Town of Comox
Urban Forest Management Plan
2012

Prepared For:
Town of Comox

Prepared by:
Mumby's Arboriculture Consulting

December, 2012

Prepared for:

Town of Comox
Parks Department

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EXECUTIVE SUMMARY

The Urban Forest consists of all forested ecosystems in the Town of Comox. This includes individual trees on both public and private property within the urban landscape. Street trees, park trees, natural areas, trees on institutional locations and trees in a variety of private ownership settings, ranging from parking lots to back yards, are included in the urban forest.

Balancing urban planning goals inclusive of managing growth, enhancing livability, protecting the environment, maintaining vibrant public spaces, and creating recreational opportunities is a challenge and trees can contribute in achieving all of these goals.

This Urban Forest Management Plan provides the Town of Comox with detailed information about its' street and park trees and the publically owned natural areas. Management goals, actions, and tools ranging from best management practices and standards for tree care, community involvement, promoting conservation of existing tree resources to enhancing canopy cover in the community and encouraging good tree management on private property are included in this document. Also included in this plan are recommendations to assist the Town of Comox in achieving a sustainable urban forest.

INTRODUCTION

Vision statement

The Town of Comox will sustainably manage the urban forest to ensure a thriving urban forest that is healthy and diverse. The urban forest will link natural areas, greenways, wildlife corridors and parks to enhance community livability, and to bring environmental benefits for present and future generations.

Scope and Purpose

Importance of protecting our urban forests

"The urban forest in and around towns and cities provide many benefits including: sequestering of gaseous air pollutants and particulates; energy conservation; storm water attenuation; noise buffering; provision of wildlife habitat; increase property values; improved aesthetics; psychological well-being; and recreational and educational opportunities. These benefits accrue not only to the owners of the trees and forest but to the entire community. While the same can be said for the wildland

forests of Canada, the connection in the urban forest is much more dramatic because the beneficiaries live within the urban forest."[1]

The Town of Comox Official Community Plan (OCP) states on Page 68 "The Urban Forest is a term used to include the forested ecosystems and individual trees found within the urban landscape. This includes natural forested ecosystems, street and park trees as well as individual trees growing on private property."

Photograph: Willow at Marine Park, Comox

Dr. Deneke, from the US Forest Service defines urban forestry as, "…the sustained planning, planting, protection, maintenance, and care of trees, forests, green space and related resources in and around cities and communities for economic environmental, social, and public health benefits for people. The definition includes retaining trees and forest cover as urban populations expand into surrounding rural areas and restoring critical parts of the urban environment after construction. Expansion at the urban/rural interface raises environmental and public health and safety concerns, as well as opportunities to create educational and environmental links between urban people and nature. In addition, urban community forestry includes the development of citizen involvement and support for investments in long-term ongoing tree planting, protection, and care programs." [2]

Urban Forest Management Plan and Urban Forest Management Strategy

Page 68 of the OCP states "finding the right balance between adequate and effective protection for our Urban Forest and appropriate human use of land and resources is challenging."

This Urban Forest Management Plan (UFMP) is one of the steps required to help the Town meet this challenge. It discusses the management needs of the Town of Comox's

[1] Canadian Urban Forest Strategy 2013-2018, July 2012, page 2. Authored by Canadian Urban Forest Network, Tree Canada.

[2] Deneke, F. 1993. Urban Forestry in North America: Towards a Global Ecosystem Perspective. pp. 4-8. In Blouin,G. and Comeau, R. [eds.] Proceedings of the First Canadian Urban Forests Conference May 30- June 2, 1993. Winnipeg MB. 151 pp.

urban forest and natural area stands based on the completed tree inventory; makes site specific, prioritized, inventory -based recommendations for managing the Town of Comox's public tree resource for a five-year period, and speaks to the management needs of the eleven natural areas located within the Town of Comox's urban forest. This document can be utilized within an urban forest management strategy. Urban forest management strategies establish the overall goals and objectives of the organization's urban forestry efforts. It creates the blueprint for administration & management of the tree program and includes input from local citizens, organizations, businesses and municipal staff. The strategy is integrated with other comprehensive community plans.

BACKGROUND

The Town of Comox has become known for its seaside location, forests, unique parks and close proximity to natural areas. The diverse ecosystem, natural areas, and parks can be enjoyed by people of all ages. The forests, soils, and water have provided the people here with recreational and subsistence benefits to K'ómoks First Nations, the original inhabitants of the Comox Valley, and later to European settlers. There have been many changes to the landscape since those early times. As a growing community, the Town of Comox faces challenges for the preservation of urban and natural forests. The following local plans identify challenges facing the Comox Valley and provide goals, objectives and actions that reflect the need to manage the urban forest.

- Town of Comox Official Community Plan (2011)
- Comox Valley Sustainability Strategy (2010)
- Comox Valley Regional Growth Strategy (2011)

In particular, the Official Community Plan (OCP) recognizes the importance of valuing, protecting, and managing the Urban Forest in the development process. The OCP identifies important steps that must be put into place to respect and manage our urban forest. This is reflected by section 2.3.12 of the OCP which includes the following environmental objectives:

- To balance the demand for development with the need to protect and maintain a healthy environment;
- To identify, protect and enhance environmentally sensitive aquatic areas and terrestrial areas;
- To encourage public stewardship of natural areas on private lands;
- To ensure that the natural environment is protected during the subdivision and development review processes.

This is further reflected in the environmental policies *(section 2.3.13*) stating that the Town of Comox will:

- Pursue opportunities to plant new trees on public lands including parks and boulevards, where appropriate.

- Consider expanding the scope of the Tree Management and Protection Bylaw to include protection of mature trees in areas zoned for residential or mixed use development and to address tree removal prior to development applications and;
- Consider development of an Urban Forest Management Strategy with a long term objective of increasing forest canopy cover including parkland, boulevard trees along roadways and on private land. Such a strategy would encourage the protection, planting and replacement of trees, primarily through public education and an expanded tree protection bylaw. Such a strategy would also be able to demonstrate how the Town will achieve Zero Net Deforestation, assess and track tree cover and enhance connectivity between forested areas

The OCP identifies an increasing emphasis to acquire and preserve open spaces and parks in order to support ecological objectives such as carbon sequestration, storm water management, and habitat protection. Acquiring natural parcels will not only assist in protecting environmentally sensitive areas within Comox but with also help to, "improve greenway connectivity… to adjacent Comox Valley Regional District and Courtenay greenway plans (OCP, Page 45)." A list of priorities for greenways can be found on Page 51 of the OCP and includes areas like Brooklyn Creek, Cottonwood Lane, Carthew Creek, and McDonald Wood Park.

A first step in managing the urban forest is to identify it and to understand its value. Both the Comox Valley Sustainability Strategy and the Comox Valley Regional Growth Strategy express this with objectives to, "achieve a clear understanding of the Valley's ecosystems through inventory and mapping[3]" and to, "identify and map areas for conservation[4]." During the development of the OCP, many citizens of Comox expressed concern for the protection of the sensitive environmental areas and support for securing additional treed areas for social and environmental purposes.

STATUS OF THE URBAN FOREST IN THE TOWN OF COMOX

To expand on many of the measures mentioned in the OCP about the Town of Comox's urban forest, we have developed the UFMP to provide the following:

- an accurate inventory of publically owned trees,
- an accurate assessment of the eleven natural areas,
- analysis of the tree data to provide specific priorities for tree care over the next 5 years,
- analysis of the natural area data to provide recommendations for proper retention,

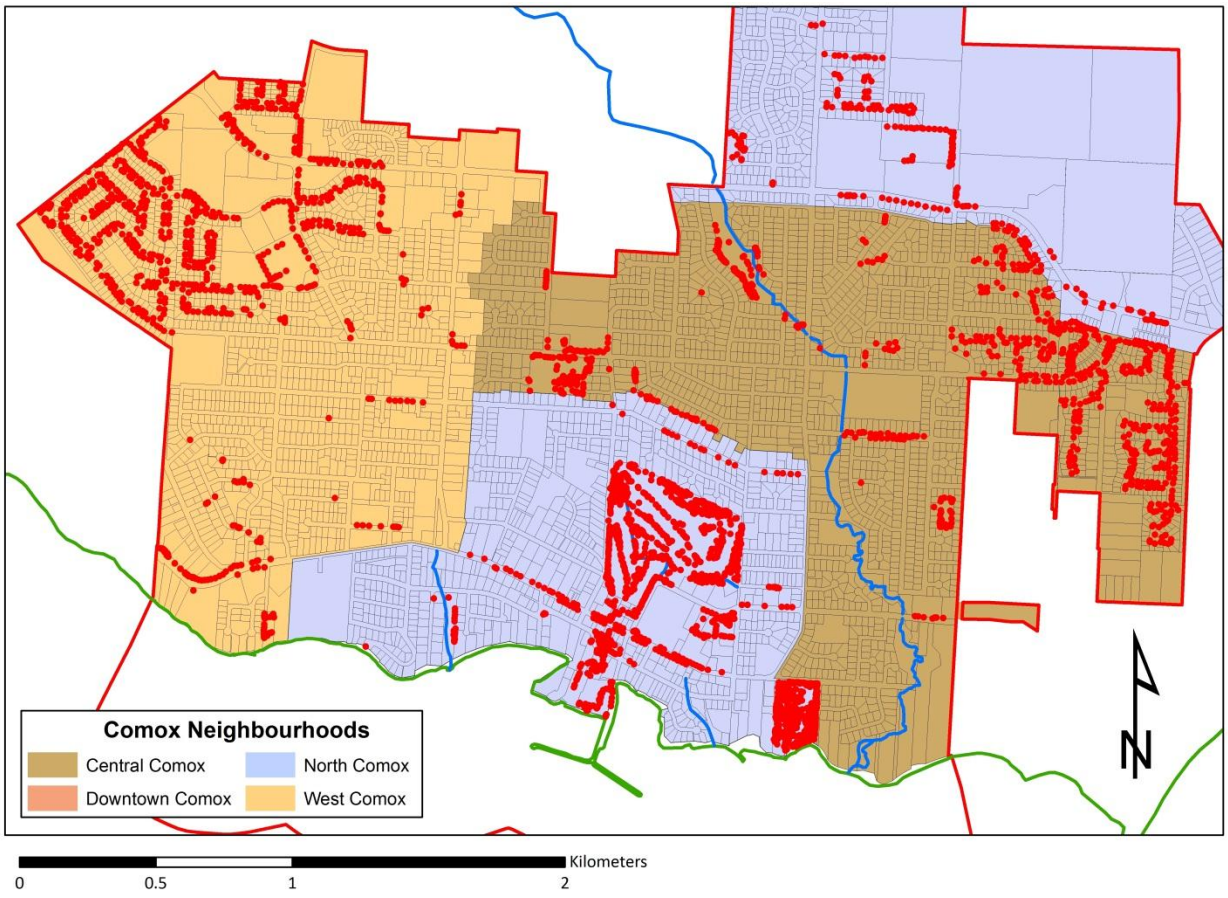
[3] Comox Valley Sustainability Strategy, 2010, pp. 85
[4] Comox Valley Regional Growth Strategy, 2010, pp. 33. Adopted by the CVRD board March 29, 2011.

- provide standards and policies specific to the needs of the tree care program, and a
- listing of strategies.

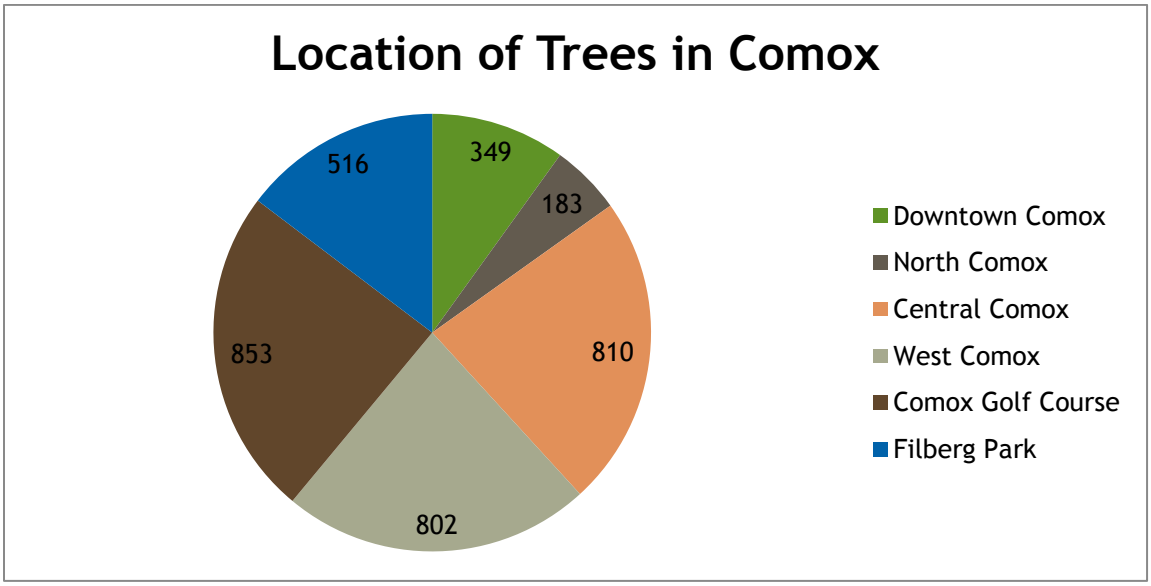
Data about each publicly owned tree within the Town of Comox was gathered using a GPS unit. The actual location of each tree is in their respective neighborhood data set. As used in the OCP, the neighborhoods are:

- West Comox
- Downtown Comox
- Central Comox
- North Comox

Map 1 Comox Neighborhoods with Tree Inventory



3,513 trees were inventoried within the Town of Comox (see map 1). A part of the UFMP for the Town of Comox is an assessment of the health and condition of trees growing in 'natural' landscapes. Natural landscapes include the trees and also the understory community of plants and the animal life they support.



Graph 1 Location of Trees in Comox

The inventory of these sites includes both:

1) assessment of tree health and the potential of trees to damage people or property; and
2) assessment of the health of the plant community as it supports the greater community goal of environmental health and biodiversity[5].

> *"Biodiversity is the variety of living things, including diversity within species (genetic diversity), diversity between species and diversity of ecosystems. An ecosystem is an interacting system of living organisms including their relationships with each other and with their non-living environmental surroundings. In a properly functioning ecosystem the components are inseparable and act upon each other. All living things including humans are part of and depend on ecosystems." (Biodiversity BC 2012)*

[5] Planning to support biodiversity and environmental health is mandated in: Objectives 2A-9 and 2B-3 of the Comox Valley Regional Growth Strategy (RGS 2011); Goal 5.2 of the Comox Valley Regional Sustainability Strategy (CVSS 2010); and strongly supported in Section 2.3.1 – Protection of Natural Areas, in the Town of Comox Official Community Plan (OCP 2011).

The natural areas assessed in this document range from largely intact forest systems such as the area called the North-east Woods, though natural area parks like along Brooklyn Creek, to some 'forgotten' corners of town lands as found on the Comox Golf Course (Map 2). Natural area forest plant communities in British Columbia are described using the Biogeoclimatic Ecosystem Classification (BEC) system (Green and Klinka 1994). Wetland and riparian forests are described using the Wetland and Riparian plant Classification system (WREC) (Mackenzie and Moran 2004). The BC Conservation Data Centre (CDC)[6] has adapted the plant associations from the vegetation component of the BEC and as the primary source for naming terrestrial ecological communities (RISC 2006). In this report we use the BEC and the WREC terminology as it provides a language for comparing forested sites.

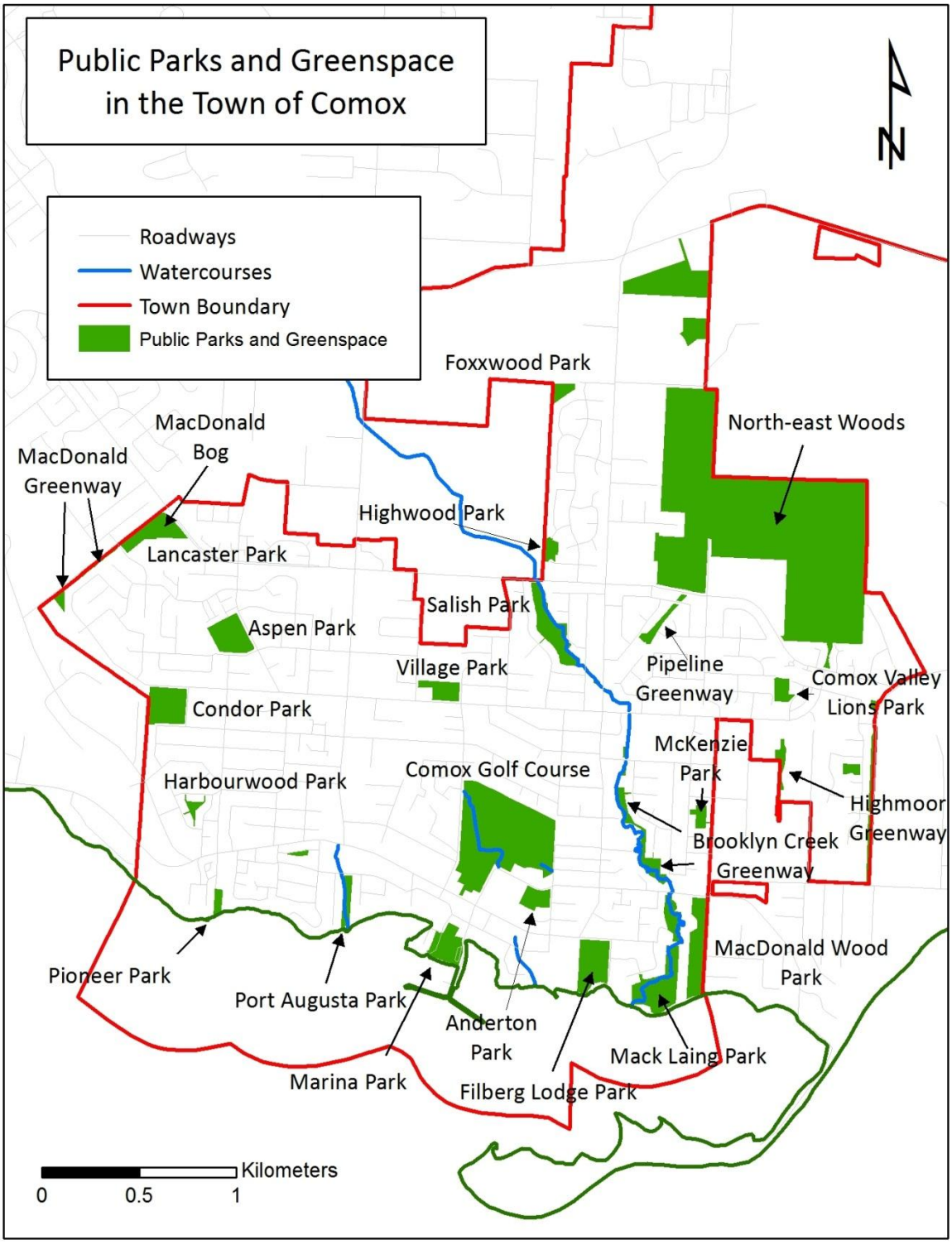
Forest plant communities on Vancouver Island have been 'listed' or assigned a status by the CDC or have been identified during the Sensitive Ecosystem Inventory (SEI)[7] based on both specific identified locations and also on the rarity of the various plant communities. That a specific location in the Town of Comox has not been identified by the CDC or the SEI does not limit its importance in the overall goal of maintaining a mosaic of healthy natural areas across the landscape. Documenting the forest plant communities in natural areas of the Town of Comox is a 'snapshot' of current conditions. By better understanding these sites, land managers can observe changes over time and make decisions to both enhance the natural qualities of the forest and better the experience of persons visiting the natural areas.

Photograph: Aerial view of Comox

[6] The BC Conservation Data Center (CDC) develops and maintains a provincial listing of BC's most vulnerable vertebrate animals, vascular plants and ecological communities. Red listed includes species that are extirpated, endangered, or threatened in B.C. and Blue listed includes species that are vulnerable in B.C.

[7] The Sensitive Ecosystems Inventory (SEI) was a joint Environment Canada - Ministry of Environment Lands and Parks initiative that used air photos to identify sensitive areas in the Comox Valley (SEI 1998).

Map 2: Public Parks and Greenspace in the Town of Comox



Methodology

Natural Areas

The natural areas in the Town of Comox have been described following methods outlined in *Standard for Terrestrial Ecosystem Mapping in British Columbia* (RISC 1998) and the related *Field Manual* (MOELP 1998). For this study we followed methods for reconnaissance level ecosystem description based on Ground Inspections and Visual Checks. We developed 11 study plots that document a range of plant communities found on sites of various soil moisture and nutrient regimes. All of the sites show evidence of past forestry activity.

The study plots were picked at near the centre of forested areas with consideration given to the overall homogeneity of the study area. Trees were mapped in an 11.3m radius around a plotted centre point. Standing dead trees were mapped and included on the Maps but not included in summary statistics. Understory vegetation, the shrub and herb layer were combined and described as approximate percentages. The centre point coordinates of the Ground Inspection plots were recorded to enable re-assessing the sites over time. Observing changes in vegetation and Full Plot ecosystem descriptions may be completed if desired. Visual Checks were used in more open parks or green spaces to make general descriptions of the natural features and the vegetation mix observed.

Table 1: Ecological Communities that best describe natural areas in the Town of Comox (CDC 2012)

Plant Community Code	English Name	CDC BC Listing[8]	Location in Comox
CWHxm1/01	Western hemlock - Douglas-fir / Oregon beaked-moss	Red	Aspen Park Condor Park MacDonald Wood Park
CWHxm1/03	Douglas-fir - western hemlock / salal	Blue	Northeast Woods
CWHxm1/05	Western redcedar - swordfern	Blue	Northeast Woods Village Park
CWHxm1/06	Western hemlock - western redcedar / deer fern	Red	Foxxwood Park
CWHxm1/08	Sitka spruce / salmonberry	Red	Northeast Woods Salish Park
CWHxm1/09	Black cottonwood – red alder / salmonberry	Blue	Mack Laing Park
CWHxm1/12	Western redcedar - Sitka spruce / skunk cabbage	Red	MacDonald Wood Park

[8] The BC Conservation Data Center (CDC) develops and maintains a provincial listing of BC's most vulnerable vertebrate animals, vascular plants and ecological communities. **Red** listed includes species that are extirpated, endangered, or threatened in B.C. and **Blue** listed includes species that are vulnerable in B.C.

Street and Park Tree Data

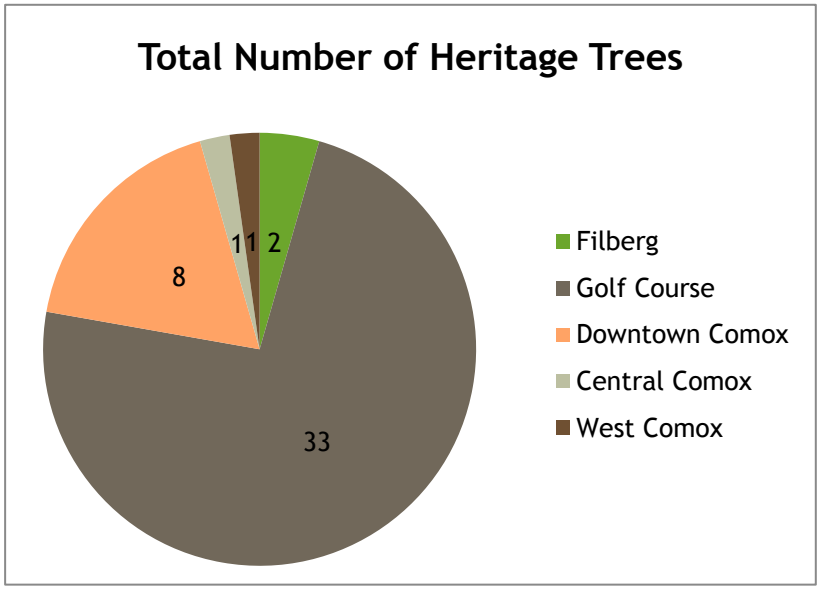
Attributes were gathered about each tree to provide to management the tools to maintain and enhance the urban forest. The attributes are:

- Type,
- number,
- Location (GPS co-ordinates)
- Diameter at Breast Height (DBH) (centimeters),
- Height (metres),
- Spread (metres),
- Condition (percentage),
- Recommended actions,
  - Pruning
  - Plant a new tree
  - Plant Health Care (PHC)
  - Monitor
  - Risk Assessment
  - Removal
- Attributes required for value calculation of each tree,
- Remarks. Heritage trees were recorded.

Along with this UFMP document the Town of Comox has received the digital information for each of the 3513 trees. The Town can then overlay the tree data into their GIS mapping program. For data management, all the attributes were delivered in the program Access.

Heritage Trees

Identifying trees within a community such as a remaining tree from an old farm, a tree of extensive age or a rare specimen, is needed to honor the history and preserve it for future generations to enjoy. 45 trees in the Town of Comox have been recognized as heritage trees. Heritage is defined as: A tangible object, an idea, a process, or an activity that is passed down through generations, or remains from past societies, and is considered worthy of



Graph 2 Heritage Trees in the Town of Comox

preserving for the enjoyment and learning of present and future generations. Heritage can be cultural (crafts, folklore, tools, customs, etc.) or natural (land, water, air, rocks, plants, habitat, etc.)[9]

INVENTORY AND TREE RESOURCE ASSESSMENT

The total number of street and park trees, their diversity and the actions recommended to improve the health and retention of the trees is documented in their respective area. Some of the attributes gathered about each tree can be placed into a tree value formula. This formula is called the International Society of Arboriculture (ISA) Trunk Formula method[10]. The basic value of a tree is the sum of two factors: the cost of transplanting the largest normally available tree of the same or comparable species; and the increase in value due to the larger size of the tree being appraised compared to the size of the replacement tree.

Some value examples of Comox trees:

- The massive English oak at Filberg Park with a diameter of 123 centimeters is valued at over $80,000.
- The 127 centimeter diameter Sequoia on the golf course is valued at $85,000 and the Arbutus in Marina Park is valued at $5,650.
- Many communities have valued their trees in accordance to this formula. The advantage of having each tree valued improves the potential to obtain management funds for the Town asset. It also justifies requesting funds from individuals or companies that damage public trees.

