas.

The City of Surrey on the lower mainland of British Columbia includes a Coarse Woody Debris Management Strategy in their Natural Areas Management Plan. Like North Saanich, the parks in Surrey have been highly affected by human activity and many of their urban forests have had CWD removed. The plan's purpose is to implement actions to retain CWD in the parks when it is created, helping to restore natural ecosystem processes. It stands as an example of integrating ecosystem stewardship with traditional park values.

The parks in North Saanich are diverse in ecosystems, disturbance, and current CWD conditions making management of the natural processes more complicated, but not impossible. The following recommendations are summarized from the City of Surrey management strategy, the Ministry of Forests Biodiversity Handbook, and the British Columbia government's silviculture and stand management training:

- CWD surveys should be conducted to maintain an understanding of current CWD conditions in the parks.
- Wildlife trees (snags) should be retained when possible as a source of future CWD in the parks. Wildlife tree and CWD management plans should be integrated to support natural ecosystem cycles in the parks.
- When trees and snags are identified as danger trees and must be removed, they should be retained on site as CWD and well distributed (not piled).
- Retained CWD should be kept as intact as possible as larger CWD has greater habitat values, retains more moisture in the soil, and decays slower meaning its benefits will last longer.
- Especially in dry conditions, suspended CWD should be brought to the ground to reduce ladder fuels and risk of canopy ignition during fire.
- Educational signage or announcements about the importance of CWD, and deterrence of any collection of CWD for firewood.

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