[9] Page 162 Dictionary of Natural resources management

[10] Explanation of the ISA Trunk Formula: In applying the Trunk Formula method the appraiser starts with the cost to buy and install the largest reasonably available replacement tree. The appraiser then calculates a cost per unit area for such a tree and applies it to the difference in size between the replacement and appraised trees. The result is added to the installed tree cost to obtain basic tree cost. The basic tree cost is then reduced by *Species, Tree Condition* and *Location* factors to reflect the difference, if any, between the cost to produce an idealized replacement for the appraised tree and the benefits the appraised tree is (or was) likely to provide. The *Species* adjustment is understood as functional depreciation that considers species related attributes such as growth characteristics, maintenance requirements and aesthetics. The *Condition* adjustment is understood as physical depreciation that considers condition related factors in the broad categories of structural integrity and plant health. The *Location* adjustment considers whether or how physical characteristics of the appraised tree are (or were) likely to be enjoyed or experienced. Council of Tree & Landscape Appraisers Guide for Plant Appraisal, page 58

Table 2: Tree Resource Assessment by Area

Area of Comox	Public Parks & Greenways	Natural Areas
West	Harbourwood Park MacDonald Greenway Pioneer Park	Aspen Park Condor Park Lancaster Park MacDonald Bog Pioneer Park
Downtown	Anderton Park Comox Golf Course Filberg Lodge Park Port Augusta Park Marina Park	Comox Golf Course Port Augusta Park
Central	Comox Valley Lions Park Mackenzie Park Pipeline Greenway Salish Park Village Park	Brooklyn Creek Greenway Comox Valley Lions Park Highmoor Greenway MacDonald Wood Park Mack Laing Park Salish Park Village Park
North	Highwood	Foxxwood Park Highwood Park North-east Woods Pipeline Greenway Salish Park

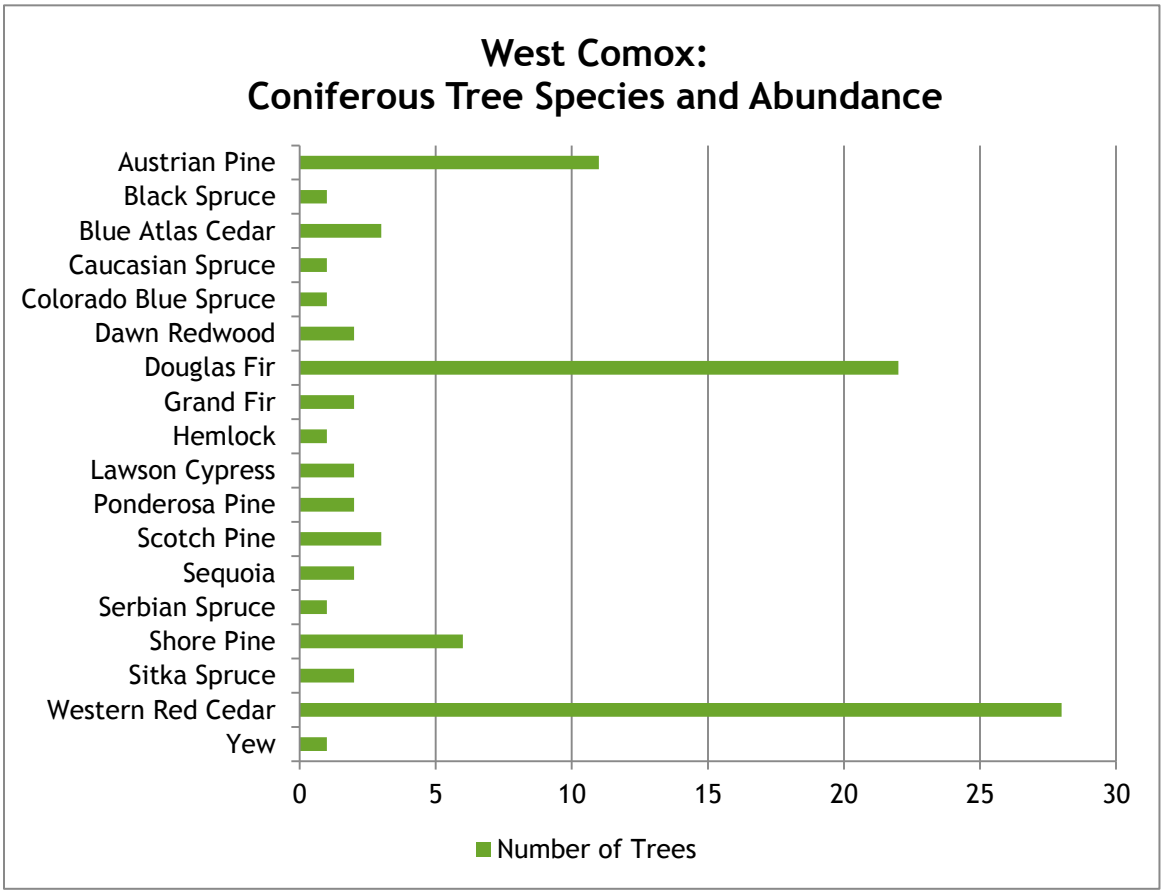
WEST COMOX

Comox West is bounded by Comox Bay on the south, then the west side of the hospital to Comox Road. The boundary follows the centre of Comox Road to one property east of Anderton Road. The boundary is an irregular north-south line between one and three properties east of Anderton Road to the North Town Boundary at Guthrie Road. The north and west boundaries follow the Town boundary. 801 trees are located in this area including MacDonald Road and Pioneer Parks. There are no trees in Harbourwood Park. The 3 natural areas are Aspen, Condor and MacDonald Road Parks.

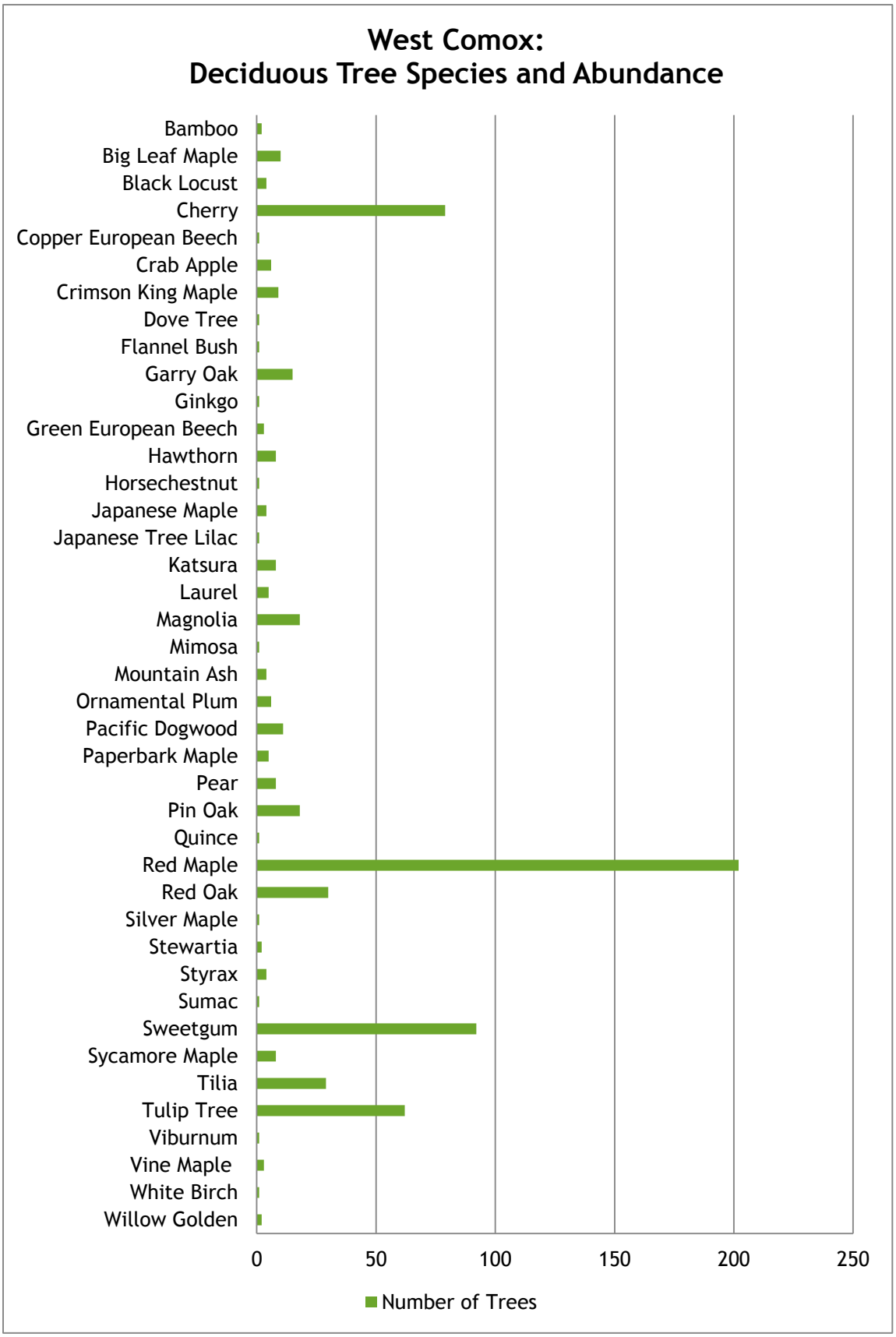
Table 3: West Comox Tree Inventory Summary

Tree Type	Number of Trees	DBH Range	DBH Average	Range of tree condition	Average Range of Tree Condition
Coniferous	91	3 to 118	30	40 to 90	79
Deciduous	710	2 to 93	11	10 to 85	74

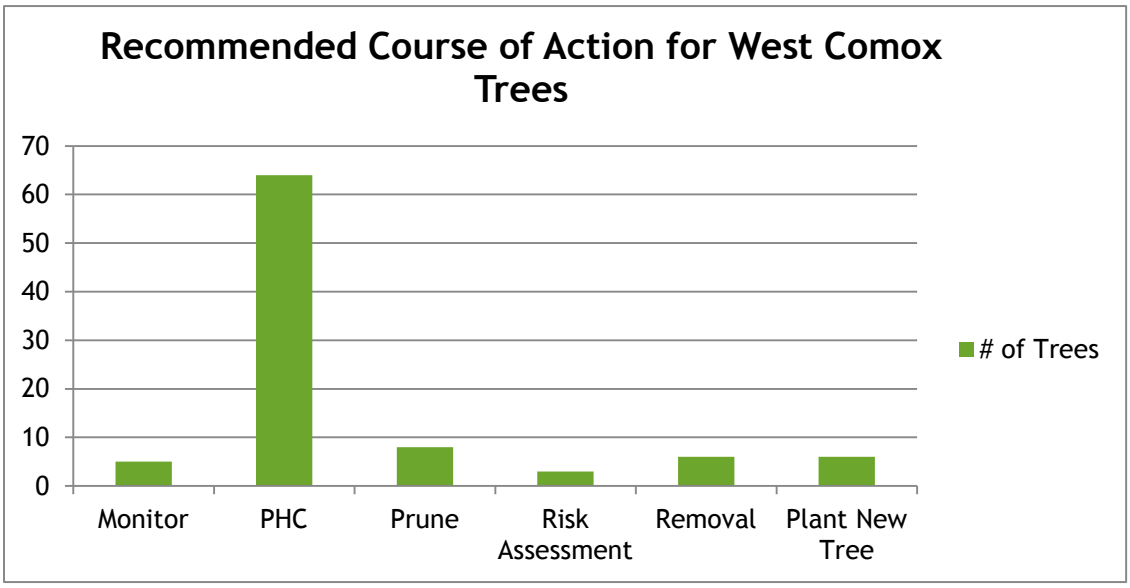
Trees in the west area are on average, small young trees. Although the overall average for tree condition is good, 8% of the tree population (63 trees) require immediate PHC of watering.



Graph 3: West Comox Coniferous Tree Species and Abundance



Graph 4: West Comox Deciduous Tree Species and Abundance



Graph 5: Recommended Course of Action for West Comox Trees

Areas like Harbourwood Park (below) are ideal locations to begin a tree planting program.

Natural Areas, Public Parks & Greenways of West Comox

Aspen Park

Aspen Park is a combination of playing fields and natural area vegetation (Map 3). The overall park is 3.03ha. The north boundary of the Park is a naturalized hedgerow (0.25ha). The natural area patch of forest (0.71ha) is in the south-east corner. The tree diameters and height suggest a transition between a Pole/sapling and a Young forest structural stage. The centre of the Aspen Park study plot is a cut stump. The plot contains a mix of Douglas-fir, big leaf maple and grand fir (refer to Appendix 1 for vegetation study lot data). Red alder are present in the Park but not captured in the study plot. An estimated 40% of the understory is bare ground. Oregon grape covered approximately 30% of the plot area. The remaining understory vegetation was a mix of: sword-fern (2%), red huckleberry (several stems); ocean spray (several stems); salal; bracken fern; and trailing blackberry.

Map 3: Aspen Park

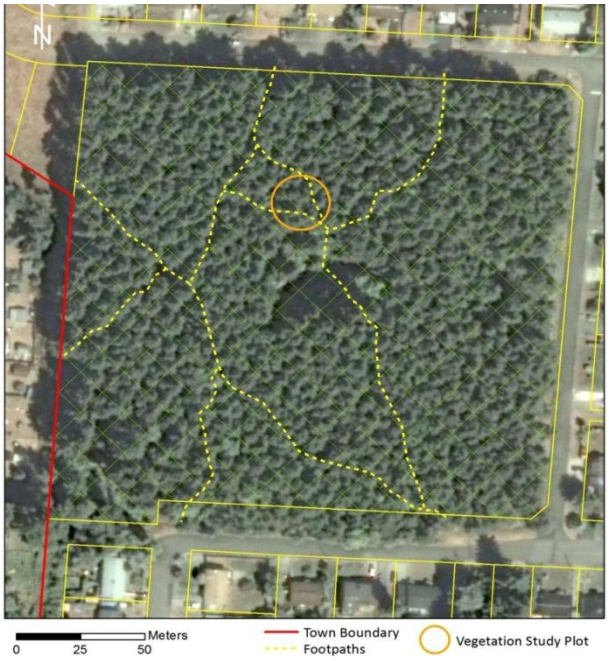
The soils appear moist where water supply, primarily precipitation but with some runoff from the playing fields, is removed somewhat slowly in relation to supply. Towards the west edge of the forest is a shallow channel that holds water during periods of rain. There is no natural outlet or storm drain at the downstream end of the channel. Historically this flow would have been part of Carthew Creek watershed that surfaces downstream of Comox Avenue and flows through Port Augusta Park.

The most common invasive plant is English holly. Primarily around the edges of the forested area are other invasive plants such as daphne; Scotch broom; and Himalayan blackberry. Compared to many natural area parks in urban areas, the infestation of invasive plants may be considered minimal and they could be eliminated. There was no evidence of the dumping of domestic yard waste.

Condor Park

Condor Park is a natural area second growth forest of 3.6ha. The park slopes gently to the south. The site would be classed as a young forest. The canopy is largely even with some initial natural thinning and growth of younger trees.

Map 4: Condor Park



The soils appear moist where water supply (primarily precipitation, but with some runoff from the north) is removed somewhat slowly in relation to supply. There are no obvious water flow channels in Condor Park. Natural water flow from the Park is subsurface and appears to be in two directions: the north-east corner flows east within the historic Port Augusta/Indian/Carthew Creek watershed; the majority of the water flow is to the south-west within a watershed that feeds a trout and Coho stream locally known as Karel Ploeuger Creek, below Back Road.

The centre of the Condor Park vegetation study plot is a Douglas fir with a blue metal tag (#7). All trees in the study site were Douglas-fir, averaging 30 metre height (refer to Appendix 1). The deciduous understory vegetation includes red huckleberry and snowberry. The ground surface plants are Oregon grape; salal; bracken and sword fern, twin flower and trailing blackberry.

Native trees observed in the Park are big leaf maple; red alder; Pacific willow; and cascara (one large cascara has a DBH of 36cm).

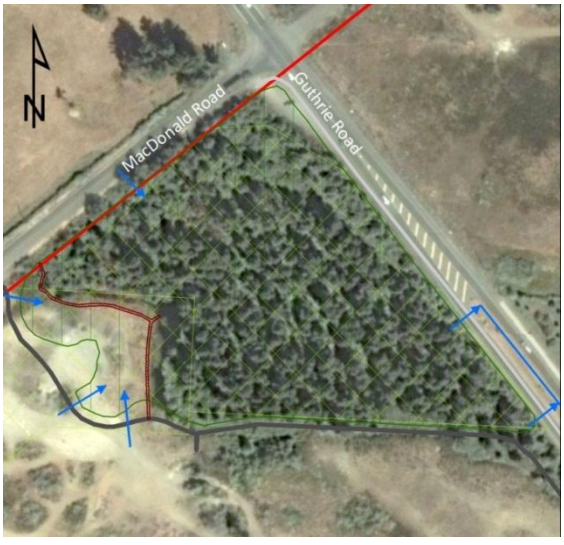
The central area of the Park had very few invasive plants (a few stems of English holly). Invasive plants are common along the park perimeter accompanied by the dumping of domestic yard waste (particularly behind a 'Do Not Dump Refuse' sign on Condor Street). The mix of invasive plants are daphne; Scotch broom; lamium; English ivy; periwinkle; English holly; and Himalayan Blackberry. There are significant amounts of invasive plants and a good possibility for removal and eradication.

Pioneer Park

Pioneer Park is a cemetery. The total area is 0.48ha, in which 0.16ha is a natural area that includes the bank that extends towards the sea and a narrow strip of planted cedars along the east boundary. Understory vegetation beneath the cedars is largely a tangle of Himalayan blackberry. Immediately inland of the bank is a naturalized patch of Saint John's Wort.

MacDonald Road Park

MacDonald Road Park runs along the Comox side of MacDonald Road from Guthrie Road south-west to the closed Noel Avenue right-of-way near Back Road, an area of 3.69ha. The natural area immediately south of the MacDonald and Guthrie Roads intersection is 1.98ha. Historically this area was uppermost source of the Golf Creek watershed. It now serves as a catchment for nearby rain runoff and directs water into culverts that eventually open into Port Augusta Creek (also named Carthew Creek or Indian Creek). To the south, water flow is part of the Mallard Creek watershed. This natural area is interesting in how wet it is, being very near the high point of the watershed. The aerial photographs below taken in 2005 and 2010 show how 80% of the trees have blown over and much of the area is standing water throughout the year due to the new residential development. Given deep water or wet mud around most of the perimeter of this natural area, and a dense tangle of fallen trees and thick vegetation around the rest, the central portion is virtually inaccessible to people.



2005

2010

DOWNTOWN COMOX

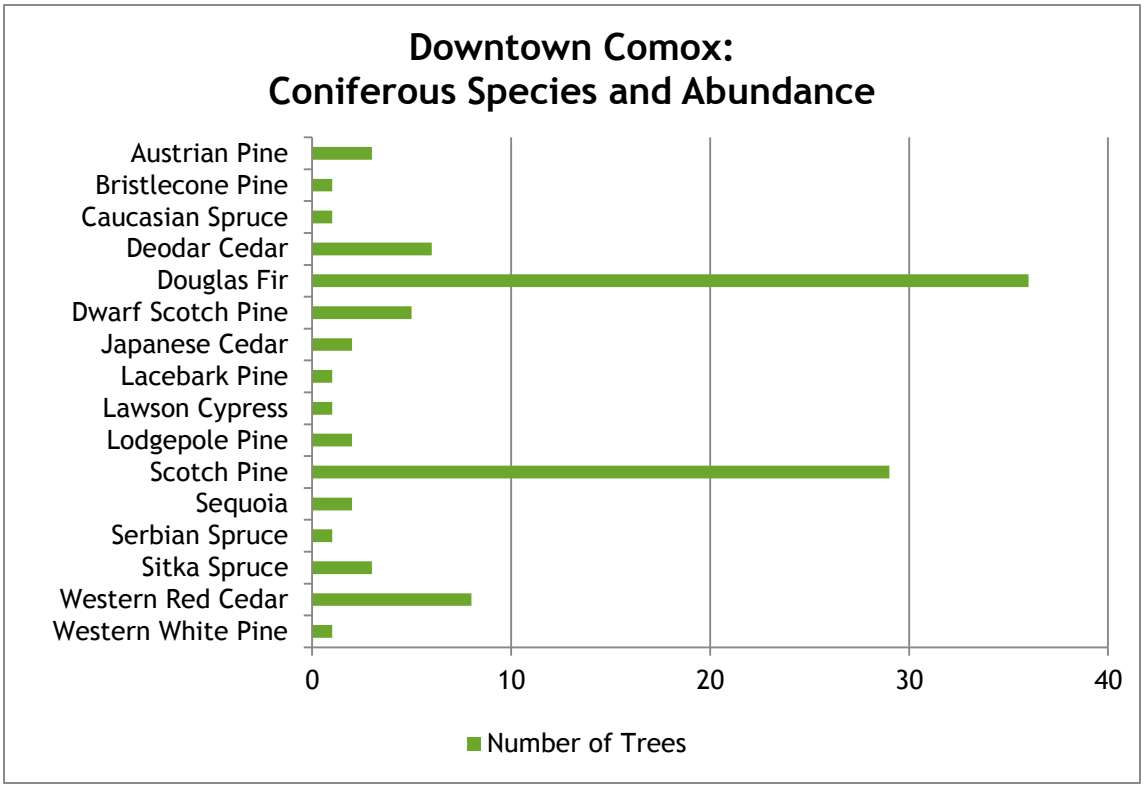
Downtown Comox is bounded by Comox Bay on the south. It includes the hospital then follows the centre of Comox Road to one property east of Pritchard Road. The boundary is an irregular north-south line between one and three properties east of Anderton Road to one property north of Robb Avenue. The north boundary is irregular at one to two properties north of Robb Avenue, east to Pritchard Road. The east boundary follows the centre of Pritchard Road, south to Comox Avenue, then east to Filberg Road. The final leg is south along the centre of Filberg Road.

349 trees are located in this area which includes Port Augusta, Marina and Anderton Parks. Comox golf course and Filberg Park data are also in the Downtown but reported separately for ease of reading.

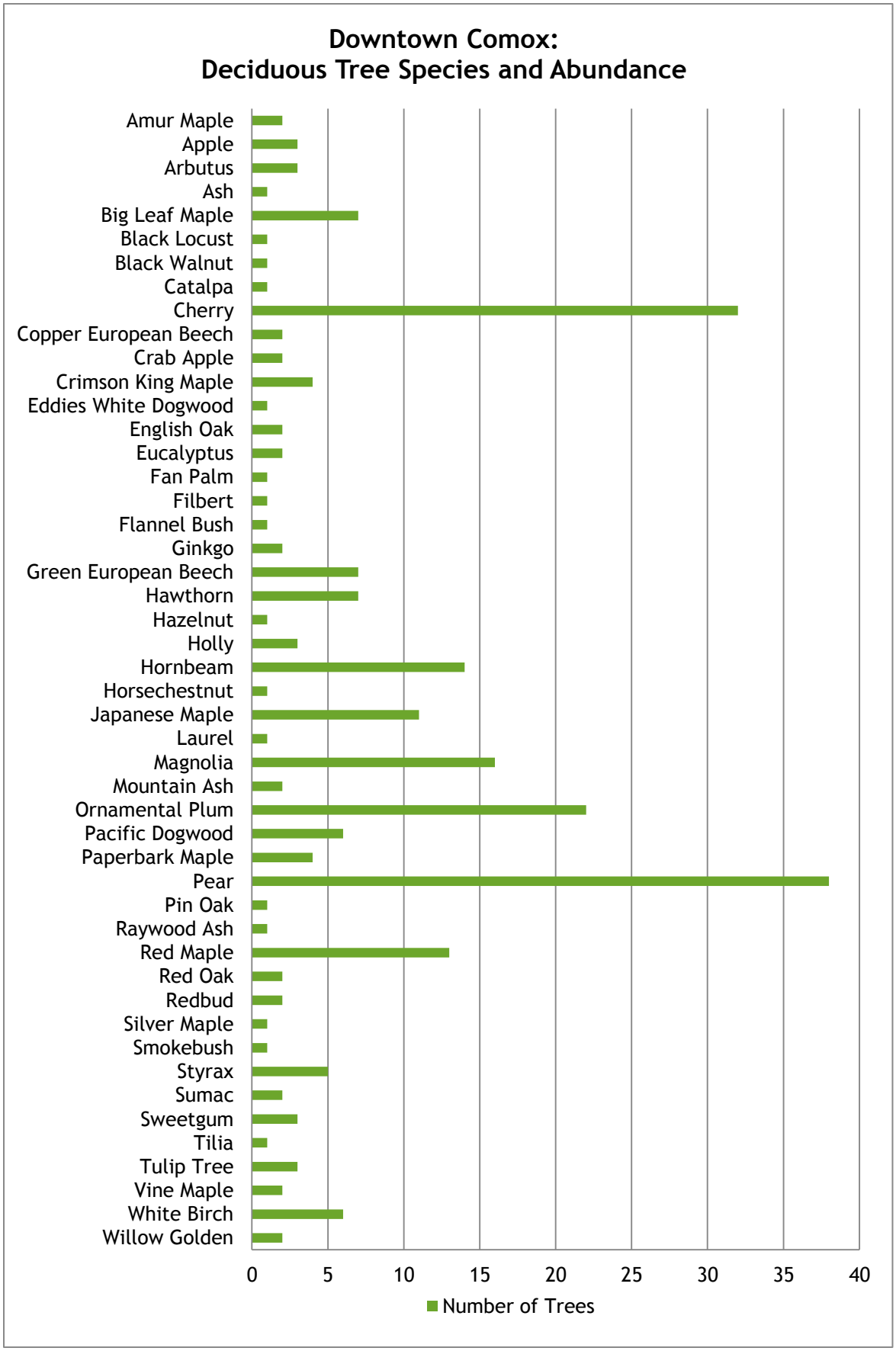
Table 4: Downtown Comox Tree Inventory Summary

Tree Type	Number of Trees	DBH Range	DBH Average	Range of tree condition	Average Range of Tree Condition
Coniferous	102	2 to 104	40	10 to 85	71
Deciduous	247	2 to 110	20	10 to 80	67

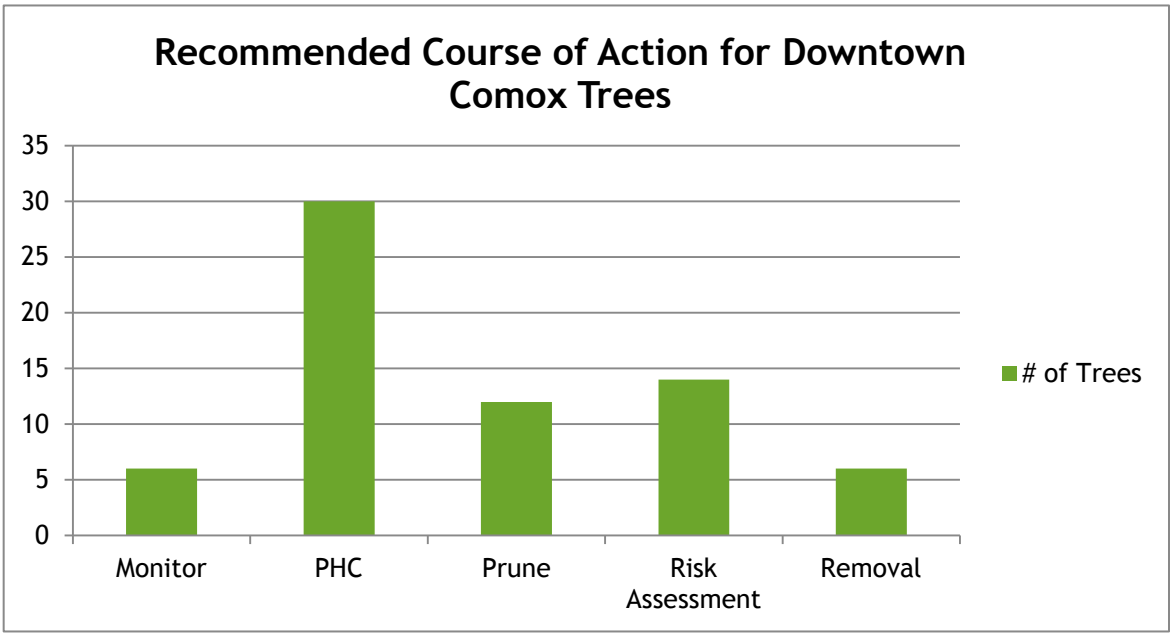
Tree diversity is good and overall health is good to very good. Of the recommended actions, PHC is needed for 8.5% of the population (30 trees). This indicates a need to review young tree care.



Graph 6: Downtown Comox Coniferous Species and Abundance



Graph 7: Downtown Comox Tree Species and Abundance



Graph 8: Recommended Course of Action for Downtown Comox Trees

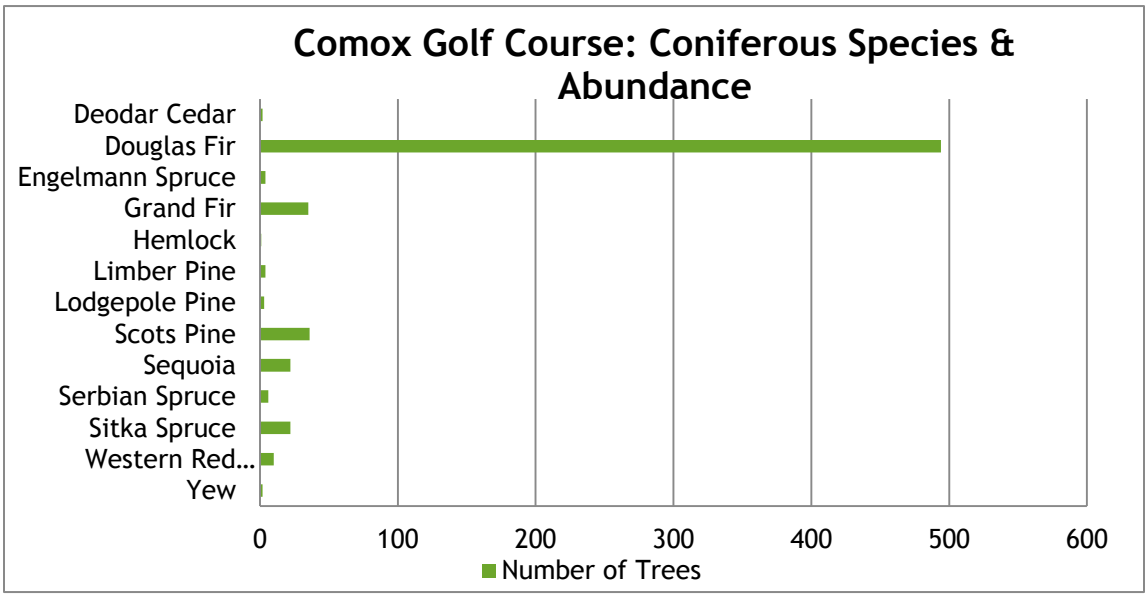
Natural Areas, Public Parks & Greenways of Downtown Comox

Comox golf course

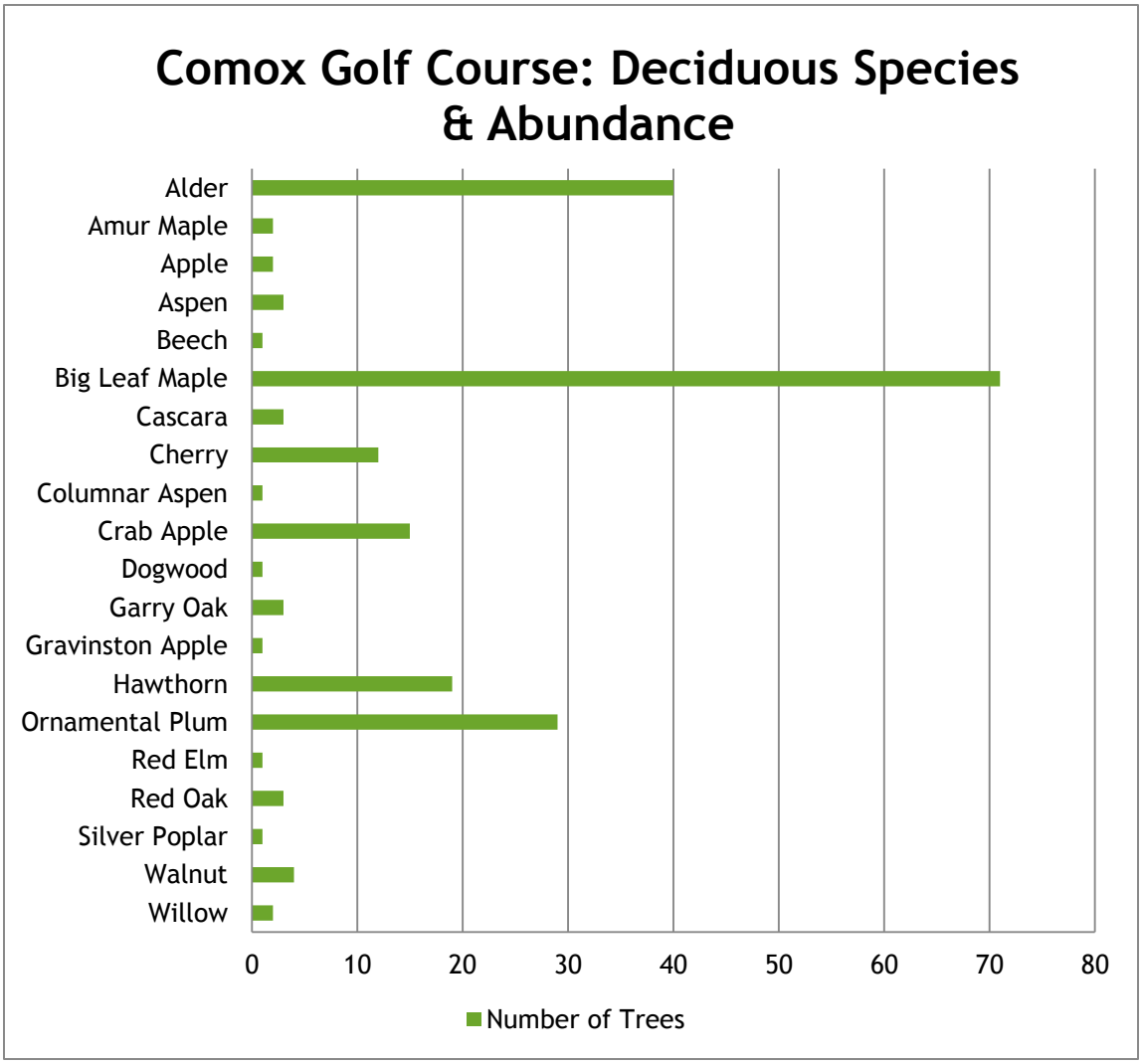
855 trees are on the golf course where some of the largest trees in Comox are located. Thirty three heritage trees are on this property (refer to Appendix 2 for a table of heritage species). The analysis of the natural areas within the golf course is on page 28.

Table 5: Comox Golf Course Tree Inventory Summary

Tree Type	Number of Trees	DBH (cm) Range	DBH (cm) Average	Range of tree condition %	Average Range of Tree Condition %
Coniferous	641	5 to 196	61	5 to 80	65
Deciduous	214	12 to 152	40	5 to 80	59



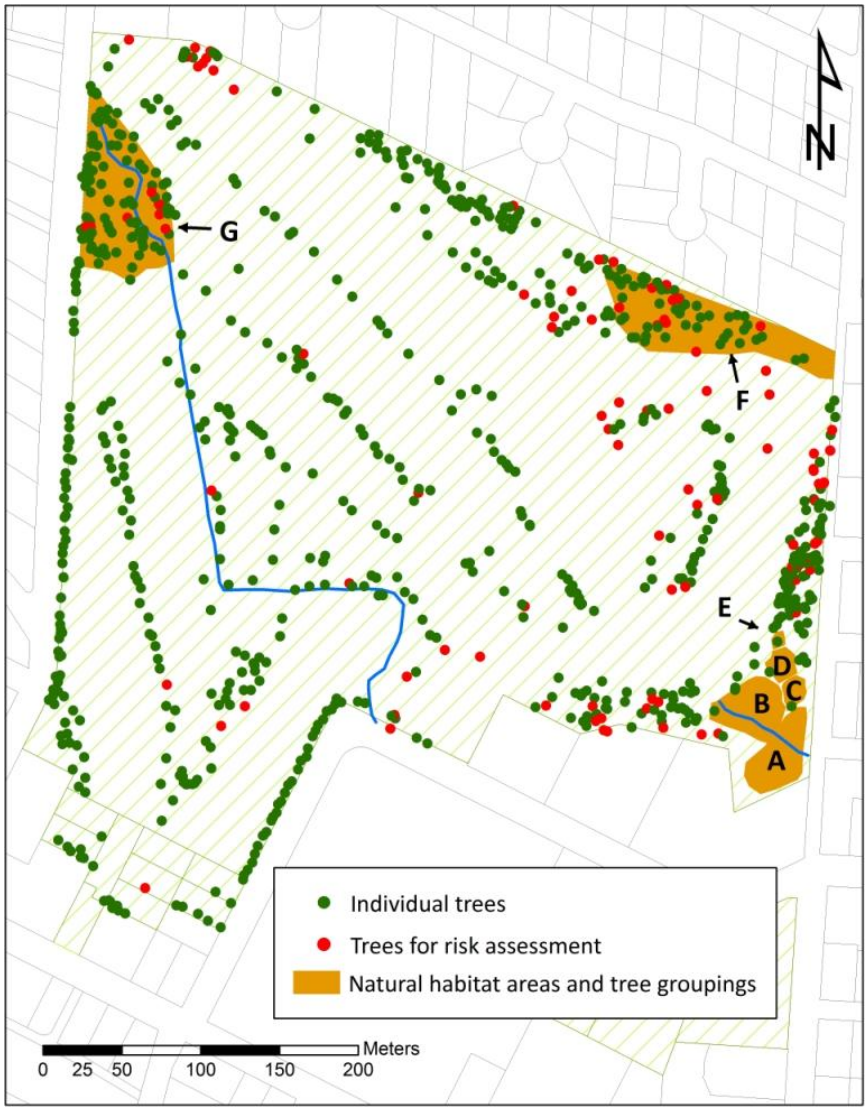
Graph 9: Comox Golf Course Coniferous Species and Abundance



Graph 10: Comox Golf Course Deciduous Species and Abundance

Tree condition is in the fair range. This indicates measures should be put in place to improve the health and vigor of some of the trees. Measures such as pruning, PHC and a replacement program should be considered. 40 trees are in decline and should be considered for removal and replacement.

Map 5: Comox Golf Course Trees for Risk Assessment



The inventory identified 96 trees (11% of the population) that require a risk assessment. 'Risk is the probability that an undesirable event will or will not occur. It is the product of the probability of the event taking place, the probability of being exposed to the event, and the probability of certain outcomes occurring if exposure takes place. Risk can be statistically quantified in a risk assessment.'[11]

[11] Page 268 Dictionary of Natural Resource Management, Dunster UBC Press

Comox Golf Course Natural Areas

A series of aerial photographs in the Comox Golf Course clubhouse, dating back to 1929, show an original site that was completely cleared of trees and other natural vegetation. Through the development of the golf course, trees have been planted along fairways and it appears that native Douglas-fir and other species have naturally regenerated along portions of the course boundary. The Comox Golf Course as it is in 2012 is a mix of open green space (the areas of play), individual trees and grouping of trees with no understory vegetation, and small stands of trees where the understory vegetation has been allowed to naturalize.

The overall topography of the Comox Golf Course is relatively flat with an aspect to the south-east. The two areas of the Comox Golf Course that may be considered as "most" natural are near the north-west corner and at the south-east corner. Both areas include naturally flowing water, remnants of the original creeks and drainages in the area. The western two-thirds of the golf course is within the watershed of what is called Golf Creek. Golf Creek enters the golf course from a culvert under Church Street and traverses the course to the south and exits into a culvert under the parking lot of Comox Mall. The eastern third of the golf course is part of a watershed that likely drained towards the Filberg Lodge. The only portion of this drainage above ground is at the extreme south-east corner of the golf course. After leaving the golf course, this vestige of a creek flows into the Town of Comox underground rainwater collection system. Both of the more natural habitat areas on the golf course are used to store branches and organic debris before periodic chipping.

For the purposes of tree inventory, the natural area at the south-east corner of the course has been divided into five patches of trees.

South-east corner A: This area is south and east of a service road and extends to the corner and meeting of the south and east fence lines. This clump of trees is primarily deciduous, a mix of mature red alder (40 – 50 cm DBH) and hawthorn (10-12 cm DBH). There are two cherries (20 cm DBH) and one big-leaf maple (20cm DBH). In the furthest south-east corner, by the fence line, there are three Douglas-firs. The remains of a large cottonwood along the south fence line fill the centre of the area. Much of the understory vegetation in this area is dominated by invasive plants (daphne 20% and English holly 20%). Several clumps of sword fern suggest that in the absence

of invasive plants it would dominate the shrub layer. Natural sedges inhabit wetter spots near a trickle of surface water.

South-east corner B: This area is bounded by Fairway Number One to the north-west and a service road that circles the perimeter of the clump of trees. The area is a mix of trees, 90% red alder (a sample of 5 DBHs average 30cm; range 18 – 40 cm) and Douglas-fir 10%. The area is bisected by an open trickle of water flow and is likely wet for most of the year. Approximately 70% of the understory vegetation is sedge. The remaining understory is made up of invasive plants (daphne 15% and English holly 15%). English ivy has covered most of the tree trunks.

South-east corner C: This area is along the east fence line, north of SE corner Site C. It is distinct as it is a grove of mature Douglas-fir. The understory vegetation is extensively infested with invasive plants (80% daphne, 5% English Holly and traces of English ivy climbing the trees). Sedges inhabit wetter areas. Traces of native plants found among the daphne suggest the natural understory vegetation would be a mix of Oregon grape and sword fern.

South-east corner D: Immediately north of plot C is a grouping of 15 stems of bitter cherry (a sample of 6 DBHs average 15 cm; range 11 – 20 cm) some of which have metal tags. In addition there are two hawthorns (DBH 9 and 16 cm). Understory is primarily daphne with one good sized clump of ocean spray.

South-east corner E: Adjacent to plot D is grouping of 10 smaller sized bitter cherry with an understory of grasses and a few young stems of daphne. This area appears to be "weed-wacked" on a yearly basis.

Overall the soils in the soils in south-east corner are classed as Imperfectly Drained or Subhygric; water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. The mix of deciduous and coniferous trees suggest a medium to rich nutrient regime.

North-west corner: Along the western fence line near the north-west corner is a patch of mature and maturing second growth Douglas-fir. Within the path are two veterans, one of which supports a Bald Eagle nest. The center of this area is non-vegetated and is used to dump discarded turf. A portion of Golf Creek flows from a culvert under

Church Street through the forest towards the south. Understory vegetation is a mix of grasses and sedges. Approximately 15% of the area is covered with Himalayan blackberry. Other invasive plants include: daphne; English holly; and English ivy. The south-west portion of this patch is 70% Daphne with large amounts of English Ivy on the tree trunks. Native understory vegetation in this area is primarily sword fern with salmonberry along the watercourse.

This area appears slightly drier than the South-east. The soil moisture regime is moderately well drained - where water is removed somewhat slowly in relation to supply and the soil remains moist for a significant but sometimes short period of the year. The predominance of Douglas-fir suggest soil nutrients in a moderately acid soil.

Filberg Park

Nine landscaped acres, with a stream running through the natural ravine provide a perfect setting for a variety of plantings such as maples and magnolias. Rare and exotic trees from many parts of the world include a selection of stately oaks, London Planes, Atlas and Deodora cedars, pines of many species and a variety of other mature trees.[12] This beautiful park contains over 500 trees having the greatest diversity of species anywhere in the Comox Valley and arguably anywhere north of Victoria.

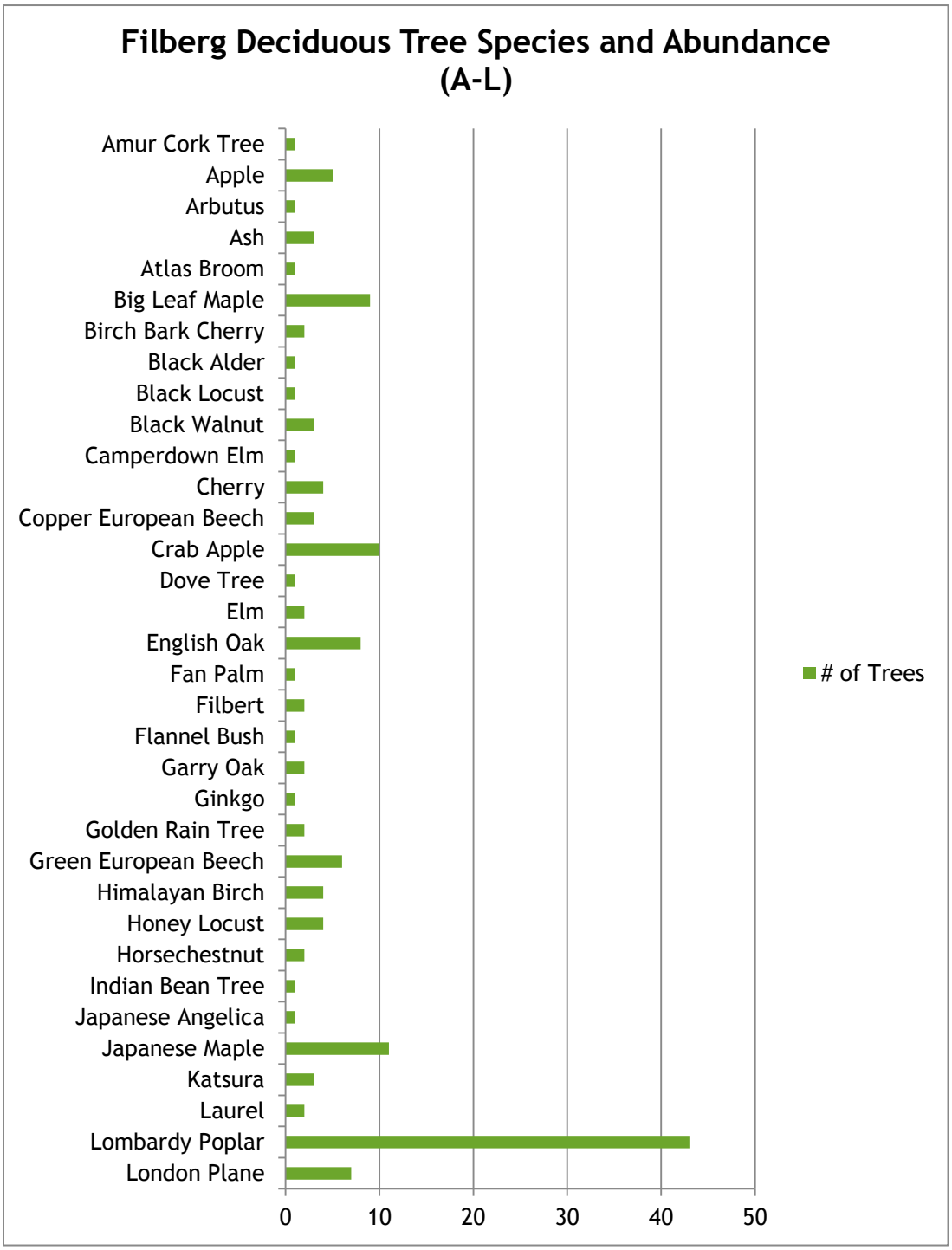
Table 6: Filberg Park Tree Inventory Summary

Tree Type	Number of Trees	DBH Range	DBH Average	Range of tree condition	Average Range of Tree Condition
Coniferous	276	4 to 103	37	10 to 80	68
Deciduous	240	4 to 128	43	10 to 80	70

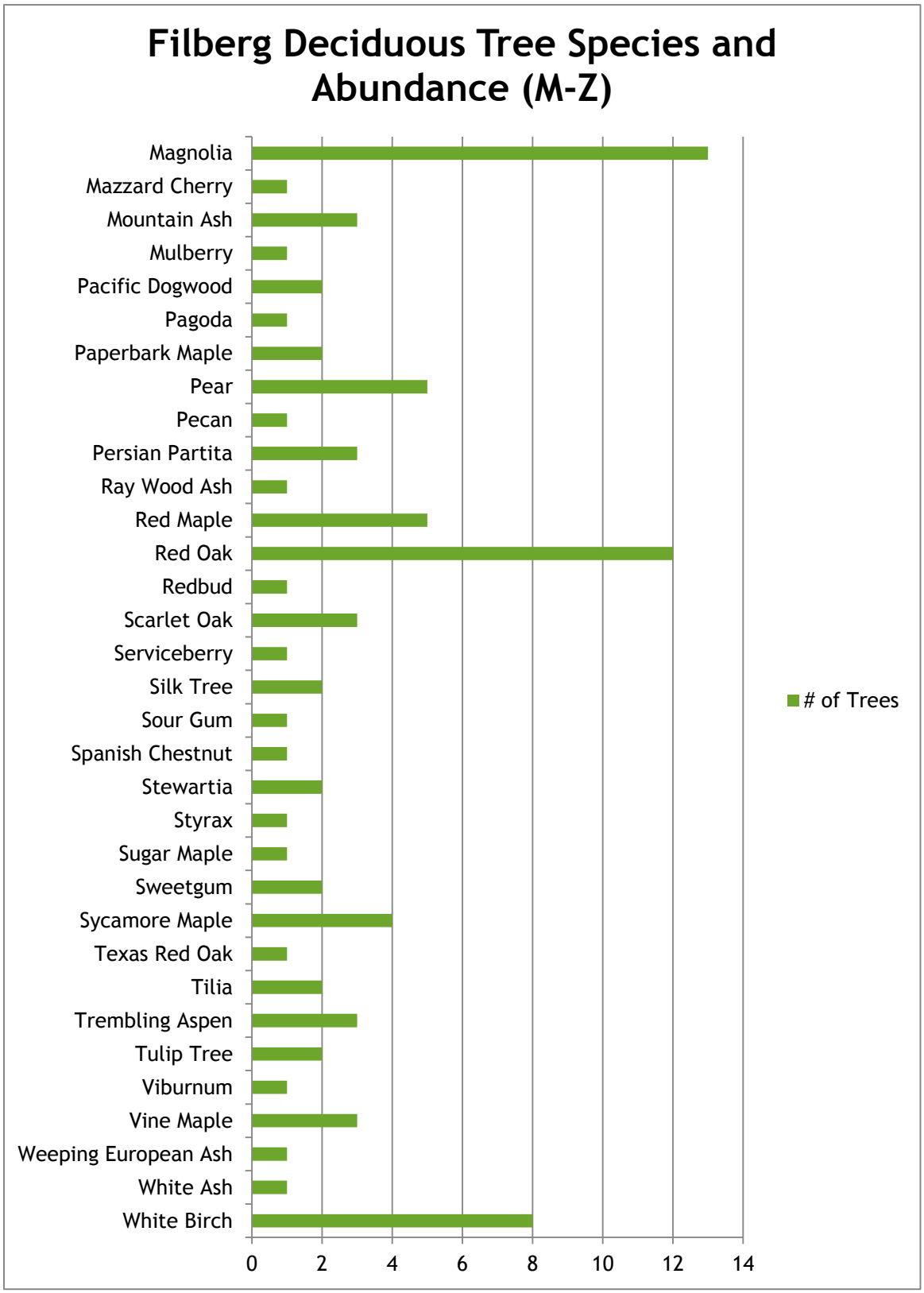
Overall condition is very good and diversity is exceptional. Only a small number of trees need to be removed (2%), risk assessed or pruned (2.5%), monitor (3%) and PHC (4%). Management and tree care by the Town staff is excellent.

[12] The Filberg Heritage Lodge and Park website

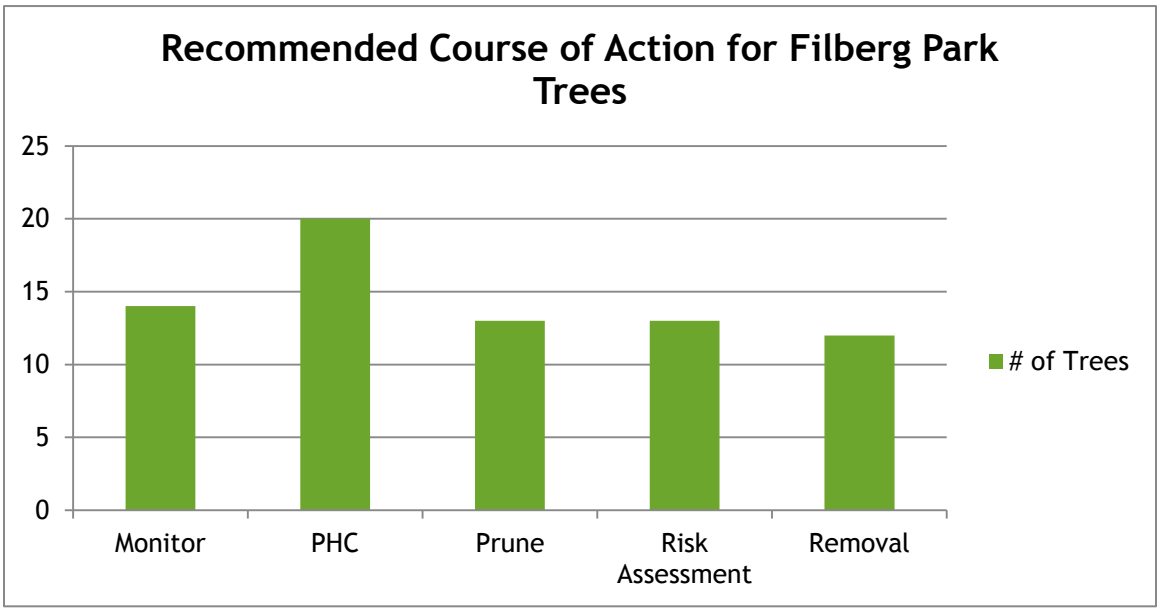
Graph 11: Filberg Coniferous Tree Species and Abundance



Graph 12: Filberg Deciduous Tree Species and Abundance (A-L)



Graph 13: Filberg Deciduous Tree Species and Abundance (M-Z)



Graph 14: Recommended Course of Action for Filberg Park Trees

Port Augusta Park

Approximately one third of Port Augusta Park is a naturalized area along a watercourse that has three local names: Port Augusta Creek; Indian Creek – as named in a Sensitive Habitat Inventory (Project Watershed 2000); and Carthew Creek as named in the Town of Comox Official Community Plan. Frizzell (2000), noted anecdotal information from the Department of Fisheries and Oceans and local residents, that suggest at least occasional fish presence in the creek.

The natural area in Port Augusta Park differs from natural areas in other parks in that there is a large component of exotic vegetation. As there is a moving line between a true natural area, a botanical garden, and an infestation of invasive species, here we will comment on invasive plants as those that appear to be proliferating at the expense of natural and planted species.

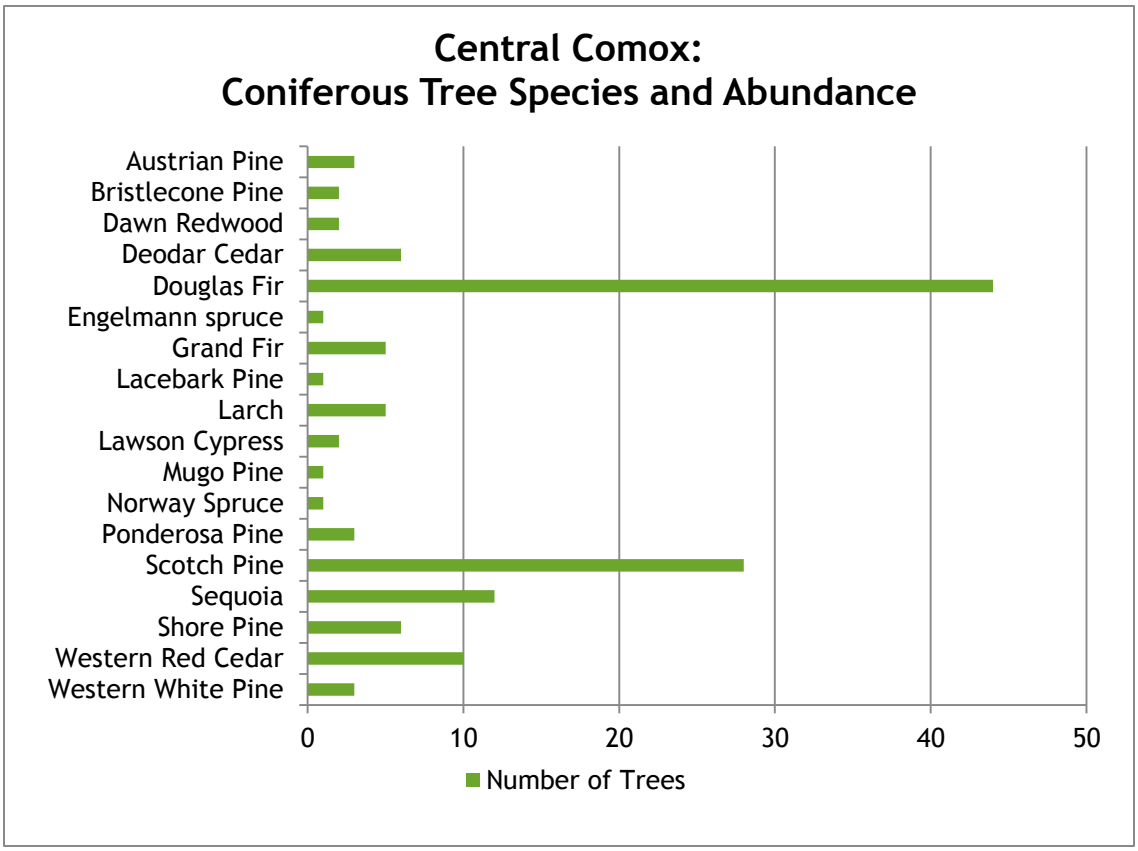
CENTRAL COMOX

Central Comox is east and north of Downtown Comox and east of the irregular boundary of West Comox. It is bounded on the north by either the Town boundary or an irregular line one to two properties south of Guthrie Road. Portions of the north boundary follow the centre of Maquina Avenue, Woodlands Drive, and Moralee Drive. The most eastern portion of the north boundary follows the north side of Beckton Drive. The east boundary follows the Town boundary along Lazo Road and over to Torrence Road. 810 trees are located in this area and includes Village, Salish, Lions, Quarry parks and Pipeline Greenway. MacDonald Wood, Brooklyn Creek Greenway, Village, Salish, Lions and Mac Laing are natural areas.

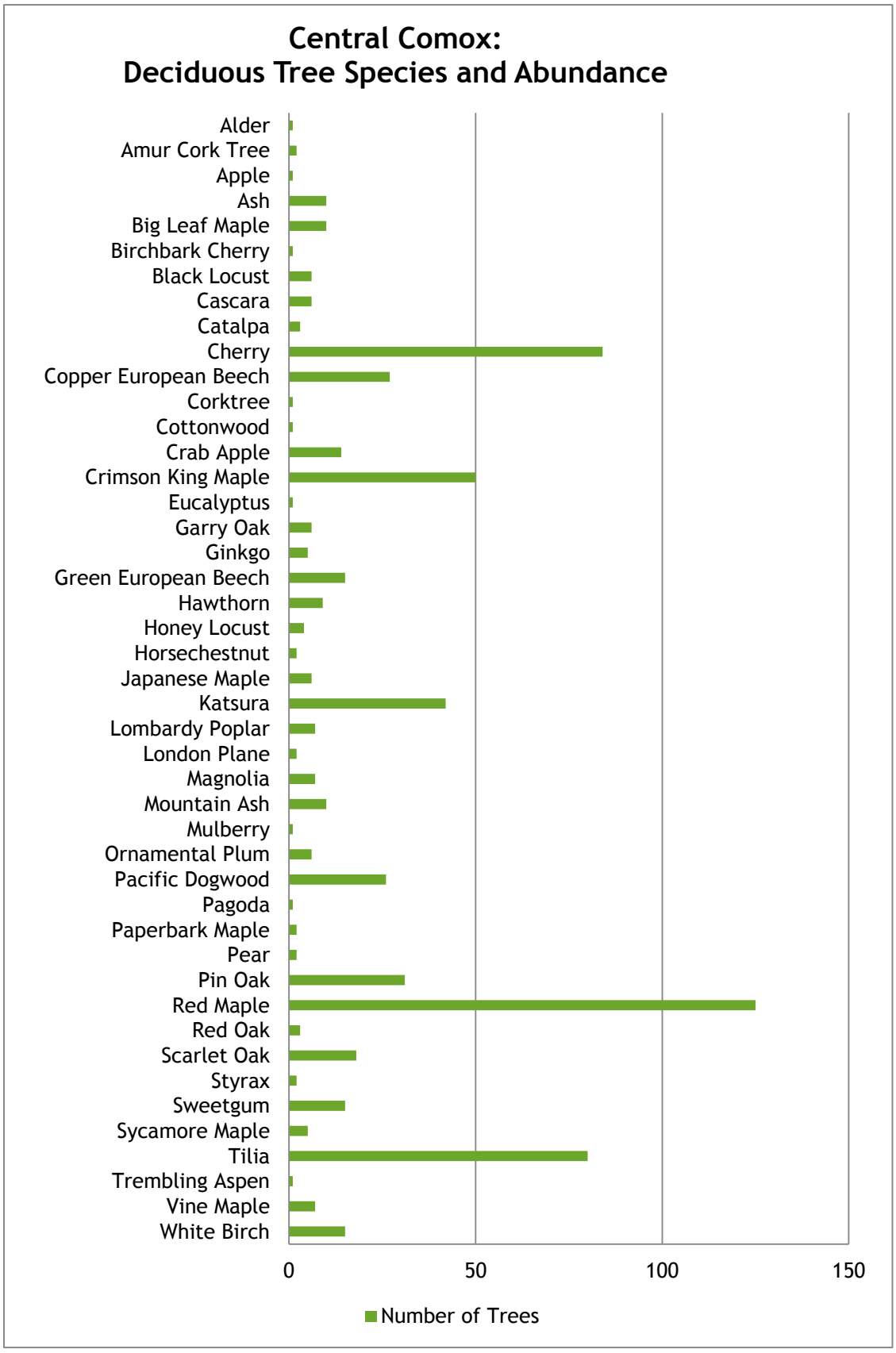
Table 7: Central Comox Tree Inventory Summary

Tree Type	Number of Trees	DBH Range	DBH Average	Range of tree condition	Average Range of Tree Condition
Coniferous	135	2 to 104	35	40 to 85	76
Deciduous	675	2 to 78	14	10 to 85	71

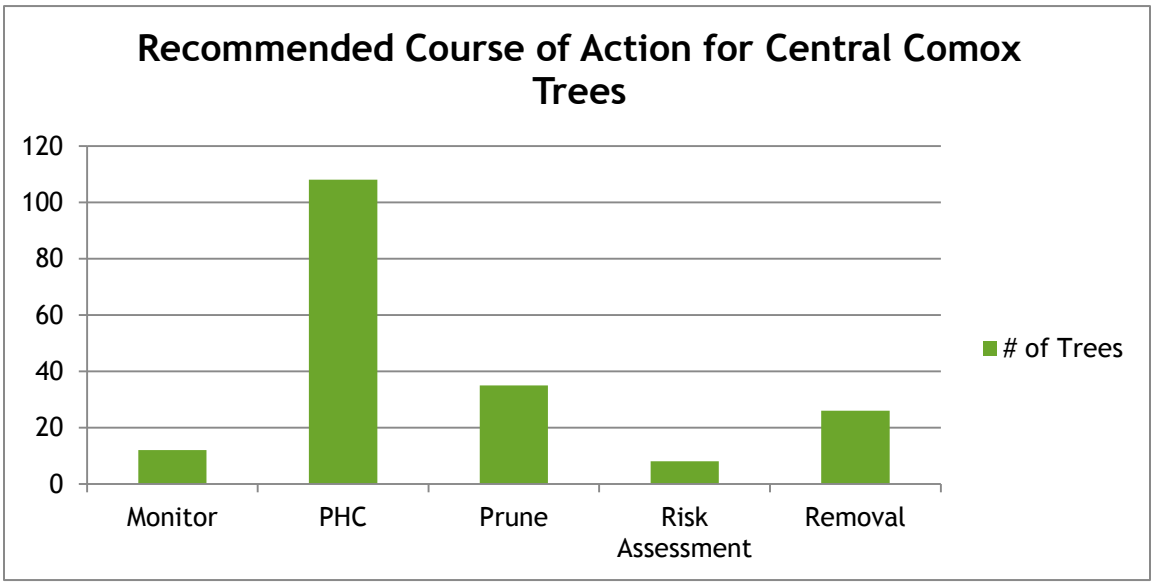
Trees in this area are small to medium sized trees in good condition. 13% of the population (105 trees) require PHC, mostly watering. 22 newly planted trees (3%) require removal.



Graph 15: Central Comox Coniferous Tree Species and Abundance



Graph 16: Central Comox Deciduous Tree Species and Abundance



Graph 17: Recommended Course of Action for Central Comox Trees

Natural Areas, Public Parks & Greenways of Central Comox

Brooklyn Creek Trail/ Greenway

Between Balmoral Avenue in the south to where the footpath dead ends at a private fence near Robb Avenue in the north, Brooklyn Creek flows through a park and narrow greenway natural area 600m long and 2.4ha in area. The trees in this area range in age class from Young Forest (40 to 80 years) into the earlier part of Mature Forest (80 to 250 year range). The understory vegetation ranges widely depending on light and soil moisture. The incidence of invasive plants ranges from almost total cover of the ground and trees to areas with none at all. Virtually all invasive plant infestations appear linked with the dumping of yard waste behind the fences of neighbouring residents. Brooklyn Creek and the footpath form some function as a barrier to the spread of invasive plants. While it would be a very large effort to remove all invasive plants,

Map 6: MacDonald Wood Park, Mack Laing Park, and the Brooklyn Creek Greenway

there are pockets where removal might be practical. The first and most important step in an invasive plant management plan would be to stop further inputs of yard waste.

MacDonald Wood Park

dumMacDonald Wood Park is a natural area second growth forest of 3.8ha. The overall aspect is a gentle slope towards the south and Comox Bay. By vegetation type the Park may be divided into three areas. The vegetation study plots for MacDonald Wood Park can be found in Appendix 1.

1. The north half of the Park is a mixed coniferous and deciduous second growth forest moving from a young to a maturing seral successional stage. The canopy is largely dense with some initial natural thinning and younger growth of trees. The soils appear fresh and well drained where water supply (primarily precipitation) keeps the soil moist but not wet. The study plot for this area includes a mix of maturing Douglas-fir, big-leaf maple and younger grand fir. Understory vegetation is 85% Oregon grape, 3% swordfern, with traces of red huckleberry and trailing blackberry. English ivy is growing on 2 of the fir trees in the plot. Other native understory vegetation in proximity to this study site, near the edge of the forest and where fallen trees had allowed more light to the forest floor are patches of salmonberry, snowberry, ocean spray and baldhip rose.

2. The second area is in the center of the Park with the same soil and moisture regime as the north section resulting in a wind-throw event in 20 07. There are some mature trees but with more open areas the shrub/herb and Pole/sapling seral stage is beginning to dominate.

3. The third area is the south approaching the shore where there is steep earth bank down to the coastal flood plain. This area has wet and rich soils and the water table is at or near the surface for most of the year. In late March approximately 15% of the plot was standing water and has primarily mature red alder. Understory vegetation is 60% salmonberry with 5% sword fern on slightly higher spots. There were traces of Oregon grape and trailing blackberry. Numerous horsetail were in the wetter patches. Skunk cabbage shoots were emerging in several spots. English ivy is present as small plants on the bare ground and growing on some of the larger trees.

Mack Laing Park

Mack Laing Park is a riparian natural area park that follows Brooklyn Creek from Balmoral Road to its mouth in Comox Bay (left hand side of Map 6). The park totals 5.85 ha, with an open lawn area near residences by the creek mouth. Much of the forest and natural area of Mack Laing Park would be classed as either the late stages of a young forest or the early stages of a mature forest. There is several mature Sitka spruce in the 80 to 250 year age range.

Compared to other areas in Comox, Mack Laing Park has some of the highest incidence of invasive plants. There are areas where the ground and trees are completely covered with English ivy. Approaching Balmoral Road, some of the side bank is total carpet of lamium. As in all other infestations of invasive plants, the source appears to be the dumping of yard waste behind the fences of nearby residents. Within Mack Laing Park, Brooklyn Creek forms a partial barrier to the spread of invasive plants towards the east and MacDonald Wood Park, which has far fewer invasive plants.

Salish Park

Salish Park, at 3.6ha, is a combination of an open space with a water catchment pond and a playground plus a more natural riparian area along Brooklyn Creek (1.9ha). Much of the riparian area is an overgrown hedgerow, a combination of *Pioneer Seral* and *Young Seral* stage regenerating forests after being cleared 30-40 years ago. This riparian area is a mix of native and invasive species that has grown up in what appears to be more of an untended area rather than a rehabilitated natural area. As the trees grow and natural thinning occurs it will in time likely take on more characteristics of natural forests of this area.

Towards the south of the Park is more established natural area (0.4ha) though still classed as a *Young Seral* stage of forest regeneration. A study plot was set up around a maturing Sitka spruce. Five tree species were measured (Table 1). A number of fallen red alder trees are being replaced by big-leaf maples and the retained Sitka spruce after the clearing are dominant in the forest.

Map 7: Salish Park

The soils are rich and very moist (*Hygric* – where there is seepage and the soils remain wet for most of the growing season). On the day of the site visit, most of turf area of the park was fully saturated after two days with no rain. Understory vegetation is salmonberry (50%); sword fern (25%); sedges (15%); and snowberry (10%). Trace species include bald hip rose and trailing blackberry.

Invasive species includes Himalayan blackberry, which covers much of the area to the south-west of the study plot and traces of English holly and daphnia. With the exception of the blackberries, this area has far less of an invasive plant infestation than other sites further downstream along Brooklyn Creek.

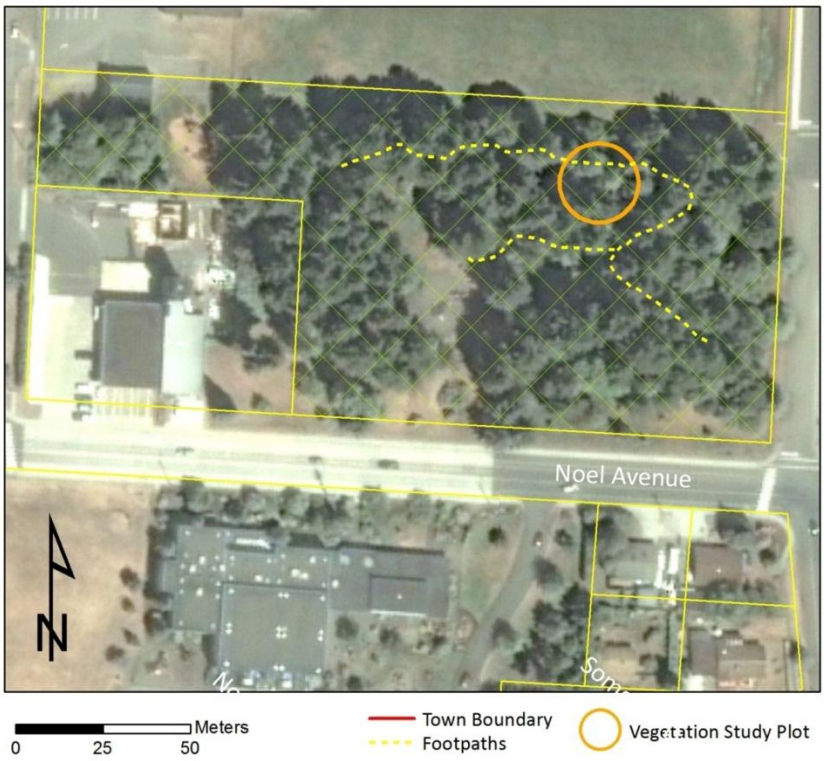
The most likely plant community to naturally grow on the entire Salish Park site is Sitka spruce – Salmonberry CWHxm-08 which is red listed by the CDC.

Village Park

This Park is 1.55 ha in total with a forested area of 1.19 ha. has a large component of natural area but because it is used as a Frisbee golf course, much of the understory vegetation gets trampled. Douglas fir are the dominant tree species with big-leaf maple and alders make up the rest of the population. There is a heavy population of sword ferns and salal.

Water supply is primarily precipitation but with some surface and subsurface runoff from higher lands to the north.

Map 8: Village Park



Comox Valley Lions Park

Comox Valley Lions Park is a mixture of open area playground and three areas of natural vegetation. The trees in the natural areas are less than 20 years of age and appear to be vigorous. Understory vegetation is well established, predominantly salal, within which are clumps of Oregon grape, sword fern, red huckleberry and ocean spray. The invasive species Scotch broom; Himalayan blackberry; and English holly are well established in several spots.

Pipeline Greenway

South of Guthrie Road and east of Skeena Drive is a 320m long (average 22m wide) linear footpath and green way along the route of the Department of National Defence airport fuel pipeline. This park is both a walkway and corridor for wildlife.

Like other parks in Comox, there are numerous invasive plants with the sourcelinked to the dumping of yard waste by neighbouring residents. This issue has raised concern with local residents with some residents attempting to deter yard waste dumping by installing signage.

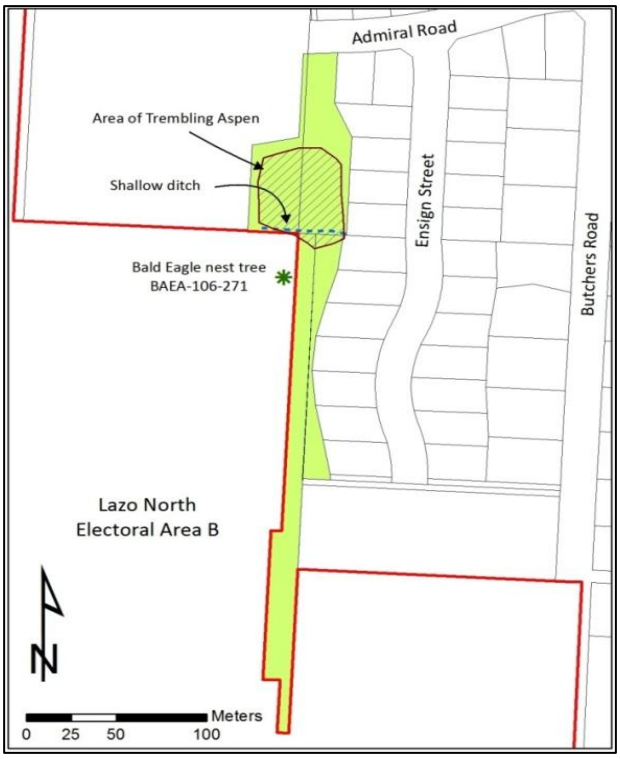
Photograph of sign handmade by a local resident.

Highmoor Greenway

This natural area greenway extends from Admiral Road in a narrow strip 415m to the south and is made up of four lots totaling 0.89ha. It has a rich assortment of native trees and vegetation along with a healthy stand of trembling aspen. Within a few metres of the Park boundary, within Electoral Area B, is a signed Bald Eagle nest tree

(Identified as BAEA-106-271 on the Map). This tree should be monitored for evidence of continued use as a nesting site.

Map 9: Highmoor Greenway



Residential development to the east of the Highmoor Greenway has been built up within the past five years. In several locations yard waste and construction debris has been discarded over the fences into the Park. In one location a landowner has removed all native vegetation and is using the Park as an extension of a residential garden.

Photograph: Local resident encroachment into Highmoor Greenway

The primary invasive plant in the park is English holly with recent intrusions of Scotch broom and Himalayan blackberry. The extent of yard waste dumping suggests that numerous domestic plants will soon colonize and spread through the area. With the removal of the invasive plants and by stopping future dumping of residential yard waste the natural native vegetation would quickly regenerate.

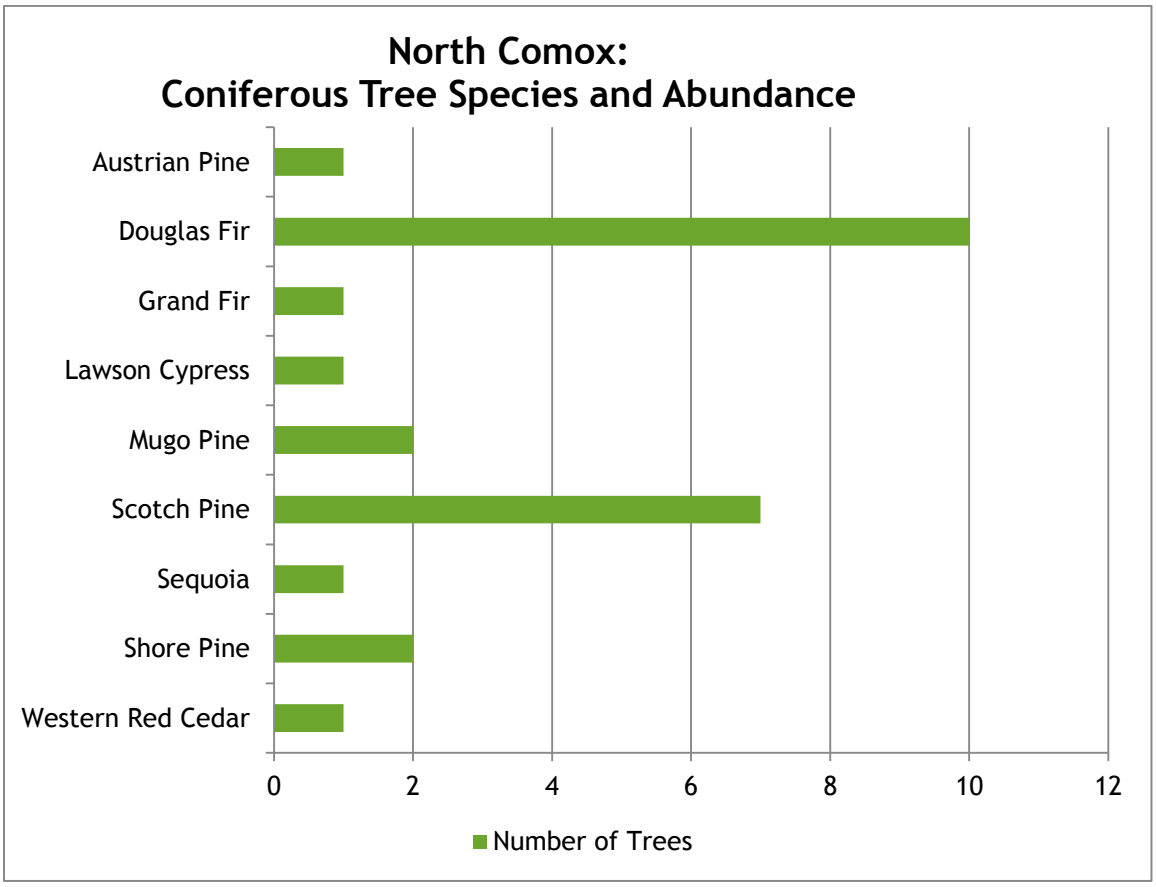
NORTH COMOX

Comox North is the area south of Knight Road next to Central Comox. 183 trees are located in this area and includes Highwood Park. Natural areas are Foxxwood, Highwood and North-East parks.

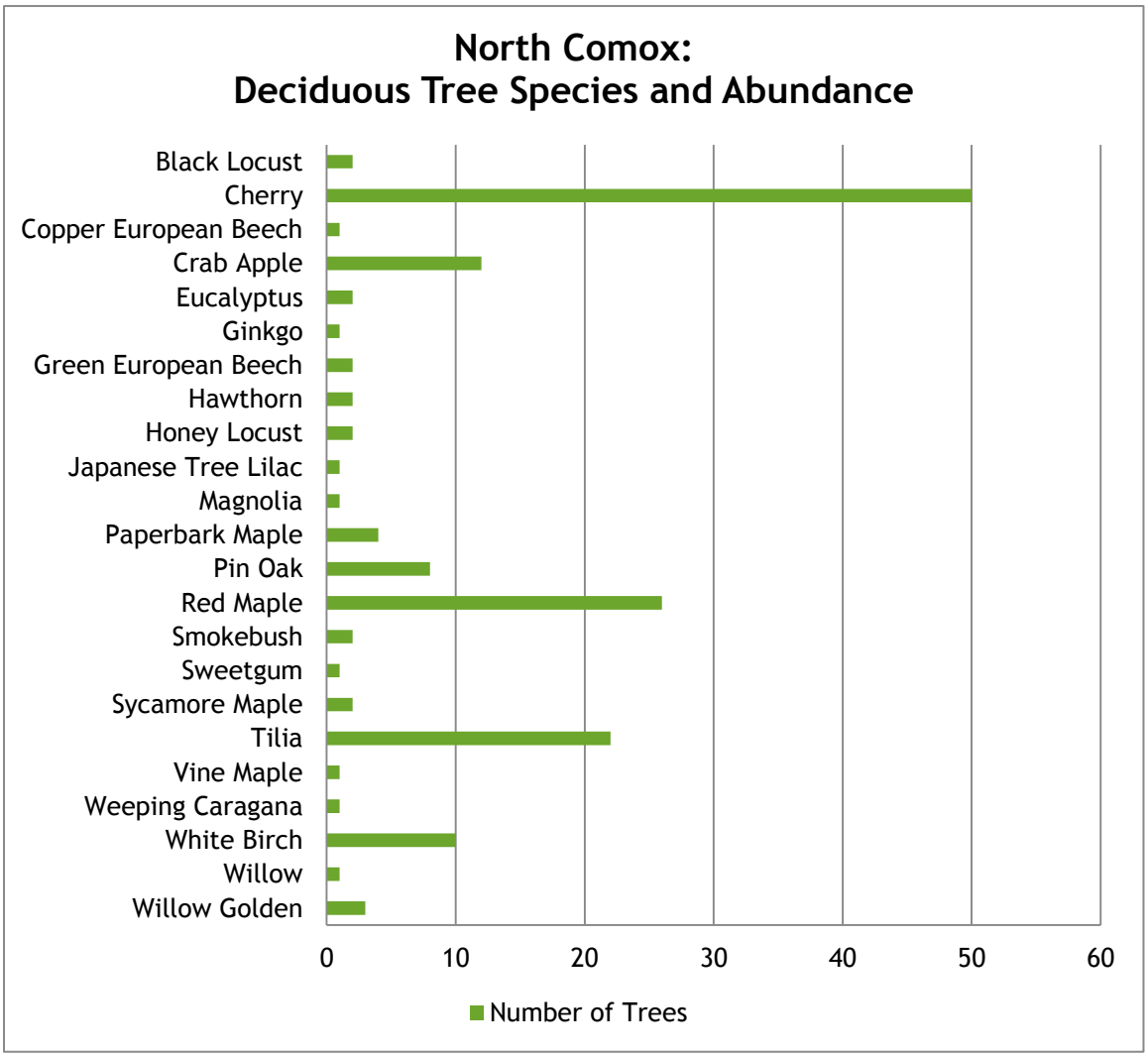
Table 8: North Comox Tree Inventory Summary

Tree Type	Number of Trees	DBH Range	DBH Average	Range of tree condition	Average Range of Tree Condition
Coniferous	26	3 to 94	35	65 to 85	78
Deciduous	157	3 to 52	21	20 to 90	79

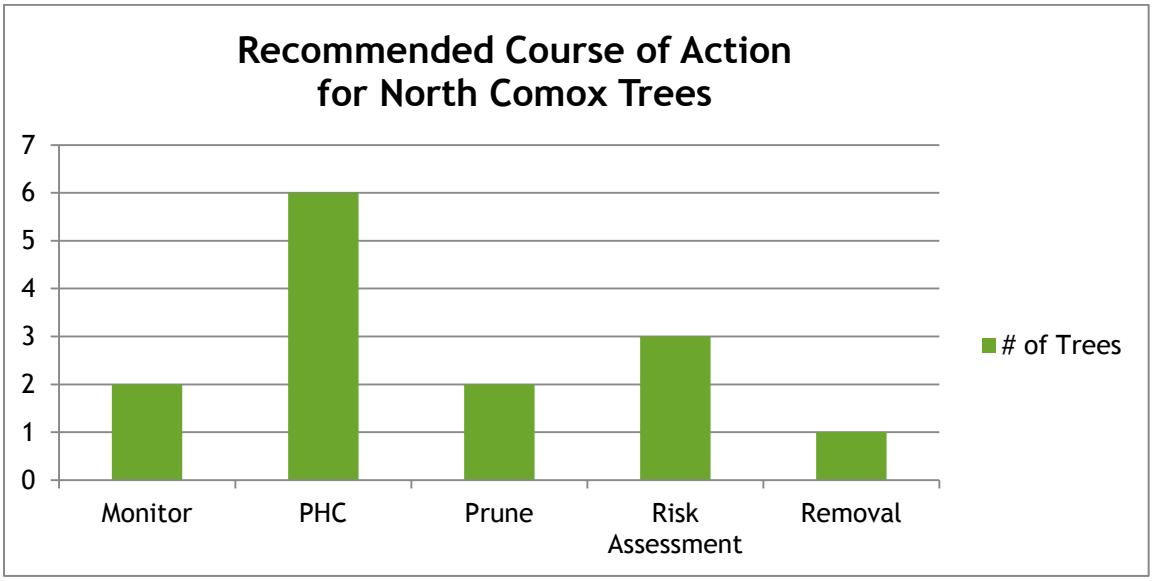
Diversity and health of the trees is good. Low numbers of trees require action to improve retention.



Graph 18: North Comox Coniferous Tree Species and Abundance



Graph 19: North Comox Deciduous Tree Species and Abundance



Graph 20: Recommended Course of Action for North Comox Trees

Natural Areas, Public Parks & Greenways of North Comox

Foxxwood Park

Foxxwood Park (0.8ha) is a natural area in the north-west corner of the Foxxwood residential subdivision. This is an interesting site with extremely wet soils and dense vegetation. The site is just within the upper watershed boundary of the Queen's Ditch where there is very little change in slope between the upper boundary of the Brooklyn Creek and Queen's Ditch watersheds. The near level aspect of the site suggests that most soil moisture is received as rainfall and soils remain moist for long periods of time. There are old growth stumps from the original logging in this park.

Within the study plot (refer to Appendix 1), the trees are primarily Douglas-fir and western red cedar. With the dense canopy, there is very little understory vegetation, just a few stems of salal. Outside the plot area, some mature big-leaf maple and red alders open up the canopy to light the understory. Here the plant mix is primarily very deep salal with some Oregon grape, red huckleberry, and trailing blackberry.

Foxxwood Park has minimal invasive plants compared to other parks in Comox. English ivy is mixed in with salal along the north boundary near the park entrance trail at the west end of Cambridge Road. Also at the park entrance is a well-established patch of lamium. There are no apparent sites where yard waste has recently been dumped.

Map 10 Foxxwood Park

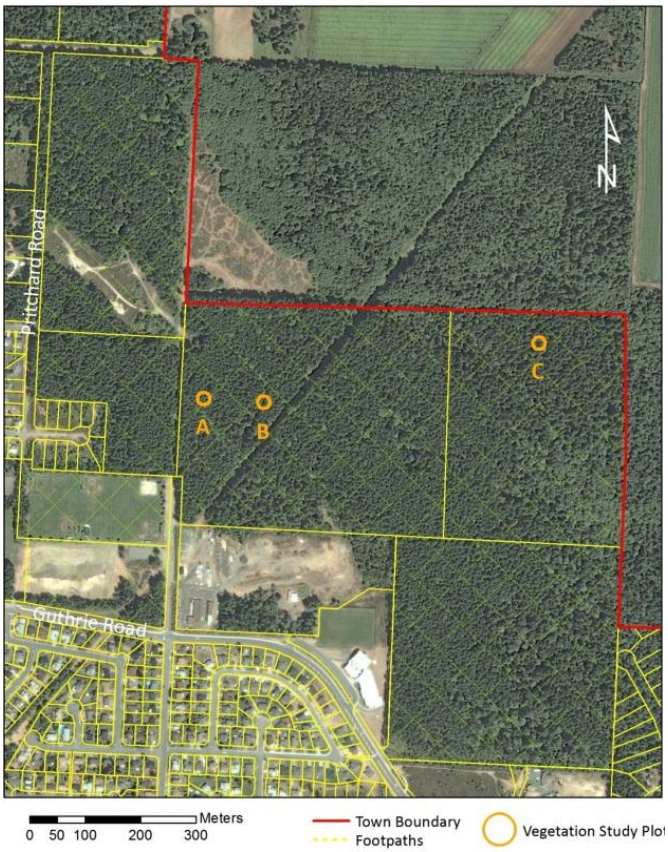
The high density of trees within the plot suggest a transition from the pole/sapling to Young forest stage where in coming years there will be much natural thinning. The soil moisture will likely support a maturing forest dominated by western red cedar.

North-East Woods

In the north neighbourhood of Comox, are seven adjoining properties that are collectively called the North-East Woods. Two properties, (6.9ha) are primarily playing fields associated with Highland Secondary School. Within the area of playing fields, a fringe of trees along the north side of Guthrie Road and a patch of trees to the north-west of the intersection of Guthrie and Torrence and Roads, (1.4ha) have natural habitat values. This area appears to be unmaintained and might be classed as "forgotten" undeveloped lands as opposed to a designated natural area park (picture right).

Photograph: Area of North-east Woods at the corner of Guthrie and Torrence Roads.

Map 11: North-East Woods



Five properties (67.4ha) make up the intact second growth forest portion of the North-East Woods. The North-east Woods are within the watershed of the Queen's Ditch with the overall aspect as a gentle slope towards Lazo Marsh in the north-east. With direct connectivity to Regional District lands and Provincial Crown Lands the total natural area is approximately 186ha[13]. This entire area is frequented by the public and there are numerous walking and cycling paths.

Within the North-East Woods, three study plots were selected to capture the plant communities

[13] CVRD Parks 2011. North-east Woods – Lazo Marsh Conservation Area/ Friends of Comox/Lazo Forest Reserve, brochure, Comox Valley Regional District. http://www.comoxvalleyrd.ca/uploadedFiles/Community_Services/Parks/Park_info/newoodslazomarshbrochure.pdf

that are found in the transition from upper slope drier soils, down to the wetter soils associated with a low slope valley bottom floodplain (refer to Appendix 1).

Study Plot A is primarily Douglas-fir of young forest age class. On the upper slope, the water supply is primarily precipitation and soil may be expected to be moist for short periods following precipitation. The dominant understory vegetation is salal, with traces of Oregon grape, sword-fern, red huckleberry, oceanspray and bracken fern. The best plant community description of the site is Douglas-fir – western hemlock / salal (CWHxm1/03).

Study Plot B, approximately 100m east of Study Plot A was chosen for being on the mid- slope. Water supply is appears to be primarily precipitation but with some subsurface flow from the higher ground to the south and west. While the dominant tree species is Douglas-fir, 25% of the trees inventoried are western redcedar. The understory vegetation is primarily salal and Oregon grape with traces of sword fern, snowberry, red huckleberry, bald-hip rose, oceanspray and trailing blackberry. The plant community best describing this site is Western red cedar / swordfern (CWHxm1/05).

Study Plot C is located on low ground in the bottom of the watershed. Water supply is both precipitation and seepage. The soils are expected to be wet or moist for much of the growing season. This plot has a mix of tree species, dominated by Sitka spruce and western redcedar. The plot captures two fairly large western white pine, a species naturally found but not common in the area. Understory vegetation is primarily salal (60%) followed by deer fern (5%) and with traces of swordfern, red huckleberry, salmonberry, bracken fern, trailing blackberry,

and cascara. The plant community that best describes this area of the North-East Woods is Sitka spruce/ salmonberry (CWHxm1/08).

Compared to other areas of Comox there are minimal invasive plants in the North-East Woods. The stands of trees near the playing fields have numerous patches of Scotch broom and Himalayan blackberry. The main forest area has English holly scattered throughout the site but at low density.

Overall, the quality of natural habitat in the North-East Woods is very high. The forest has a mix of both healthy trees and dead or dying trees with high value for wildlife. To best protect the natural qualities of this area it is recommended the trails be inventoried and managed. Half the trails, better maintained, would better serve both the public and the natural qualities of the site. As this is a high use public area, dead trees in falling distance to trails should be monitored and removed when dangerous. Given the size of the forest, the removal of danger trees in proximity to trails should have no impact on the availability of wildlife trees in the overall forest.

Highwood Park

Highwood Park is an open area water catchment park in a residential neighbourhood. The parks totals 0.77ha and is made of a grassy area of 0.49ha with individual trees, and a pond component of 0.28ha. The natural habitat value of this park is the pond and surrounding vegetation. The margins of the pond are made up of natural vegetation: cat-tails, sea breeze and Nootka rose; with patches of bamboo likely planted by local residents.

Water leaving the pond flows into nearby Brooklyn Creek. It is not known if there is a fish presence in the pond. It is expected that this pond would have a summer population of nesting ducks that are often enjoyed by local residents. To develop this park as a natural area, it would be recommended that the bamboo be removed and that the site be observed for the presence of invasive plants, particularly Japanese knotweed and giant hogweed.

Brief History of Canadian Urban Forest Management[14]

"The history of Canada and the history of its forests are very much intertwined: from the use of the forest by First Nations, the colonization by Europeans, the era of logging white pine for the British navy, the expansion of land clearing in the 1800s to the birth of the conservation movement at the turn of the last century. It was during this last era that Canadian urban forests began. The development of the major park systems in Canada often incorporated forest elements: Stanley Park in Vancouver (created in 1888), High Park in Toronto (1873), Parc Mont-Royal in Montreal (1876) and Point Pleasant Park in Halifax (1866) all prominently featured aspects of the Coast, Deciduous, Great Lakes-St. Lawrence and Acadian Forest Regions. However, aside from roadside planting projects and the most rudimentary protection of natural forests within the scenario of a suburbanizing Canada, no major efforts to develop urban forest programs in Canada were developed until the 1960s, when Dutch Elm Disease struck. Here, the effects of invasive pathogens and monoculture plantings came to roost as thousands of kilometres of roadsides were affectively denuded as a result of the effects of the disease. This resulted in a chain of events which quickly developed urban forestry including:

- The term "urban forests" by Prof. Erik Jorgensen and the creation of and urban forest program at the University of Toronto in the 1970s
- The support from 1972-1979, by the Canadian Forest Service of the urban forest program "A Forest for Man";
- The International Urban Forestry Conference at Laval University in 1979 (Canada's first);
- The rapid expansion in the 1980s of municipal forestry departments throughout Canada;
- The 1st Canadian Urban Forest Conference in Winnipeg in 1993;
- The first definition of urban forests in legislation in Ontario's Professional Foresters Act 2000;
- The formation of the CANUFNET list serve for urban foresters as a result of the 5th Canadian Urban Forest Conference in 2003;
- The integration of urban forests in the National Forest Strategy 2003-2008; and
- The formation of the Canadian Urban Forest Network in 2004."

[14] Compendium of Best Management Practices for Canadian Urban Forests

Best Management Practices for Urban Forestry

Developing your urban forest management plan is the first step towards meeting your goals and attaining your vision for the urban forest. However, it is only the first step of a process that needs to respond and adapt to changes as they develop over time.

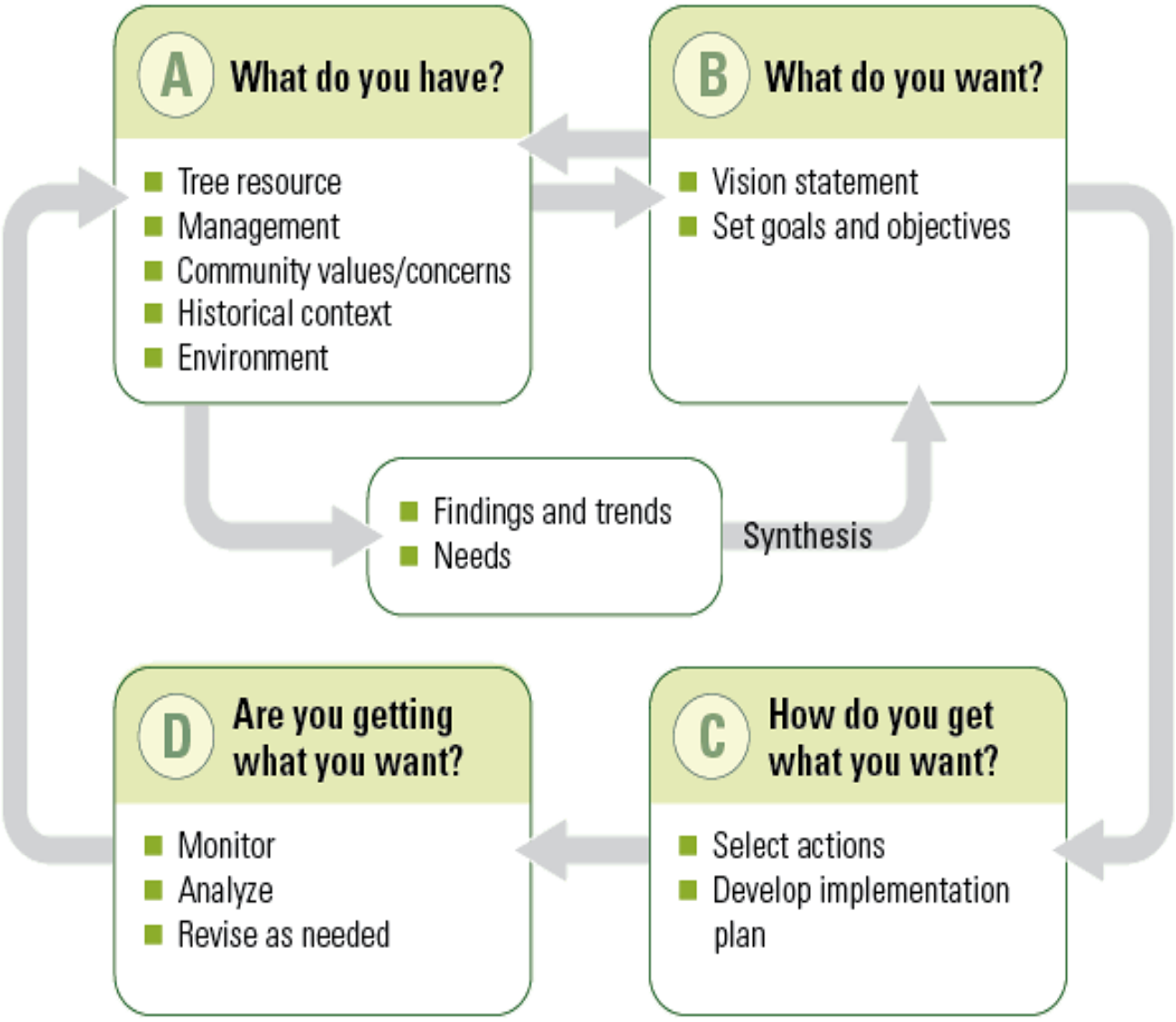


Figure 1 Urban Forest Management Planning Process

Figure 2 identifies the key elements for Best Management Practices for Urban Forestry. The Town of Comox UFMP will include some of these BMP, others should be worked on in an Urban Forest Management Strategy.

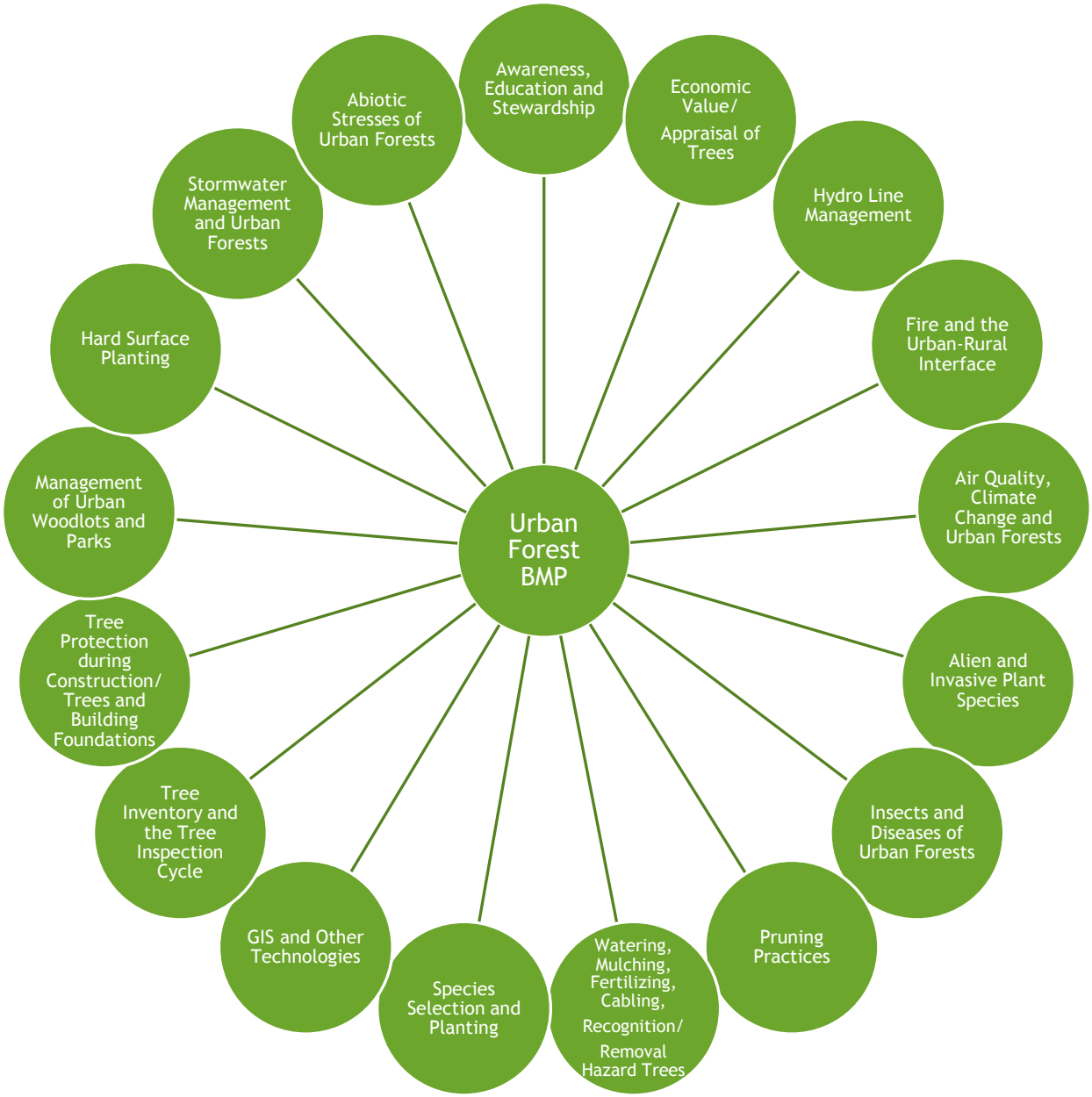


Figure 2 Urban Forestry: Best Management Practices

Management Goals

Mumby's Arboriculture Consulting (MAC) recommends specific goals for the Town of Comox UFMP. These include the needs of the forest, its' management and the needs of the community in relationship to the urban and natural forested areas.

1. Establish and maintain optimal levels of tree cover to maximize ecosystem benefits provided by the urban forest, (maintain air quality, reduce energy use, moderate storm water runoff, and provide a favorable environment for city residents).
2. Maintain trees in a healthy condition through good cultural practices.
3. Establish and maintain an optimal level of age and species diversity.
4. Promote conservation of existing tree resources.
5. Select, situate, and maintain urban trees appropriately to maximize benefits and minimize hazard, nuisance, hardscape damage, and maintenance costs.
6. Promote efficient and cost-effective management of the urban forest.
7. Foster community support for the local urban forestry program.
8. Encourage good tree management on privately-owned properties.

Goal 1

Establish and maintain optimal levels of tree cover to maximize ecosystem benefits provided by the urban forest, maintain air quality, reduce energy use, moderate storm water runoff, and provide a favorable environment for Town residents.

Since the early 2000's arboriculture research has been recommending a canopy cover of no less than 25%. Tree canopy cover refers to the tree cover as might be seen when flying over an area. Tree canopy cover provides environmental benefits that include; maintaining air quality; reducing energy use to both heat and cool homes; being a buffer to stop flooding from rainwater runoff; and providing a favorable aesthetic environment for Town residents. A measure of tree canopy cover includes trees overhanging roofs and roads, and is not a measure of understory vegetation and natural area habitat. Several municipalities are working towards a higher goal. Seattle canopy cover is 23% with a goal of 30% by 2030. City of Vancouver canopy cover is 20% with a goal of 28% and the City of Nanaimo has 28% forest cover. West, Downtown, Central, and North (the portion south of

Knight Road) neighbourhoods were assessed for canopy tree cover using i-Tree[15] canopy, a software package developed by the US Forest Service sand corporate partners (i-Tree 2012). See Table 9. i-Tree Canopy produces a statistically valid estimate of land cover types (e.g.tree cover) using aerial images available in Google Maps. The Google Maps image available for this analysis was from 2005. Comox neighbourhoods were measured in two ways:

1) The entire neighbourhood including public parks; and
2) The neighbourhoods excluding park lands - to give a measure of tree cover along roadways and on private properties.

Table 9: Tree canopy cover in Comox Neighbourhoods

Neighbourhood	Total Area of Neighbourhood (ha)	Estimated % Canopy Cover Entire Neighbourhood	Estimated % Canopy Cover Excluding Parks and Greenspace
West	**235**	**34**	**21**
Downtown	160	44	46
Central	**265**	**47**	**39**
North	291	68	48
All of Comox	**951**	**50**	**37**

Please Note: The results calculated by i-Tree Canopy, using 100 randomly chosen points of reference resulted in a 95% confidence range of +/- 9.8.

Table 10 calculates the overall 15.3% of the study area in Comox is public parks and green spaces, within that area, 65% of it is natural area.

Table 10: Parks, Greenspace and Natural Areas in Comox Neighbourhoods

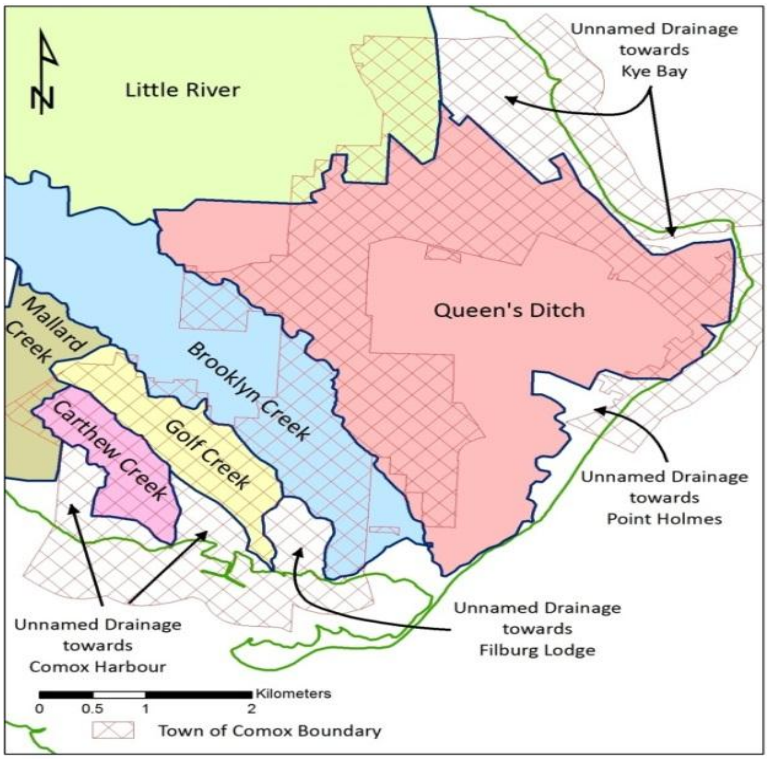
Neighborhood	Total Area of Neighbourhood (ha)	% Of Neighbourhood in Public Parks and Greenspace	% Of Public Parks and Greenspace That is Natural Area Habitat
West	**235**	**4.8**	**55.4**
Downtown	**160**	**17.2**	**7.0**
Central	**265**	**8.5**	**60.9**
North	**291**	**28.9**	**86.3**
All of Comox	**951**	**15.3**	**65.0**

[15] iTree is a state-of-the-art, peer-reviewed software suite and provides urban forestry analysis and benefits assessment tools http://www.itreetools.org/

Green Space Allocation

One method to calculate the amount of park land for a community uses a ratio of area to population of hectare / 1,000 people. In Canada, studies show this ranges from 0.7 – 6 hectares / 1,000 people with an average of 2.79 hectares. The Green Space Acquisition and Stewardship in Canada Urban Municipalities document calculates the green space average as 9.2 hectares/ 1,000 people with a median of 6.1 hectares/ 1,000 people[16]. The Town of Comox green space ratio is 12.1 hectares/1,000 people. With consideration of the projected growth of the Town of Comox (referring to the RGS), the average ratio will be 9.7 hectares/ 1,000 people.

Map 12: Watersheds in the Town of Comox



Urban forests help reduce the quantity of storm water flows, soil erosion and stream sedimentation and help improve the quality of storm water runoff through absorption (Bernatzky 1983). Trees attenuate storm water in 3 ways: above ground through interception, evaporation and absorption of precipitation; at ground surface through temporary storage; and below ground through infiltration and permeation (Habecker 2004). Factors that influence the level of interception and evapotranspiration include tree species, stature, size and leaf area density. Increasing canopy cover is a simple way to help control storm water runoff and reduce overall quantity.

Trees and vegetation maintained as natural areas are not irrigated but receive water primarily in two ways:

1. From direct rain and surface flow following rain; and
2. From shallow subsurface interflow in the root zone.

[16] Available online at http://www.evergreen.ca/docs/res/Green-Space-Canada-Survey.pdf

What individuals do in their landscapes throughout the watershed has a direct impact on storm water quality. Planting and preserving trees is the cheapest and easiest way to assist in managing stormwater.

---Vancouver 2011 Urban Tree Canopy Assessment

In Comox the underlying soil parent material is fine grained glacio marine sediments deposited during the last ice age (BCGS 2012). This layer acts as hardpan, holding interflow water within the root zone of most trees. It may be seen as a pale layer during excavations and forms the streambed of several portions of Brooklyn Creek. With the exception of sand dune formations in the Point Holmes area, most of Comox has a gentle slope from a high point at the North-east Woods down towards the sea either in the Queen's Ditch Watershed or in one of several watersheds draining into Comox Harbour (Map 13).

As the ground slopes there are a series of gentle terraces. The result is rich deep soils that have a varying water holding capacity depending on the location. In general, more elevated sites hold less water and those at the bottom of slopes are wetter with deeper richer soils. For example, the soils in the shallow basin of Salish Park are very wet as opposed to the much drier soils found on the medium slope at Condor Park.

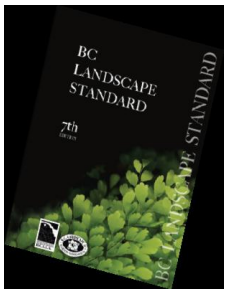
During land development perimeter drains and ditching are often designed to intercept surface and interflow water and send it in a new direction away from constructed buildings. Following land development trees and vegetation downstream may be affected by an increase or decrease in water availability. When planning and managing for natural areas it is important to understand the long and short term dynamics of the local watershed.Bi

Goal 2:
Maintain trees in a healthy condition through good cultural practices.

MAC recommends the Town of Comox adopts the following ANSI A300 standards and the International Society of Arboriculture (ISA) Best Management Practices. The following sections are brief descriptions of 6 Standards & BMP for implementation into your management plan. In addition to having the standards and BMP implemented as part of the Town of Comox

practices for good tree care, adopt the BC landscape standard (7th edition) where applicable.

The ANSI A300 standards represent the industry consensus on performing tree care operations. The standards can be used to prepare tree care contract specifications. Best Management Practices (BMPs) are guides written as how-to companions for the ANSI A300 standards, providing urban foresters with effective methods of standards application.[17] The ANSI standards are recognized by the Canadian Standards Association and Canadian Occupation Health and Safety.



The BC Landscape Standard 2008 is an essential reference for growers, landscape installation and maintenance companies, municipalities, and anyone buying their services or products. Developed by the BC Society of Landscape Architects and BCLNA, it establishes levels of quality to minimize variation in production, manufacturing and/or use.[18]

Pruning

The most common tree maintenance practice is pruning, representing 62% of daily activities in the field. There are several reasons to prune urban trees: to prevent branches from falling on objects or people, to allow remaining branches to bear more weight; to improve the health and quality of the tree by removing damaged, dead, diseased or crossed branches; to control the size and shape of the tree; to correct for storm damage; and clearance from hydro and other utilities. The most widely recognized reason for pruning urban trees is for safety. Pruning can reduce tree size and affect the health of a tree as a result of tissue removal. Reduction of leaf, shoot, or root volumes and the carbohydrate and nutrient reserves they contain directly disrupts and limits potential growth. Ultimate effects of pruning on tree growth and size must be considered in relation to tree age, growth and fruiting habits, stage of tissue development, and the environment to which the tree is exposed (Kozlowski 1991).

[17] http://www.isa-arbor.com

[18] http://bclna.com/bc-landscape-standards/

Tree Support Systems

ANSI A300 Standard & BMP *Supplemental Support Systems* (includes Cabling, Bracing, Guying, and Propping)

A300 Part 3 Supplemental Support Systems standards provide four basic cabling methods:

- *Direct:* Direct cabling consists of a single cable between two tree parts, e.g., two limbs, two stems, or a trunk and a limb.
- *Triangular:* Triangular cabling consists of connecting tree parts in combination of threes. This method should be preferred, when maximum support is required.
- *Box:* Box cabling consists of connecting four or more tree parts in a closed series. This system should be used only when minimal direct support is needed.
- *Hub and Spoke:* Hub and Spoke cabling consists of a center attachment (hub) with spans (spokes) of cable radiating to three or more leaders. Hub and Spoke cabling should only be used when other installation techniques cannot be installed.

Soil Management and Fertilization

ANSI A300 Soil Management a. Modification, b. Fertilization, and c. Drainage

A consistent issue in most cities is compaction and the lack of soil volume in sidewalk plantings. Soil compaction in high traffic areas impedes on the root system performing its physiological functions of absorbing water and minerals. Although trees adapt to their environment by adjusting their growth patterns, tactics to promote and improve tree health, such as raising the root ball, spreading a layer of mulch and implementing a watering schedule to suit drainage conditions can greatly increase tree survival.

Planting and Transplanting

Selecting the appropriate tree species and location for planting is imperative to sustaining a healthy urban forest, providing for a cost effective urban forest program and providing acceptable urban forest solutions to neighborhoods and communities. The right tree in the right place should always be the urban foresters' modus operandi. Tree species should be considered based on aesthetic appeal, hardiness zone, size, form and site conditions of the growing location. To minimize conflicts and reduce maintenance needs, trees should be visualized at full functional size when surveying a potential site for planting. Selecting a tree that is well suited to the soil conditions, light availability, pedestrian

traffic, drainage, space and microclimate of the specific site is essential to its long-term survival and public safety.

Plant Health Care (PHC) & Integrated Pest Management (IPM) BMP

Practices for designing, planning, and implementing an IPM program within a landscape as part of a comprehensive Plant Health Care management system. The objective of PHC is to maintain or improve the landscape's appearance, vitality and—in the case of trees—safety, using the most cost-effective and environmentally sensitive practices and treatments available. Plant Health Care involves monitoring, and using preventive treatments.

PHC begins with the premise that if you tend a plant properly-- if you can prevent a plant from undergoing stress by giving it the proper location, sunlight, soil, moisture, and protection from pests, the plant will thrive.

Trees and shrubs are subjected to a host of environmental stresses such as disturbed and poor soil, drought, and bad planting techniques, soil compaction, air pollution and much more. These stresses tend to weaken their natural defensive systems and leave them subject to diseases and insect infestations. If left undetected and untreated, these problems can seriously damage and even destroy the plants.
With PHC, arborists and other landscape professionals establish ideal growing conditions for the plants they tend. They remove the stresses, which drain a plant's energy, then bolster its natural defenses by determining and meeting essential requirements. Simple principles are the foundations:

- preventive care,
- frequent monitoring (check-ups),
- early detection of problems,
- informed decision-making,
- and integrated treatments to provide long-term, stable solutions.

Trees, shrubs, ground covers and lawn grasses all require sunlight, water and rooting space for growth. Each plant in the landscape competes with the neighbouring plant regardless of type or species. Contrary to general thinking, most tree roots are in the top two feet of soil. More importantly, the majority of fine, water absorbing roots is in the top six inches of soil. Grass roots ordinarily occupy a much greater percentage of the soil volume than tree roots and out-compete them for water and nutrients, especially around young trees.

Cost Effectiveness: Because Plant Health Care maintains the vigor of the landscape; plants are much less susceptible to pests. Proactive PHC practices cost considerably less than reactive interventions. Professional plant maintenance can actually pay for itself when considering how much healthy, beautiful plants add to property values.

PHC focuses on maintaining healthy plants, which stimulates their natural defensive systems and suppresses pests.

Use IPM and PHC programs together. This will fulfill the goal of maintaining tree health while minimizing the adverse ecological impact of the intervention practices. Figure 3 outlines the process of gathering information, assessing the severity, determining the expectations and deciding upon a course of action.

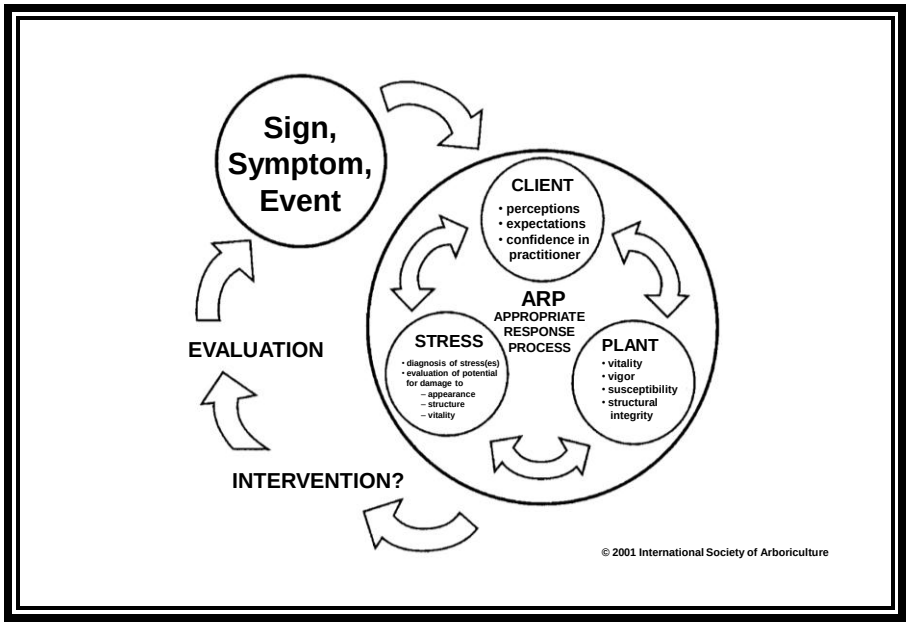


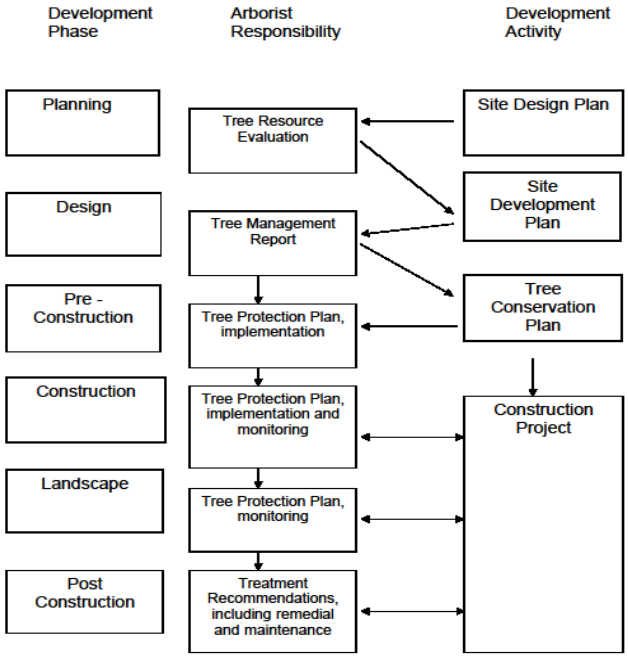
Figure 3 Appropriate Response Process

Tree Management and Development Sites

ANSI A300 Standard & BMP *Management of Trees and Shrubs During Site Planning, Site Development, and Construction*

Experts agree that tree protection during construction is more important (and less expensive) than tree planting programs after the fact. Construction activities such as paving, sidewalk installations, excavation, and road widening can severely affect existing trees. Some areas of impact are root cutting, branch abrasions and trunk fractures; these injuries can lead to rot and decay, structural damage, canopy loss or tree death. Properly valuing green space and implementing a strategy to monitor, sample, measure and protect vegetation is critical to urban development *preceding* the construction stages to effectively preserve the urban forest and maintain its integrity. Similarly, there exists a wealth of information on the complex relationship between trees and building foundations as they relate to soil types, surface drainage practices and the variation between species of trees.

Figure 4 Tree Management on Development sites flow chart



Tree Risk Assessment

A300 Standard & BMP *Tree Risk Assessment* are guides for arborists to assess tree risk as accurately and consistently as possible, to evaluate that risk, and to recommend measures that achieve an acceptable level of risk. In doing so, tree risk assessors should recognize the value of preserving trees and the importance of avoiding unnecessary treatments. Topics include risk assessment basics and types of risk associated with trees; levels and scope and tree risk assessment; assessing and evaluating risk from tree failures; tree risk categorization; risk reporting; and tree risk mitigation, including preventive and remedial actions.

Following these Standards and BMP for Pruning, Tree Support System, Soil Management & Fertilization , Planting, IPM and PHC, Trees & Development, and Risk Assessment, management can identify how each tree care tasks should be performed by in-house staff or contractors.

The detailed inventory provided in this UFMP outlines the task needed for the care of the trees. Following the standards and BMP by staff or contractors is a first step to maintaining your trees with good cultural practices.

Goal 3
Establish and maintain an optimal level of age and species diversity.

In arboriculture the goal for diversity is recommended at no more than;

- 25 per cent of any one genus for the city as a whole,
- 25 per cent of any one genus per sector,
- 20 per cent of any one genus in each park, and
- 30 per cent of any one genus on residential streets per sector.

The reasoning behind good diversity is to retain a healthy urban forest should infestations such as Emerald Ash Beetle or Mountain Pine Beetle occur.

MAC recommends review of the data tables provided for each neighbourhood area of Comox in the Inventory & Tree Resource Assessment section of this UFMP. Some areas have a high percentage of one or two genuses of trees (i.e. Red maple, Tulip tree). To reduce the potential for single species of trees to be infected or infested, allow for inter-planting of different species along boulevards and in parks.

Ensuring there are trees of various ages in your urban forest is the best way to secure environmental benefits over time.

Established trees provide immediate benefits. The investments our community leaders made 30, 40, and 50 years ago are producing dividends today. Dr. McPherson, Director of the Center for Urban Forest Research, points out that "since up-front costs to establish these trees have already been made, keeping these trees healthy and functional is one of the best investments communities can make." In one year an acre of mature trees can provide enough oxygen for 18 people.

Research over the years has calculated care for large trees can be as little as $13 per year per tree, yet each tree returns an average an average of $85 in energy savings, cleaner air, better managed storm water, extended life of streets, and higher property values. Smaller trees cannot provide the same magnitude of benefits. Research shows their net benefits are 8 times less than those of large trees.

MAC recommends the Town assess new development areas, identify the location of trees prior to any site plans being drawn up. Allow for different tree ages in new development areas and diversify the species of trees planted.

Goal 4
Promote conservation of existing tree resources.

Existing tree resources within urban forests can be conserved with Tree Ordinances and Tree Bylaws, appropriate Standards and Best Management Practices, and written Action Plans for natural areas, parks and street trees. MAC can provide a Tree

Inventory software program tailored for the Town of Comox's urban forest to facilitate tree data management (see Appendix 3 for example of the database interface).

The purpose of this database is to track and report on tree inventory and tree maintenance for smaller populations of trees (5,000-75,000). It has been built with Access 2010 for multi-user deployment, but can also be used as a single computer application. There are four cumulative permission levels: Admin, Manager, Write, and Read-Only.

There are two areas of focus:

1. Tree Inventory: information is stored about each tree's location, species, status, and attributes. Tree pictures and files may also be linked to and viewed for each tree. GIS location-mapping of each tree can be set up using a generic control which opens a mapping web page (like Google) to the GPS coordinates, or a custom set up can be done by a GIS department.

2. Tree Tasks: task statuses for each tree can be maintained and task lists can be generated for each tree district. Some examples of tasks are PHC assessment, risk Assessment, tree removal, stump removal, pruning, and watering. Tree replacement lists can also be generated.

Tree Ordinances

Tree ordinances are among the tools used by communities striving to attain a healthy, vigorous, and well-managed urban forest. To be effective, Tree Ordinances must be integrated into an overall management strategy.

Tree ordinances fit into one of three basic categories.

- Street tree ordinances primarily cover the planting and removal of trees within public rights-of-way. They often contain provisions governing maintenance or removal of private trees which pose a hazard to the traveling public. Also included in this category are ordinances with tree planting requirements, such as those requiring tree planting in parking lots.
- Tree protection ordinances are primarily directed at providing protection for native trees or trees with historical significance. They usually require that a permit be obtained before protected trees can be removed, encroached upon, or in some cases, pruned.
- View ordinances are designed to help resolve conflicts between property owners that result when trees block views or sunlight.

MAC recommends the Town of Comox consider writing Tree Ordinances to help promote conservation of the urban forest. See Appendix XX for an example of a city tree ordinance.

Existing Town of Comox Tree By-laws

MAC recommends a review of both the Town of Comox's Tree Cutting and Tree Management Bylaws to determine if the areas stated for protection reflect the findings of the Inventory & Tree Resource Assessment in this report, and to determine if the language in the bylaws sufficiently protects and sustains the Town of Comox's urban forest and natural areas.

Goal 5

Select, situate, and maintain urban trees appropriately to maximize benefits and minimize hazard, nuisance, hardscape damage, and maintenance costs.

As part of their Urban Forest Management Strategy of 2010 the City of Nanaimo did extensive research to write up these tables. With our close proximity, climate and urban forest practices MAC recommends the Town of Comox review the species identified in Appendix 4 and incorporate them in the UFMP.

The tables listed below, and located in Appendix 4, were graciously provided by the City of Nanaimo Parks department and their urban forester, Al Kemp.

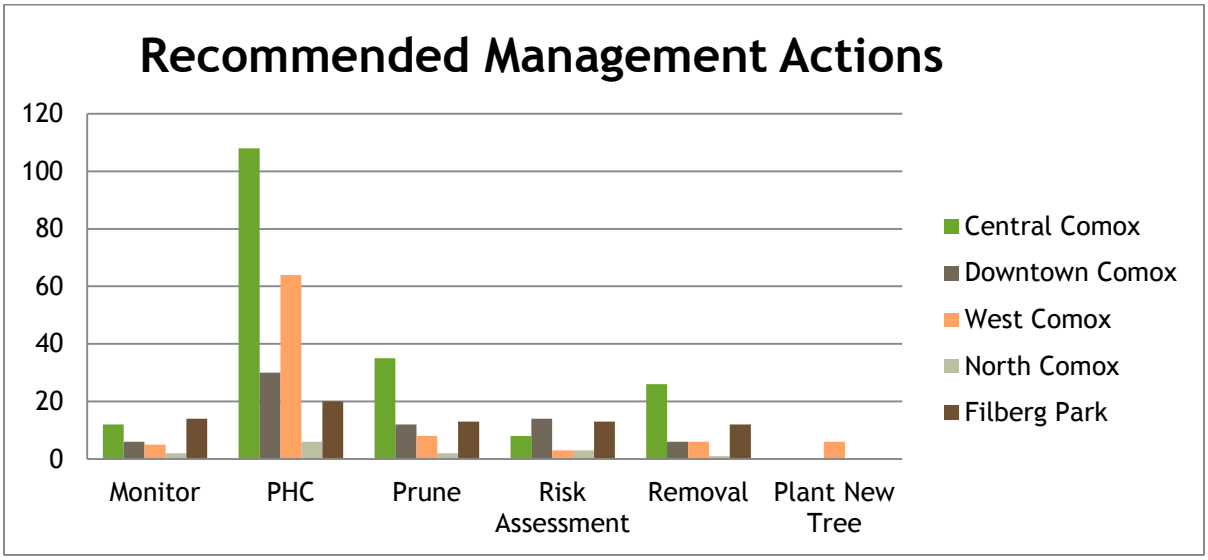
- Trees for Directly Under Hydro Lines
- Trees for beside Hydro Lines
- Trees for Limited Available Soil Volume
- Trees for Available Soil Volumes of 9cu.m. per tree or more
- Trees for Wide Boulevards or Wide Median
- Native Trees and Shrubs for Landscaping Non-Boulevard Areas
- Street Tree Size, Spacing and Location

Goal 6

To promote efficient and cost-effective management of the urban forest.

The tree inventory provides the Town of Comox with data needed for recommended actions required to promote and preserve the health of over 3,400 trees in the Town's urban forest. MAC recommends that the Town of Comox's Parks Department determine if they can manage these actions in-house by having a trained ISA certified arborist staff member assigned to this task. Plant Health Care is the highest priority in most of the Town areas (see graph 21). The development of a watering and fertilizing program and health assessment program is needed. The arborist could be responsible for pruning, removals, planting and monitoring. Risk assessments should be performed by an ISA Certified Tree Risk Assessor.

The data gathered for the golf course indicates immediate action is needed with regard to removals (40 trees), risk assessment (96 trees) and pruning. Additional work includes PHC and a tree replacement program. To promote efficient management of the golf course trees, implementation of a tree care program by the Town or the golf course board is strongly recommended.



Graph 21: Recommended Management Action for the Town of Comox

Natural Areas

MAC recommends writing a natural area management plan for the Town of Comox. Appendix 5 is the City of Surrey's Natural Area Management Plan. This is an excellent reference for the Town of Comox to use in writing a Natural Area Management Plan.

Management topics addressed in the document:

- Preservation and Protection
- Accessibility
- Community Participation
- Education
- Health, Safety and Liability
- Aesthetics
- Preservation of property Values and Economic Development
- Cost Effectiveness
- Biodiversity Conservation

The management specifics are:

- Vegetation
- Fauna
- Access and Recreation

- Tree Hazard
- Fire Management
- Course Woody Debris
- Yard Waste and Refuse Management

In the Town of Comox yard waste and refuse was found in nearly all of the natural areas. The Town of Comox may consider the City of Surrey's strategy for managing illegal dumping as detailed in appendix 5.

GOAL 7

Foster community support for the Town of Comox's urban forestry program.

- Share the data presented in this UFMP with the Town of Comox departments, interested naturalist organizations (e.g. Sierra Club, Friends of NE Woods, Friends of Lazo Marsh, school environmental clubs, Comox Valley Conservation Strategy groups from the Comox area, Comox Valley Naturalist Society and neighbourhood clubs) and the general public.
- Have the tree inventory map available for viewing on the Town website.
- Promote the fact that the Town of Comox has a robust diverse urban forest with a high percentage of natural areas.
- Promote the care the areas need such as implementing strategies to reduce yard waste dumping in natural areas, organize invasive weed pulling events, provide 'how-to- care' brochures for home owners in newly developed areas.
- Start a Forest Steward or Forest Ranger program for each neighbourhood. Below is an example from the Green Seattle Partnership program.

GOAL 8
Encourage good tree management on privately-owned properties.

Educational and incentive programs are positive ways to encourage good tree care within the community. Programs to educate citizens about, and involve them in, the local urban forestry program will help increase public support and interest in the program.

Obtain a public opinion poll about the Town of Comox's citizens' attitudes and knowledge about the urban forest. The City of Nanaimo's UFMS used a mailed survey questionnaire asking for the public's opinion about the management of trees in public places. Three open houses were also run to gather public feedback.

Some other strategies to encourage good tree management for homeowners could be:

- Share the information we have about the Comox urban forest and natural areas,
- Determine the percentage of trees on private land by collecting (using GPS) the tree inventory or use aerial photos to determine an average size and number of trees,
- Provide an information brochure for people moving to Comox about proper tree care,
- Write an ordinance specific for trees on private land. Form a citizen tree commission to help develop incentive programs such as cost-sharing, grants, providing loans for tree planting or tree maintenance.
- Write a bylaw to protect trees from unnecessary removal. Refer to Appendix 6 for a tree protection bylaw example from the City of Vancouver.

BENEFITS OF A SUSTAINABLE URBAN FOREST

To understand the significant role that forests play in an urban setting and the importance of sustainable urban forest management, the services and benefits provided by the urban forest must be identified and valued. Aesthetic and recreational benefits provided by the urban forest are often more easily identified as they are 'visible' benefits. However, there are a number of social, environmental, cultural, and economic benefits that flow from having a sustainably managed urban forest. The lists below are a compilation of research from Wolf (2003) and McPherson et al. (2002).

Economic

- Increase property values (higher values of properties in tree lined areas, with signifignt tree cover, and with large trees located in yards)
- Reduce residential and municipal energy costs by reducing air conditioning needs.
- Reduce costs associated with stormwater and wastewater management
- Increase commercial activity-positive impact on consumer behavior showing a willingness to pay more for parking and goods in landscaped business district
- Revitalize business districts-businesses and consumers are attracted to districts with trees

Environmental

- Reduce carbon dioxide emissions and ozone levels
- Improve air quality (absorb pollutants and particulate matter)
- Reduction of weather and climate impacts (provide shade, act as windbreaks)
- Mitigate impacts from floods and assist in stormwater management (reduce stormwater runoff, intercept water, enhances water absorption)
- Protection against erosion and slope instability
- Increase biodiversity (provide habitat for wildlife)

Social and Cultural

- Empower local groups and encourage community building
- Faster recovery in rehabilitation centers and hospitals
- Mitigate emotional stress
- Enhance worker productivity,
- Reduce traffic noise and stress
- Reduce crime
- Enhance aesthetic appeal and place making
- Increase recreational opportunities

Numerous studies link urban forests and green space with an increase in human health and well-being. Alternatly, human and natural activities can sigifigantly impact the urban forest and there can be risks associated with the urban forest if it is not sustainably managed.

RECOMMENDATIONS

This UFMP provides the Town of Comox with information about their tree resources located in natural areas, on streets, and within parks.

Policies, strategic planning, and implementation are required in order for the Town of Comox to adequately care for the tree resources.

During planning, positive engagement with the community around how to care for this tree resource (on public and private lands) could result in better management of trees on both public and private property.

Summarized below are three key areas for managing the urban forest in the Town of Comox.

Tree Resource	
Maintain public trees to promote health and longevity	Implement goals 2, 6
Maintain the natural areas tree resource	Implement goals 1, 6, 7
Strive to establish a diverse species & age class	Implement goal 3
Management Framework	
Track the condition of the urban forest	Implement goal 4
Implement resource management tools	Implement goal 4, 5
Manage urban forest with improved regulations	Implement goal 4
Manage trees on private property through incentives & regulations	Implement goal 8
Community Framework	
Enhance public awareness about Comox urban forest	Implement goal 7, 8
Volunteer engagement	Implement goal 7, 8

Summary of Recommendations for the Town of Comox

- Determine canopy cover on private property,
- Determine the canopy cover goal for the Town of Comox,
- Determine the long and short term dynamics to the local watershed during land development,
- Adopt the ANSI A300 Standards and ISA Best Management Practices,
- Review the tree inventory to determine the requirements of establishing and maintaining a diverse and optimal age level of trees,
- Purchase a tree inventory database to track and report your inventory and maintenance,
- Consider writing Tree Ordinances and review existing Town of Comox Bylaws,
- Implement the recommended management actions for the care of the trees,
- Research and write a Natural Area Management Plan for the Town of Comox natural areas,
- Write the tree tables for specific planting sites and adopt into the management plan,
- Share the data from the UFMP with Town of Comox departments, organizations and the general public,
- Promote the urban forest and natural areas with development of neighborhood programs and,
- Obtain a public opinion poll from the citizens of Comox about their attitude and knowledge about the urban forest.
- Calculate the total value of the urban forest using the ISA Trunk Formula

GLOSSARY

Biogeoclimatic Zones and Biogeoclimatic Subzones	Zones of similar biological geological and climatic features classified under British Columbia's Biogeoclimatic Ecosystem Classification System.
Canopy Cover	The proportion of land area occupied by tree crown (leaf) area when viewed from above. This measure consists of the two-dimensional area extent of the combined canopies of all trees within a specified land area.
DHB	Tree diameter at breast height, at a level approximately 4.5 feet or 1.37m above ground level.
Hazardous Tree	A tree or tree part which is considered, by a certified Arborist, to present a hazard to the safety of persons or to the public or to private property due to its location, condition, health or other circumstances.
Heritage Tree	A tree that is considered worthy of preserving for the enjoyment and learning of present and future generations because of its importance through generations or from past societies.
Invasive Species	A species that is not native to the ecosystem under consideration whose introduction causes or is likely to cause economic or environmental harm or harm to human health.
Natural Area(s)	In Canada, natural areas are those that fulfil one or more of the following criteria. 1) They are natural or near natural in character and relatively undisturbed or else in the process of recovery from human disturbance. 2) They are significant regional habitats for either typical or endangered plant or animal species. 3) They encompass one or more regionally characteristic or rare natural ecosystems. 4) They contain typical or unusual geological formation or archaeological sites. 5) They exhibit diverse scenery or other natural physiographic features of scientific, educational, aesthetic, or cultural value.
Natural Area Parks	Park natural areas are defined as park spaces that are relatively undisturbed and contain a high percentage of native species, providing habitats for a diversity of native wildlife. They are natural or near natural in character, or are in the process of recovery from human disturbance. These natural areas may represent or contain fragments of regionally typical ecosystems; they may contain habitat for endangered plant and animal species. They help maintain a diversity of living organisms through the conservation of wild genetic resources.

Natural Area Trees	Trees that have germinated naturally in open areas or areas designated as parks are an integral component of functional ecosystems, including a variety of forested and non-forested communities in various ecological successional stages.
Natural Forest	A forest area that has developed free from the influence of humans and remains largely unaffected by their activities. The natural forest may include, but is not necessarily equivalent to an old growth forest.
Natural Landscape	An area where human effects, if present, are not ecologically significant to the landscape as a whole.
Nature Park	Use of lands, buildings or structures primarily for conservation and enjoyment of natural areas. Uses can include boardwalks, trails, environmentally sensitive areas, nature centres, nature sanctuaries and the like.
Riparian Area	Sites that are adjacent to a water body.
Urban Forest	The forested ecosystems and individual trees found within the urban landscape. This includes natural forested ecosystems, street and park trees as well as individual trees growing on private property.
Urban Forestry	Urban forestry is the sustained planning, planting, protection, maintenance, and care of trees, forests, green space and related resources in and around cities and communities for economic, environmental, social, and public health benefits for people. The definition includes retaining trees and forest cover as urban populations expand into surrounding rural areas and restoring critical parts of the urban environment after construction. Expansion at the urban/rural interface raises environmental and public health and safety concerns, as well as opportunities to create educational and environmental links between urban people and nature. In addition, urban and community forestry includes the development of citizen involvement and support for investments in long-term on-going tree planting, protection, and care programs.
Urban Landscape	The urban landscape is a set of interdependent elements that creates a controlled sense of place. It includes thoroughfare type, building type, frontage type, and the form and disposition of landscape.
Wetland	Areas where soils are water-saturated for a sufficient length of time such that excess water and resulting low soil oxygen levels are principal determinants of vegetation and soil development. Wetlands will have a relative abundance of hydrophytes in the vegetation community and/or soils featuring “hydric” characters.

Wildlife tree	Any tree that provides present or future habitat critical for the maintenance or enhancement of wildlife. The assessment of a wildlife tree as a critical habitat may be determined by one or more physical attributes, such as structure, age, condition, abundance, species, geographic location, or surrounding habitat features. A high quality wildlife tree has the following attributes 1) a standing, dead tree greater than 15 metres in height; 2) at least 30 centimetres in diameter at breast height; 3) preferably with a broken top; 4) some of the bark is intact; 5) the tree is wind firm and; 6) lean is minimal.
Veteran Trees (vets)	Refers to mature trees that are considerably older than the rest of the stand. Usually, veterans are trees remaining from a previous forest that have survived while a new forest has been goring up around them.

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APPENDICES

Appendix 1: Natural Areas Diagrams and Tables

1. Aspen Park Vegetation Study Plot

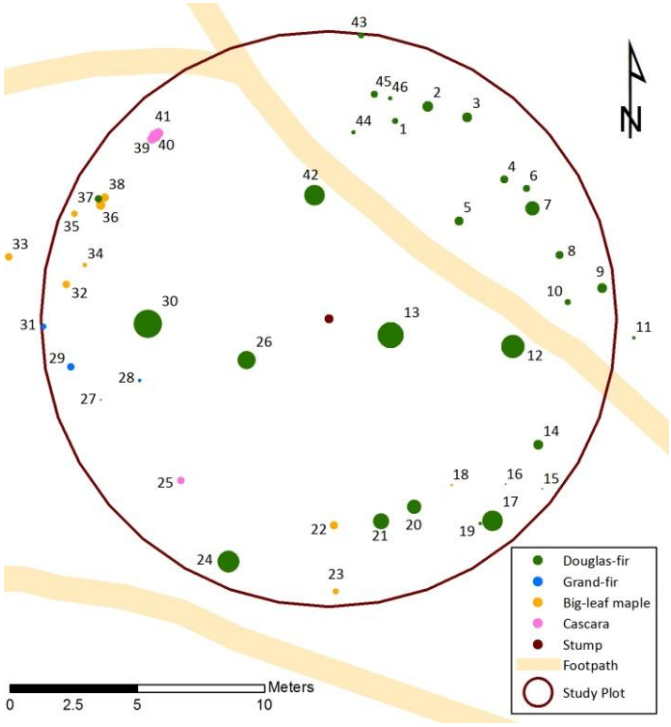


Table: Aspen Park Vegetation Study Plot

Coordinates of Centre of Study Plot: 10U 359872 5505397
Aspect: South-south-west
Slope: 3°
Forest structural stage: Young Forest
Crown closure: 87%
Soil Moisture Regime: *Mesic class*:-Water supply, primarily precipitation but with some runoff from the playing fields, is removed somewhat slowly in relation to supply

Tree Species	Number of trees	Average DBH (cm)	Range DBH (cm)	Best fit plant community description	Dominant understory native plants
Douglas-fir	28	22	3 - 54	Western hemlock - Douglas-fir / Oregon beaked-moss - CWHxm1/01	Oregon grape – 30% Sword-fern - 2% Red huckleberry Oceanspray Salal Bracken fern Trailing blackberry
Big-leaf maple	8	13	5 - 18		
Grand-fir	4	9	3 - 14		
Cascara	4	18	25 - 40		

Invasive plants: English holly, Daphne, Scotch broom, and Himalayan blackberry
Recommendations: Removal of invasive species and replanting. Planting of native seedlings.

2. Condor Park Vegetation Study Plot

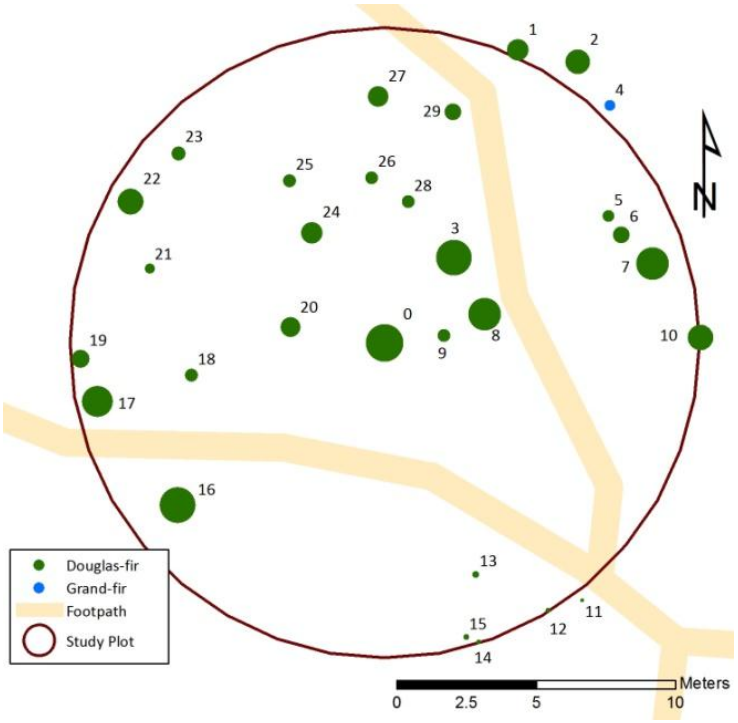


Table: Condor Park Vegetation Study Plot

Coordinates of centre of Study Plot: 10U 359472 5505120					
Aspect: South-south-west					
Slope: 1°					
Forest structural stage: Young Forest					
Crown closure: 84%					
Soil Moisture Regime: *Mesic class*-Water supply is primarily precipitation, but with some runoff from the north, is removed somewhat slowly in relation to supply					
Tree Species	**Number of trees**	**Average DBH (cm)**	**Range DBH (cm)**	**Best fit plant community description**	**Dominant understory native plants**
Douglas-fir	26	32	20 – 68	Western hemlock - Douglas-fir / Oregon beaked-moss - CWHxm1/01	Oregon grape – 70% Salal – 10% Red huckleberry Snowberry Bracken fern Trailing blackberry
Invasive plants in study plot and also throughout the park: English holly, Daphne, Scotch broom, Himalayan blackberry, Lamium, English ivy, Periwinkle					
Recommendations: Stop all dumping of yard waste. Removal of invasive species will allow native species to dominate.					

3. Pioneer Park

Table: Pioneer Park Tree and Understory Species

Area of Pioneer Park	Tree Species	Understory Native Plants	Invasive Plants
Coastal Bank		Salal, Oregon grape, Sword-fern, Red huckleberry Oceanspray	Himalayan blackberry, Saint John's Wort
East Boundary	Conifers Deciduous		

4. MacDonald Road Park

Table: MacDonald Road Park Tree and Plant Species

Coniferous Trees	Deciduous Trees	Understory native plants
Shore pine – 60% of the total number of trees Sitka spruce Western red cedar Western hemlock	Red alder Willow Trembling aspen Big-leaf maple	Salal – high % Red huckleberry Bracken Elderberry Oceanspray Viburnum
Invasive plants: Scotch broom, Himalayan blackberry		
Recommendations: Maintain the natural area as inaccessible as possible to people – leave it alone. Yearly removal of Scotch Broom along the natural area perimeter. Strategic removal of Himalayan Blackberry where natural vegetation will fill in.		

5. Port Augusta Park

Table: Port Augusta Park Tree and Plant Species

Native Tree Species	Exotic Tree Species	Understory native plants	Exotic Understory Plants
Douglas-fir Red alder Native plum Pacific Dogwood	European birch Maples Ginkgo Laurel Hazelnut Forsythia Hawthorn	Nootka Rose Flowering red currant Salal Oregon grape Sword-fern Red huckleberry Oceanspray	Periwinkle Bluebells Boxwood Saint John's Wort
Invasive plants: Himalayan blackberry, English Ivy, Daphne			

6. Brooklyn Creek Trail/ Greenway

Table: Brooklyn Creek Greenway Tree and Plant Species

Coniferous Trees	Deciduous Trees	Understory native plants
Douglas-fir Grand-fir Western red cedar	Big-leaf maple Red alder Bitter cherry	Salal Oregon grape Sword-fern Red huckleberry Oceanspray Salmonberry
Invasive plants: English Ivy, Himalayan blackberry, English holly, Lamium, Periwinkle Scotch broom		
Recommendations: Removal of invasive species and letting the native vegetation re-establish. On a regular basis risk assess for danger trees.		

7. MacDonald Wood Park Vegetation Study Plot - North

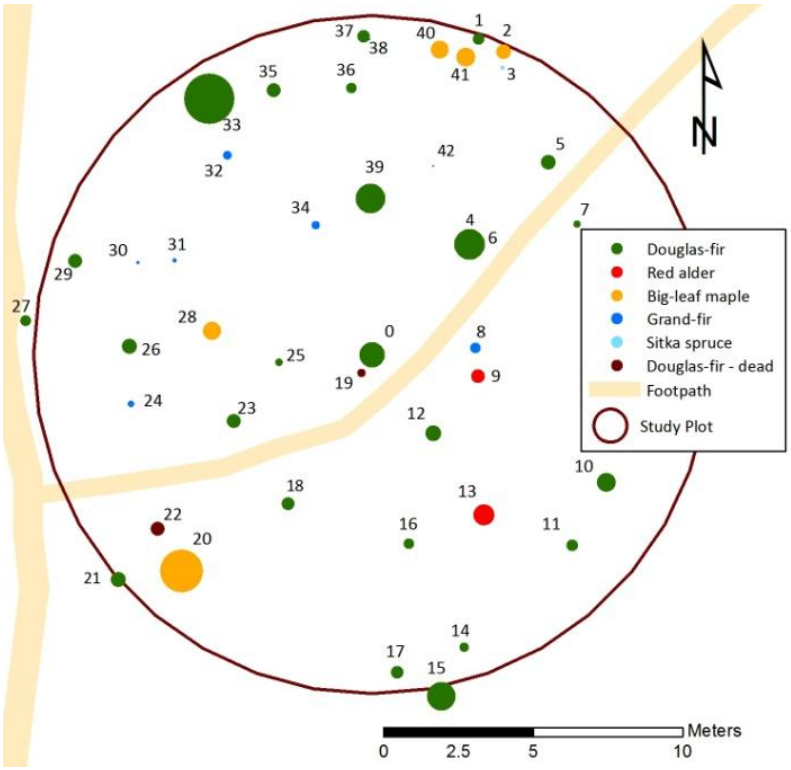


Table: MacDonald Wood Park Vegetation Study Plot-North

Coordinates of centre of Study Plot: 10U 362233 5504057					
Aspect: South-south-west					
Slope: 2°					
Forest structural stage: Young to Mature Forest					
Crown closure: 87%					
Soil Moisture Regime: *Mesic class*-Water supply, primarily precipitation but with some runoff from the playing fields, is removed somewhat slowly in relation to supply					
Tree Species	**Number of trees**	**Average DBH (cm)**	**Range DBH (cm)**	**Best fit plant community description**	**Dominant understory native plants**
Douglas-fir	23	28	11 - 83	Western hemlock - Douglas-fir / Oregon beaked-moss - CWHxm1/01	Oregon grape – 85% Sword-fern - 3% Red huckleberry Oceanspray Salal Bracken fern Trailing blackberry
Grand-fir	8	9	3 - 18		
Big-leaf maple	5	38	25 - 70		
Red alder	2	29	22 - 36		
Sitka spruce	1	6			
Invasive plants in the study plot and/or in surrounding areas of the park: English holly, Daphne, Scotch broom, Himalayan blackberry					
Recommendations: Removal of invasive species and letting the native vegetation re-establish. On a regular basis risk assess for danger trees.					

8. MacDonald Wood Park Vegetation Study Plot - South

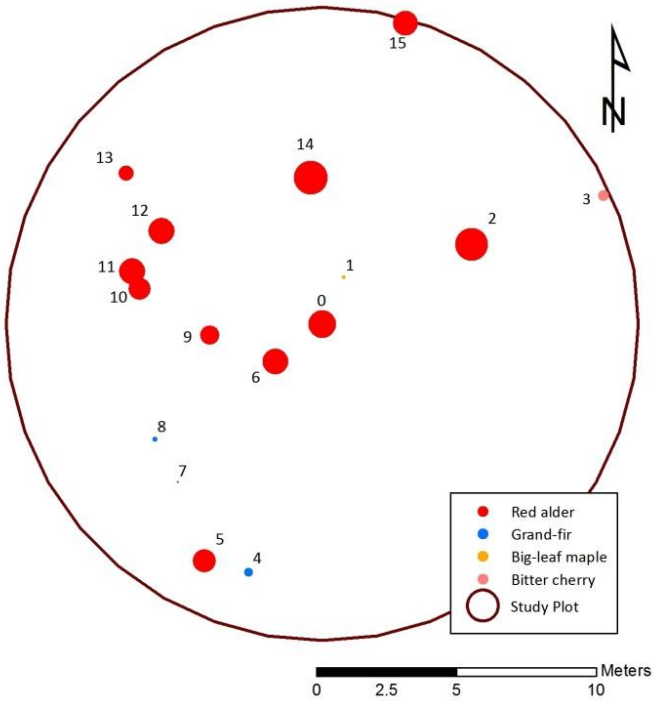


Table: MacDonald Wood Park Vegetation Study Plot-South

Coordinates of centre of Study Plot: 10U 362207 5503691					
Aspect: South					
Slope: <1°					
Forest structural stage: Young to Mature Forest					
Crown closure: 36%					
Soil Moisture Regime: *Subhydric*- where there is much seepage and the water table is at or near the surface for most of the year					
Tree Species	**Number of trees**	**Average DBH (cm)**	**Range DBH (cm)**	**Best fit plant community description**	**Dominant understory native plants**
Red alder	11	45	27 - 61	western redcedar - Sitka spruce /skunk cabbage - CWHxm1/12	Salmonberry - 60% Sword-fern - 5% Oregon grape - Traces Trailing blackberry-Traces Horsetail Skunk Cabbage
Grand-fir	3	9	3 - 15		
Big-leaf maple	1	7			
Cherry	1	19			
Invasive plants in the study plot and/or in surrounding areas of the park: English ivy					
Recommendations: Remove invasive species and let the forest grow and age naturally. On a regular basis risk assess for danger trees.					

9. Mack Laing Park Vegetation Study Plot

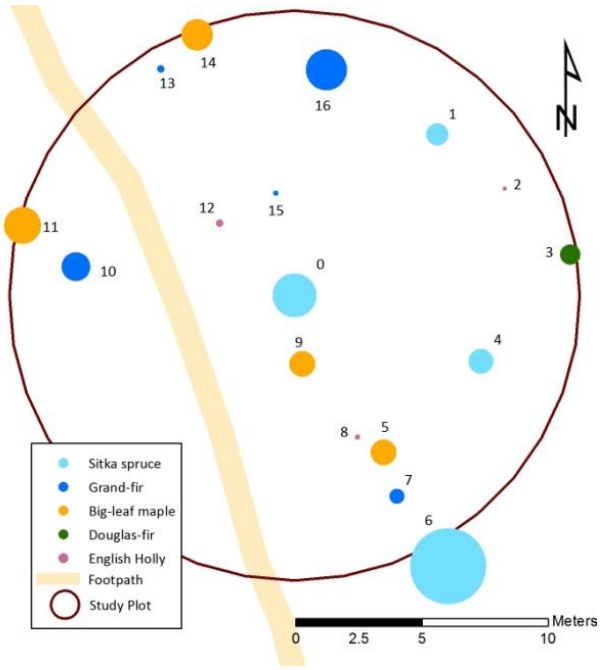


Table: Mack Laing Park Vegetation Study Plot

Coordinates of centre of Study Plot: 10U 362089 5503805					
Aspect: South					
Slope: 1°					
Forest structural stage: Mature Forest					
Crown closure: 84%					
Soil Moisture Regime: *Mesic class*-Water supply, primarily precipitation but with some surface and subsurface runoff from higher terrain to the east. Soil moisture is removed somewhat slowly in relation to supply					
Tree Species	**Number of trees**	**Average DBH (cm)**	**Range DBH (cm)**	**Best fit plant community description**	**Dominant understory native plants**
Grand-fir	5	38	10 - 81	Black cottonwood – red alder / salmonberry CWHxm1/09	Sword-fern - 70% Salmonberry – 5% Elderberry Bald hip rose Skunk cabbage
Big-leaf maple	4	58.8	51 - 72		
Sitka spruce	3	60	44 - 87		
Douglas-fir	1	41			
Invasive plants in the study plot and/or in surrounding areas of the park: English holly, English Ivy Daphne, Lamium, Himalayan blackberry					
Recommendations: Strategic removal of invasive plants (focus on areas that have a natural isolation from the main infestations). On a regular basis risk assess for danger trees.					

10. Salish Park Vegetation Study Plot

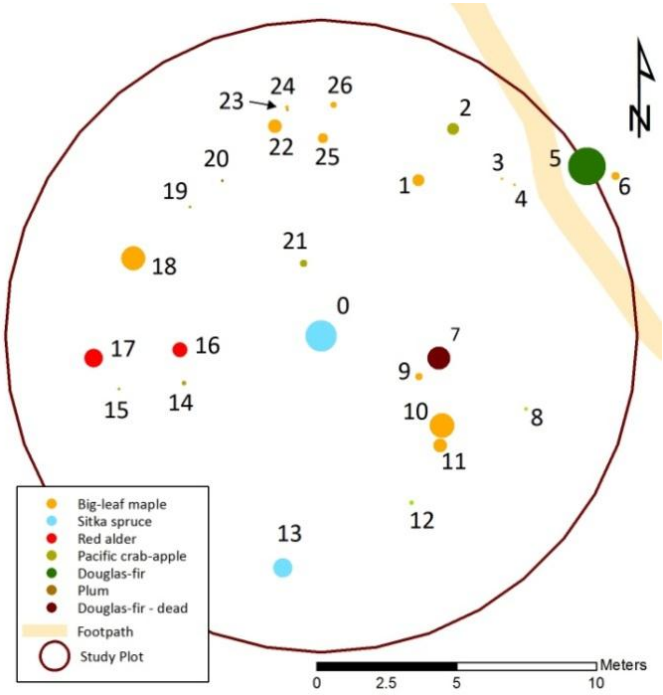


Table: Salish Park Vegetation Study Plot

Coordinates of centre of Study Plot: 10U 361555 5505321					
Aspect: South-east					
Slope: 1°					
Forest structural stage: Young Forest					
Crown closure: 45%					
Soil Moisture Regime: *Subhygric*- Water supply is precipitation and seepage. Water is removed slowly enough to keep the soil wet for a significant part of the growing season.					
Tree Species	**Number of trees**	**Average DBH (cm)**	**Range DBH (cm)**	**Best fit plant community description**	**Dominant understory native plants**
Big-leaf maple	11	19	5 - 44	Sitka spruce / salmonberry CWHxm1/08	Salmonberry – 50% Sword-fern - 25% Sedges – 15% Snowberry – 10% Oregon grape – 30% Bald hip rose
Pacific crab apple	6	9	4 - 22		
Sitka spruce	2	45	34 - 56		
Red alder	2	29	26 - 32		
Hawthorn	2	7	7 - 8		
Douglas-fir	1	67			
Plum	1	4			
Invasive plants in the study plot and/or in surrounding areas of the park: English holly, Daphne, Himalayan blackberry					
Recommendations: Retain spruce. Remove invasive plants. On a regular basis risk assess for danger trees.					

11. Village Park Vegetation Study Plot

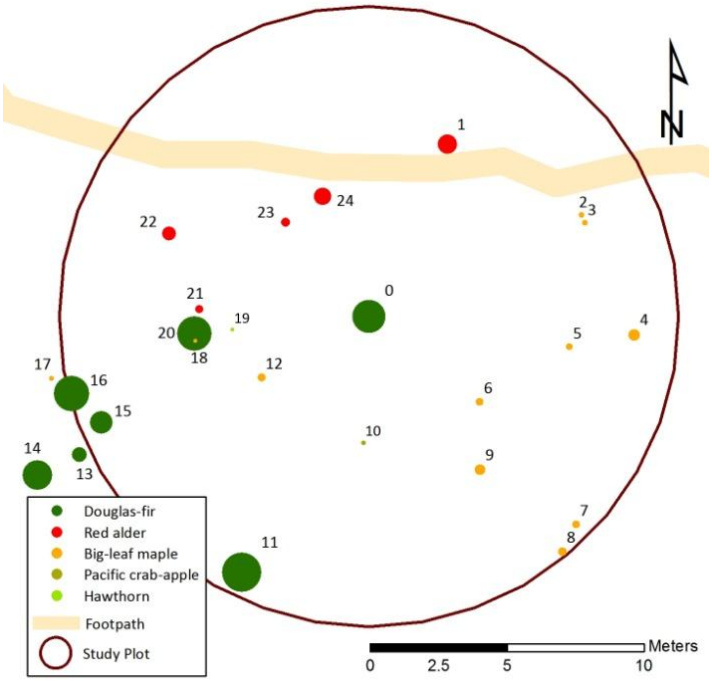


Table: Village Park Vegetation Study Plot

Coordinates of centre of Study Plot: 10U 360930 5505179					
Aspect: South					
Slope: 3°					
Forest structural stage: Young Forest					
Crown closure: 69%					
Soil Moisture Regime: *Mesic class*-Water supply is primarily precipitation but with some surface and subsurface runoff from higher lands to the north. Water is removed somewhat slowly in relation to supply and soil may remain moist for significant but sometimes short periods of the year					
Tree Species	**Number of trees**	**Average DBH (cm)**	**Range DBH (cm)**	**Best fit plant community description**	**Dominant understory native plants**
Big-leaf maple	9	15	10 - 21	Western redcedar - swordfern CWHxm1/05	Sword-fern - 40% Snowberry - 10% Sedges - 5% Oregon grape Bald hip rose Salmonberry Bracken fern Trailing blackberry
Douglas-fir	5	59	41 - 72		
Red alder	5	24	13 - 36		
Pacific crab-apple	1	8			
Hawthorn	1	7			
Invasive plants in the study plot and/or in surrounding areas of the park: English holly, English Ivy Daphne, Himalayan blackberry					
Recommendations: Removal of invasive plants. Allow the forest to naturally mature. On a regular basis risk assess for danger trees.					

12. Comox Valley Lions Club

Table: Comox Valley Lions Park Tree and Plant Species

Area of Comox Valley Lions Park	Coniferous	Deciduous	Understory native plants
SE Corner	14 (Douglas-fir)	8 (cherry and willow)	Salal Oregon grape Sword-fern Red huckleberry Oceanspray
NE Corner	24 (Douglas-fir)	10	
West Area	17 (Douglas-fir)	4	
Invasive plants: Scotch broom, Himalayan blackberry, English holly			

13. Highmoor Greenway

Table: Highmoor Greenway Tree and Plant Species

Coniferous Trees	Deciduous	Understory native plants
Douglas-fir Grand-fir Western white pine	Trembling aspen Red alder Big-leaf maple Bitter cherry Pacific crab-apple	Oregon grape Salal Salmonberry Oceanspray Snowberry Red huckleberry Nootka rose Bald-hip rose Trailing blackberry
Invasive plants: English holly, Himalayan Blackberry, Scotch Broom, Daphne, Lambs ear		
Recommendations: Remove invasive plants. Educate local landowners about the negative impacts dumping yard waste does to the natural area. Organize a "friends of" group for the care of the natural area.		

14. Foxxwood Park Vegetation Study Plot

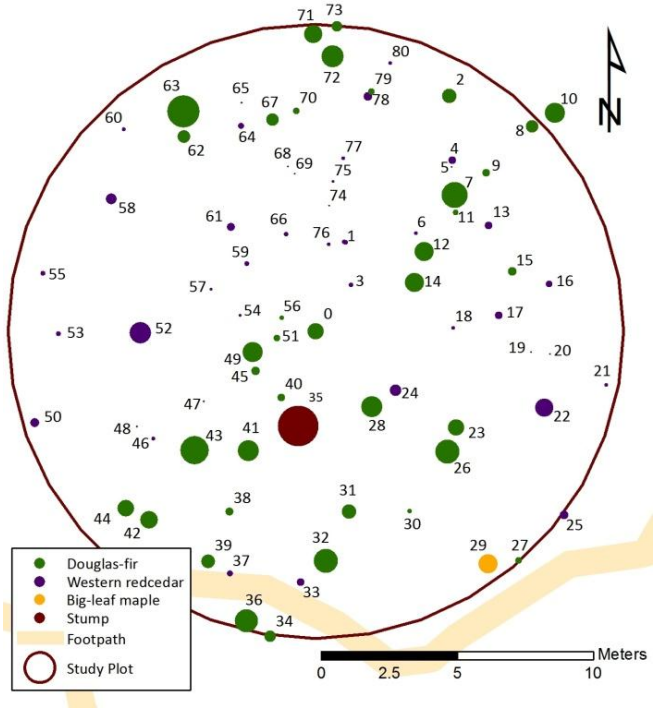


Table: Foxxwood Park Vegetation Study Plot

Coordinates of centre of Study Plot: 10U 361524 5506681					
Aspect: North-north-east					
Slope: <1°					
Forest structural stage: pole/sapling to Young forest					
Crown closure: 95%					
Soil Moisture Regime: *Mesic class*-moisture is received as rainfall and soils remain moist for some time after a rain					
Tree Species	**Number of trees**	**Average DBH (cm)**	**Range DBH (cm)**	**Best fit plant community description**	**Dominant understory native plants**
Western redcedar	40	10	3 - 38	Western hemlock – western red cedar / deerfern (CWHxm1/06)	Salal - Traces
Douglas-fir	36	27	8 - 59		
Big-leaf maple	1	35.7			
Invasive plants in the study plot and also throughout the park: English ivy, Lamium					
Recommendations: Removal of invasive plants around the perimeter of the park					

15. North-east Woods - Vegetation Study Plot A

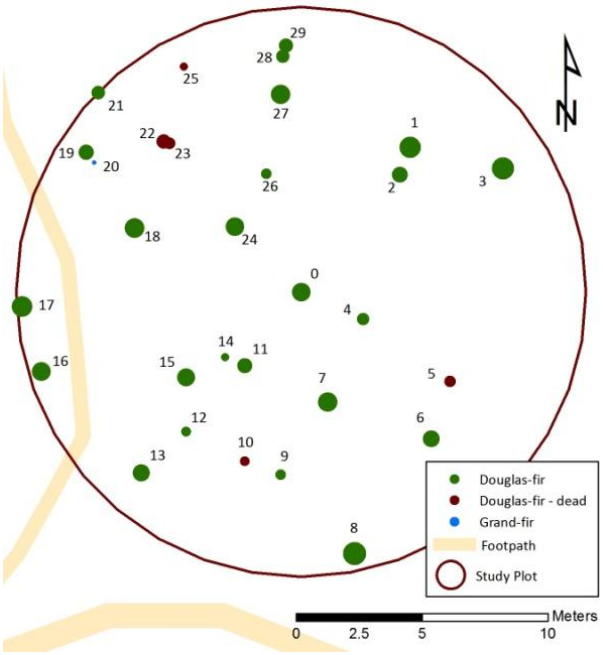


Table: North-east Woods Vegetation Study Plot A

Coordinates of centre of Study Plot: 10U 362318 5506066					
Aspect: North-east					
Slope: 3°					
Forest structural stage: Young Forest					
Crown closure: 87%					
Soil Moisture Regime: *Submesic class*-Water supply, primarily precipitation is removed readily in relation to supply. Soil is moist for short periods following precipitation					
Tree Species	**Number of trees**	**Average DBH (cm)**	**Range DBH (cm)**	**Best fit plant community description**	**Dominant understory native plants**
Douglas-fir	24	32	16 - 46	Douglas-fir - western hemlock / salal CWHxm1/03	Salal – 90% Oregon grape Sword-fern Red huckleberry Oceanspray Bracken fern
Grand-fir	1	9			
Invasive plants in the study plot and/or in surrounding areas of the park: English Holly.Overall there are very few invasive plants in the central areas of this park					
Recommendations: Removal of invasive plants. Monitoring of potential danger trees along pathways. Allowing the forest to naturally mature.					

16. North East Woods Vegetation Study Plot B

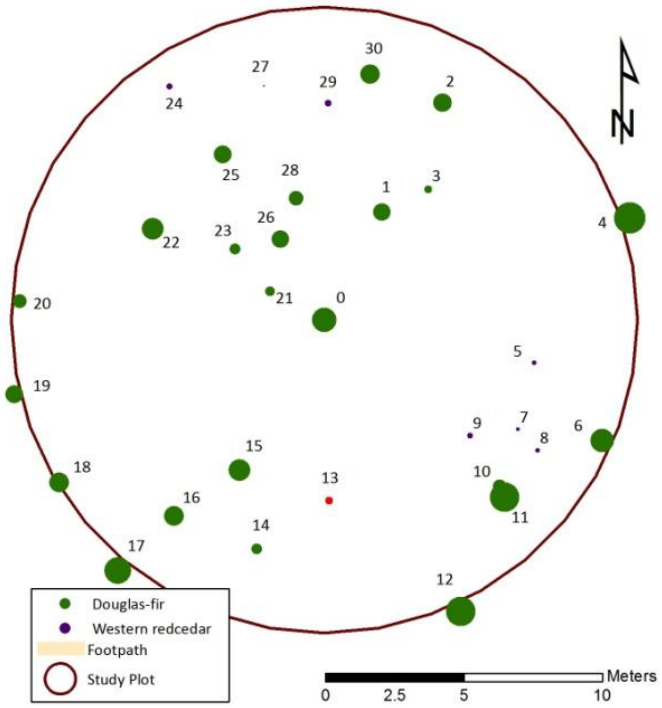


Table: North-east Woods Vegetation Study Plot B

Coordinates of centre of Study Plot: 10U 362426 5506060					
Aspect: North					
Slope: 2°					
Forest structural stage: Young Forest					
Crown closure: 95%					
Soil Moisture Regime: *Mesic class*-Water supply is primarily precipitation but with some surface and subsurface flow from higher ground nearby. Water is removed somewhat slowly in relation to supply.					
Tree Species	**Number of trees**	**Average DBH (cm)**	**Range DBH (cm)**	**Best fit plant community description**	**Dominant understory native plants**
Douglas-fir	20	32	13 - 54	Western redcedar - swordfern CWHxm1/05	Salal - 50% Oregon grape - 40% Sword-fern Snowberry Red huckleberry Bald hip rose Oceanspray Trailing blackberry
Western redcedar	7	9	3 - 13		
Red alder	1	13			
Invasive plants in the study plot and/or in surrounding areas of the park: English holly. Overall there are very few invasive plants in the interior areas of this park					
Recommendations: Removal of invasive plants. Monitoring of potential danger trees along pathways. Allowing the forest to naturally mature					

17. North East Woods Vegetation Study Plot C

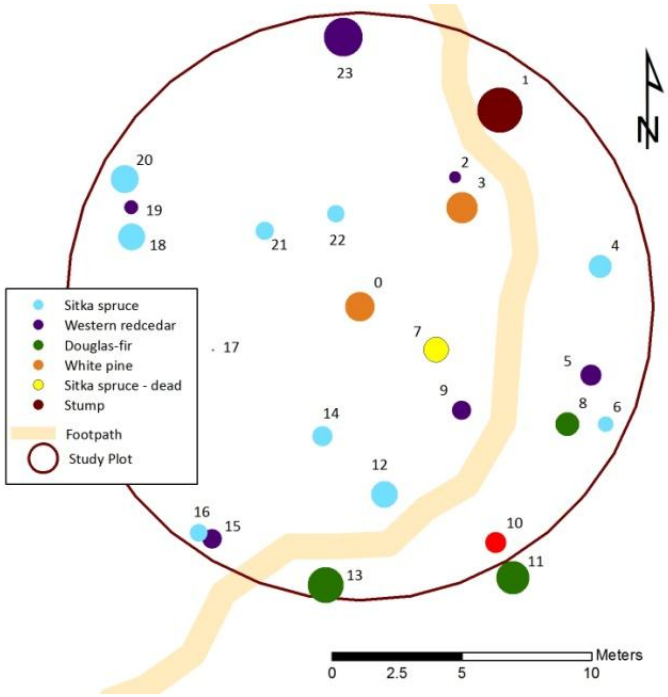


Table: North-east Woods Vegetation Study Plot C

Coordinates of centre of Study Plot: 10U 362923 5506166					
Aspect: North-north-east					
Slope: <1˚					
Forest structural stage: Mature Forest					
Crown closure: 89%					
Soil Moisture Regime: *Subhygric class*-Water supply is both precipitation and seepage. Water supply is removed slowly enough to keep the soil wet for significant parts of the growing season.					
Tree Species	**Number of trees**	**Average DBH (cm)**	**Range DBH (cm)**	**Best fit plant community description**	**Dominant understory native plants**
Sitka spruce	9	41	30 - 54	Sitka spruce / salmonberry CWHxm1/08	Salal- 60% Deer fern – 5% Sword-fern Red huckleberry Salmonberry Bracken fern Trailing blackberry Cascara
Western redcedar	7	35	4 - 74		
Western white pine	2	58	56 - 59		
Douglas-fir	2	57	45 - 70		
Red alder	1	40			
Invasive plants in the study plot and/or in surrounding areas of the park: English holly					
Recommendations: Removal of invasive plants. Allowing the forest to naturally mature. Protection of tree roots in the areas of footpaths with woodchips or clear mulch. Monitoring of potential danger trees along pathways.					

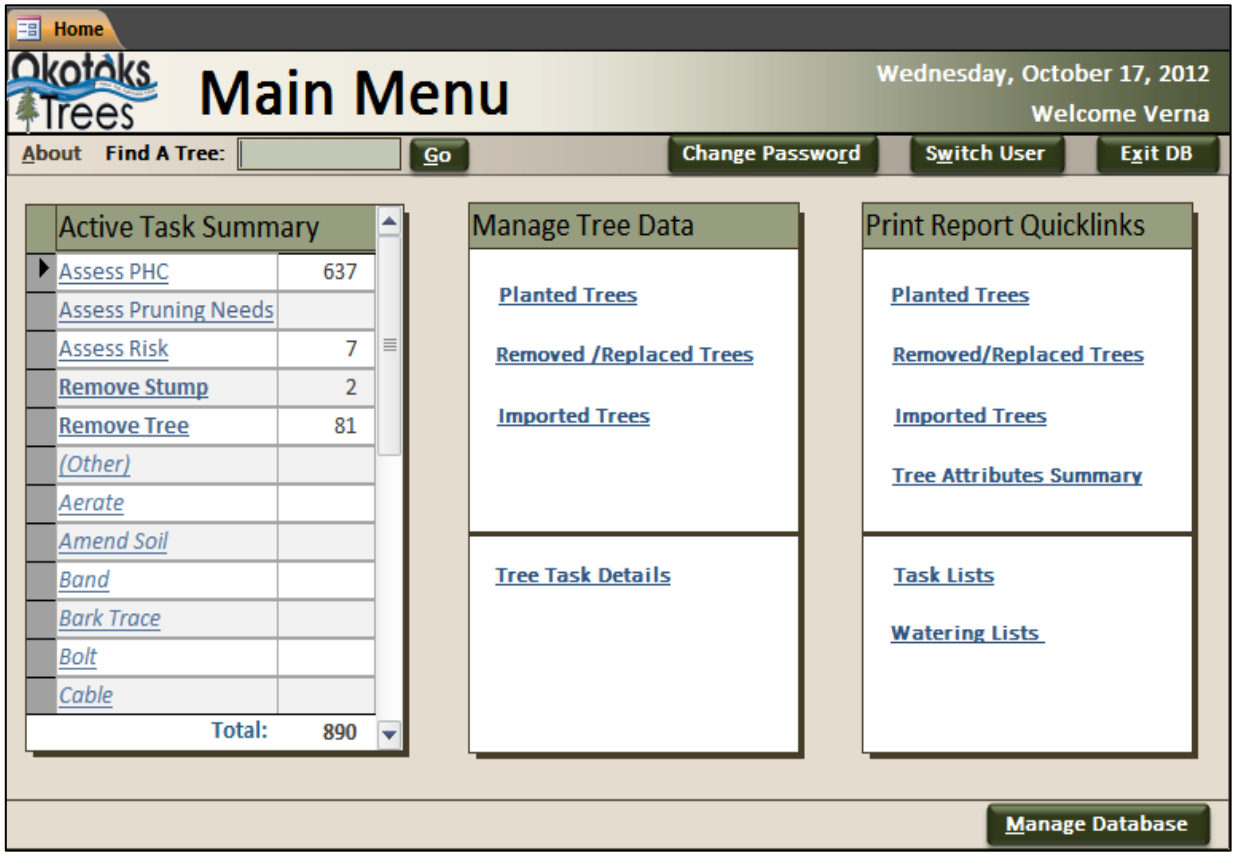
Appendix 2: Comox Golf Course Heritage Trees

Inventory #	Tag # On Course	Species	DBH	GPS Easting	GPS Northing	Location specifics (if any)
39	513	Sequoia	101	361118.038	5504439.56	
43	223	Big Leaf Maple	152	361394.891	5504480.052	hole 2 fairway
160	84	Big Leaf Maple	95	361093.023	5504155.055	
180	85	Big Leaf Maple	112	361083.196	5504162.151	
260	765	Apple	24	360989.311	5504190.778	
265	766	Apple	30	360983.461	5504194.996	
288	2116	Sequoia	112	361259.367	5504548.601	hole 2 fairway
328	2143	Sequoia	93	361233.722	5504567.932	hole 2 fairway
333	2144	Sequoia	120	361217.554	5504578.837	hole 2 fairway
335	738	Sequoia	89	360992.793	5504277.223	
344	None	Sequoia	117	361051.837	5504280.077	
354	None	Sequoia	127	361054.587	5504266.61	
442	915	Sitka Spruce	126	361278.515	5504336.407	clubhouse
447	914	Douglas Fir	142	361279.267	5504343.448	clubhouse
452	913	Douglas Fir	116	361277.631	5504344.486	clubhouse
457	20	Sitka Spruce	150	361251.018	5504311.473	clubhouse
472	1	Hawthorn	35	361219.261	5504325.108	practice green
480	6144	Douglas Fir	152	361015.686	5504600.129	
554	525	Douglas Fir	114	361120.419	5504392.047	
562	926	Douglas Fir	107	361143.126	5504374.051	
570	924	Douglas Fir	100	361152.726	5504375.374	
574	923	Douglas Fir	114	361182.209	5504362.869	cbx
578	922	Crab Apple	43	361185.083	5504361.439	
582	None	Yew	14	361198.338	5504361.923	
594	935	Douglas Fir	93	361189.222	5504350.41	
614	None	Gravinston Apple	40	361152.595	5504357.002	
616	399	Douglas Fir	147	361256.858	5504378.362	hole 3 green
619	42	Douglas Fir	131	361266.223	5504352.942	hole 4 tee
646	6170	Douglas Fir	107	361028.044	5504612.21	
677	332	Douglas Fir	114	361037.632	5504620.809	natural area off 3
678	331	Douglas Fir	97	361035.077	5504623.879	natural area off 3
707	235	Douglas Fir	142	361405.597	5504513.452	north end rough
802	436	Douglas Fir	196	361030.254	5504558.411	eagle tree

Appendix 3: Tree Inventory Database Interface Sample

Main Interface

After logging in, a Manager or Admin user would see something like the screen shot below. The colours can be customized and the logo would be changed. Write-Data and Read-only users would see everything except the bottom 'Manage Database' button.

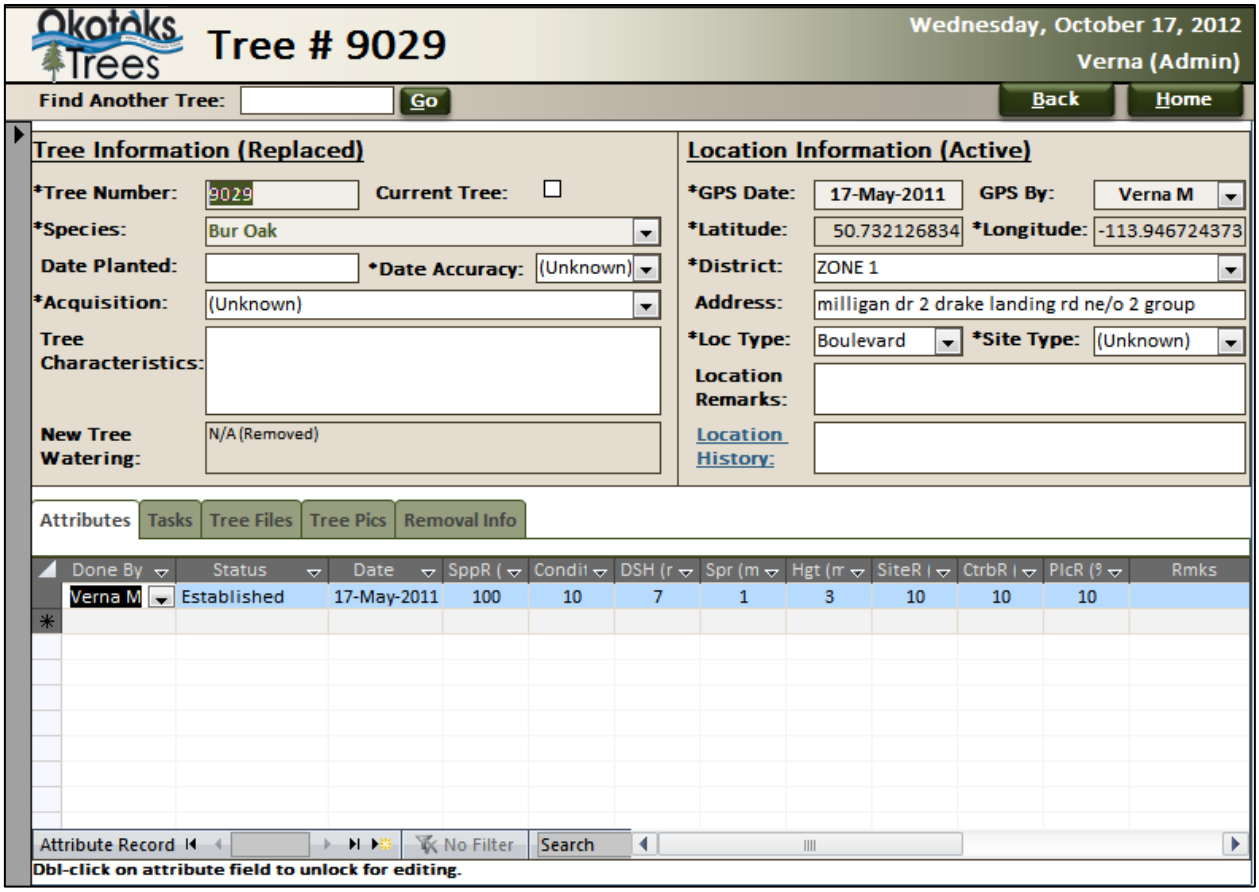


***About* Link (Main Menu):**

This link opens a form that shows current front-end and back-end information. This is also the screen that you see when logging in.

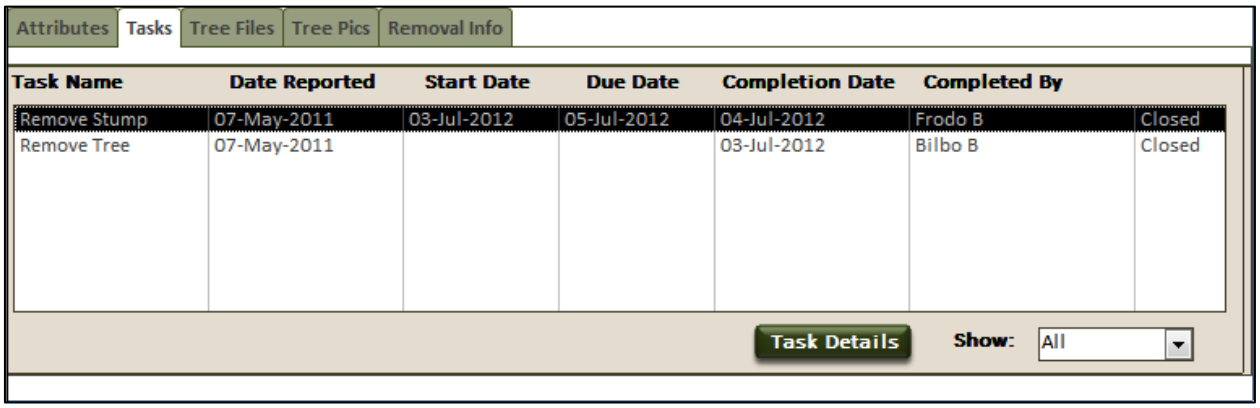
***Find A Tree* Link (Main Menu):**

A tree number is entered, and the tree's information is opened. The tabs that are shown (on the bottom section) are dependent on the tree's status and acquisition information. A mapping tab would also be placed here, (either custom GIS or generic web brower). The tree below had no planting information, (so no Planting or FAC tab), and has been replaced, so a Removal Information tab is shown. The tabs, *Attributes, Tasks, Tree Files* and *Tree Pics* are always shown.

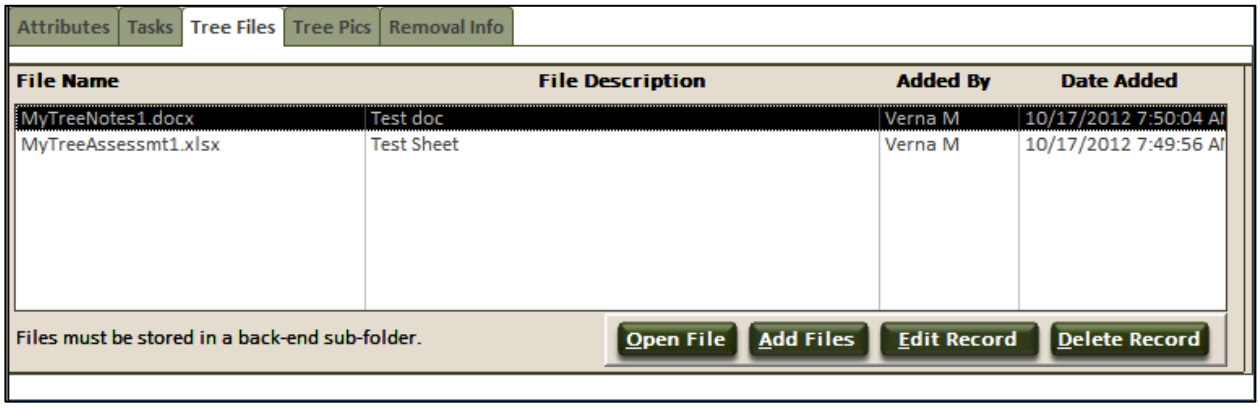


The Location History can be viewed by double-clicking the link which will open:

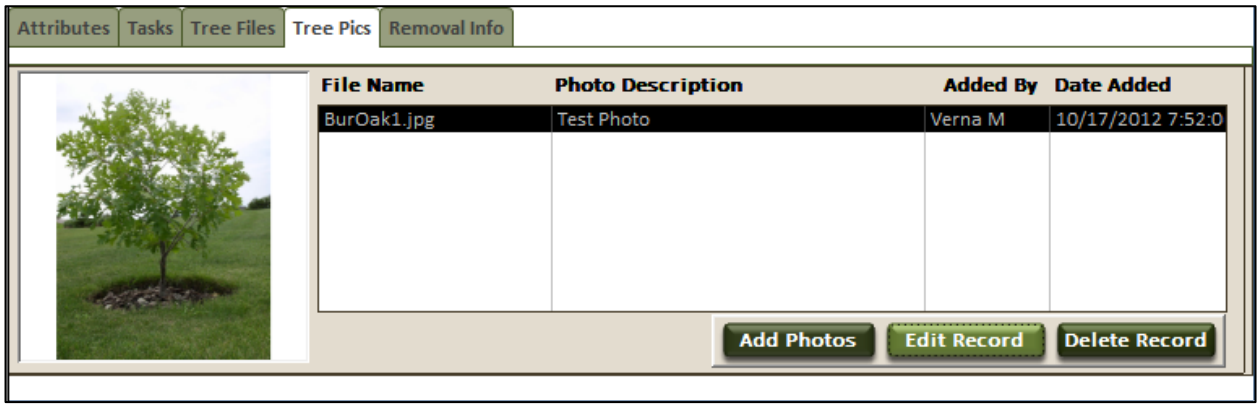
Tasks Tab:



Tree Files Tab:



Tree Pictures Tab:



Appendix 4: Preferred Tree Species to Plant

Please Note: All tables and information in this appendix have been provided by Alan Kemp, Urban Forester, City of Nanaimo and are originally located in City of Nanaimo Urban Forest Management Strategy.

Part 1- Trees for Directly Under Hydro Lines

Minimum allowable soil volume per tree 4 cu.m. with 1 m depth pit.
Selection criterion for alternative trees not listed in Part 1: Mature height not greater than 7.62 m.

Common Name	Scientific Name	Features	Mature size (metres)		Light and Soil Tolerances	Comments
			Height	Width		
Paperbark maple	*Acer griseum*	Chestnut bark flakes and peels; dark green, three-palmate leaves turn deep brown to red in the fall.	10-20	4-8	Sun to partial shade; prefers moist, well drained soil.	A slow-growing, spreading tree suitable for gardens of all sizes; clean up peeling bark.
Amur maple (tree form)	*Acer ginnala*	Typically showy red, but can be yellow; colors early in fall; small, pale yellow flowers.	3-10	3-10	Full sun or partial shade, colder climates (cool summers); adaptable to different soils.	Easily transplanted; can be pruned heavily; small specimen or patio tree, containers, hedges or screens, groupings or mini-groves.
Globe Norway maple	*Acer platanoides* 'Globosom'	Develops a compact, rounded, dense head.	3-6	3-6	Full sun; average water needs; water regularly but do not overwater.	Suitable for growing in containers, an excellent choice for planting beneath utility lines.
Tatarian maple	*Acer tataricum*	Large, multi-stemmed shrub or small rounded tree; pink winged seed pods, yellow to red fall colour.	3-8	5-7	Requires well drained soils; tolerant of shade; fairly drought tolerant.	Attractive small tree for limited spaces; a good tree for planters or patios.
Amur maackia	*Maackia amurensis*	Leaves emerge silvery-gray, becoming dark green; white flowers in July and August.	8	8	Prefers full sun, average-medium moisture and well-drained soil; adapts to a wide range of soil conditions.	Grows slowly and is easy to transplant.
Adirondack crabapple	*Malus* 'Adirondack'	Display of pink-edged white blossoms, green leaves and red fruit.	3	2-3	Well drained moist soil; full sun.	Requires little pruning; edible fruit.
Golden raindrops crabapple	*Malus* 'Golden Raindrops'	Pink flowers, green leaves, golden yellow fruit.	4-6	4-6	Well drained moist soil; full sun.	Requires little pruning; edible fruit.

Sentinel crabapple	*Malus* 'Sentinel'	Columnar shape; pale pink flowers and small red fruit.	6-10	2-4	Well drained moist soil; full sun	Requires little pruning; edible fruit.
Amanaga cherry	*Prunus serrulata* 'Amanagawa'	Ornamental variety; flowers are densely clustered; they are white, flushed pink and fragrant.	6-8	1-4	Grow in any moist but well-drained, moderately fertile soil; full sun.	Easily transplanted, but prone to damage from aphids and caterpillars.
Kwanzan cherry	*Prunus serrulata* 'Kwanzan'	Bundles of large double light pink blossoms.	4-8	4-6	Widely adaptable to differing soil and moisture types; full sun,	Rapid growth rate.
Pink perfection cherry	*Prunus serrulata* 'Pink Perfection'	A compact flowering cherry with abundant tight, rosy-pink flowers in mid-spring.	4	4	Sunny location is best; it needs moist, well-drained soil, preferably slightly acidic.	Moderate growth rate; good for smaller parks and gardens.

Part 2- Trees for beside Hydro Lines (Min. 2.75m lateral distance from nearest line.)
Minimum allowable soil volume per tree 4cu.m. with 1m depth pit.
Trees listed in Part 1 may also be used.
Selection criterion for alternative trees not listed in Part 2: Mature spread not greater than 5m.

Common Name	Scientific Name	Features	Mature size (metres)		Light and Soil Tolerances	Comments
			Height	Width		
Columnar Norway maple	*Acer platanoides* 'Columnare'	More compact form of columnar; summer foliage is dark green and turns yellow in the fall.	8-18	10	Partial to full sunlight,; grows in various soil conditions.	One of the more drought resistant maples; fast growing and not as susceptible to leaf scorch; excellent for street planting.
Crimson sentry Norway maple	*Acer platanoides* 'Crimson Sentry'	Dark red-purple leaves turning red, brown and orange in autumn and small clusters of red-tinged, yellow spring flowers.	12-15	4-5	Full sun or partial shade; fertile, moist, well-drained soil.	Excellent specimen tree for a medium-sized garden.
Bowhall red maple	*Acer rubrum* 'Bowhall'	Red leaves, pyramidal or elliptical when young which become more spreading with age.	12-18	7-14	Sun to shade; range of soil types.	One of the first trees to show fall color; wide variation due to seedlings; easy to transplant.
Fastigiate hornbeam	*Carpinus betulus* 'Fastigiata'	Tear drop or oval-vase shape with age; bright green leaves.	9-12	5-9	Part-full sun; grows in various soil types; moist and well-drained.	Well-adapted for planting in areas with limited horizontal space; for crown development tolerates clipping well; can be used as a screening plant; attracts birds.

Princeton sentential ginkgo	*Ginkgo biloba* 'Princeton Sentinel'	A dense, columnar form; vivid yellow fall color.	15-20	4-6	Ginkgo tolerates most soil, including compacted, and alkaline.	Easily transplanted; recommended for buffer strips around parking lots or for median strip plantings in the highway; sidewalk cut-out (tree pit); or residential street tree.
Fastigiate beech	*Fagus sylvatica* 'Fastigiata'	Deep purple foliage densely pyramidal to oval or rounded, branching to the ground.	30	10-14	Part shade- full sun; various soils.	Slow to medium growth, withstands pruning well; can be used to form a very narrow yet tall hedge or windbreak.
Columnar sargent's cherry	*Prunus sargentii* "Columnaris"	Showy, pink, early spring before leaves, purple-black cherries; vase-shaped to rounded.	12-16	6-9	Full sun.	Medium to fast growth; easy to transplant; cherries are short-lived trees (only 50 years in good site); fruit could stain sidewalk and be a nuisance in some situations.
Fastigiate English oak	*Quercus robur* 'Fastigiata'	Dark green oak leaves, acorns; massive open-headed tree with a short trunk,	18-21	6	Tolerates poor soils (but prefers well drained); pH adaptable; full sun	Needs large space; good for parks and other large areas.
European mountain ash	*Sorbus aucuparia* cultivars	Green leaves to yellowish or reddish in the fall; small white flowers; oblong shape.	9-12	6-8	Prefers acidic well-drained soils; full sun.	Medium growth rate.
Corinthian linden	*Tilia cordata* 'Corzam'	Dark green leaves changing to yellow in the fall; yellowish fragrant flowers.	18-25	12-15	Moist, well-drained fertile soils; pH adaptable; full sun.	Easily transplanted; one of the best street and city trees; quite pollutant tolerant.

Part 3- Trees for Limited Available Soil Volume

Trees listed in Part 1 or 2 may also be used.

Selection criterion for alternative trees not listed in Part 3: Mature spread not greater than 10m.

Common Name	Scientific Name	Features	Mature size (metres)		Light and Soil Tolerances	Comments
			Height	Width		
Hedge maple	*Acer campestre* (tree form)	Rounded and dense; often branched to the ground; dark green maple leaf.	7-12	7-12	Rich, well-drained soil; variable pH levels; full sun or light shade.	Readily transplanted; extremely adaptable; withstands severe pruning; excellent small lawn specimen, street tree; can be pruned into hedges.
Vine maple	*Acer circinatum*	Vine-like in shade; large shrub or small tree in full	5	6	Shade to full sun; moist, humus-rich soil.	Nesting site and cover for many birds and mammals.

	(tree form)	sun.				
Norwegian and Pacific sunset maples	*Acer platanoides* x *truncatum* cv.	Rounded symmetrical crown, usually with very dense foliage and shallow root system; dark green leaves.	12-16	8-12	Various soils; prefers full sun, tolerates full shade.	Easy to transplant; well adapted to extreme soils; use as lawn, street, park tree; needs considerable space ;tends to heave sidewalks unless adequate rooting space is provided.
Raywood ash	*Fraxinus oxycarpa* 'Raywood'	Oval and upright; moderate canopy; dark green leaves.	15-19	7-9	Prefers sun and moist well-drained soils, but can withstand drought, any soil, and extreme temperatures; does not tolerate constant wind or fog.	Fast growth rate; used in large variety of areas.
Redspire callery pear	*Pyrus calleryana* 'Redspire'	Symmetrical canopy with a regular (or smooth) outline; white flowers.	10-14	6-9	Full sun; variety of soil types; variety of pH levels; well-drained.	Street tree, parking lot islands; it is also quite suited for downtown tree pits due to its urban tolerance; able to tolerate small soil spaces.

Part 4- Trees for Available Soil Volumes of 9cu.m. per Tree or More, 1m Pit Depth

Trees listed in Part 1-3 may also be used.
Selection criterion for alternative trees not listed in Part 3: Mature spread not greater than 20m.

Common Name	Scientific Name	Features	Mature size (metres)		Light and Soil Tolerances	Comments
			Height	width		
Shademaster honeylocust	*Gleditsia triacanthos* 'Shademaster'	Tree with short trunk; open spreading crown; long green glossy leaves.	15-22	11-15	Part shade/part sun; grows in full sun; can grow in variety of soils and pH levels; prefers moist, rich, well-drained soils.	Variety of uses; surface roots can lift sidewalks or interfere with mowing; tree has winter interest due to unusual form; nice persistent fruits; showy winter trunk, or winter flowers.
Skyline honeylocust	*Gleditsia triacanthos* 'Skyline'	Rounded canopy comprised of several dominant ascending branches; yellow flowers	15-22	11-15	Part shade to full sun; variety of soils and pH levels; prefers moist, rich, well-drained soils.	Fast growing; require little pruning; well suited for street tree planting.
Scarlet oak	*Quercus coccinea*	Green oak leaves, acorns; irregular, spreading crown; green oak leaves turn red to scarlet in fall; acorns half-covered by a deep	25	13	Full sun; prefers acidic, sandy soils on the dry side based on natural occurrence.	Difficult to transplant; long-lived oak with distinctive shape and character; striking fall color; shade/

		cap.				lawn tree.
Red oak	*Quercus rubra*	Round topped and symmetrical; green oak leaves, acorns.	18-23	18-23	Well drained, slightly acidic soils; full sun.	Fast growing oak; for lawns, parks, golf courses and commercial areas.
Crimean linden	*Tillia x euchlora*	Upright and oval; retains lower branches; rounded, glossy green leaves; yellowish-white flowers.	12-16	6-10	Sun; prefers moist well drained soil but will grow in a range of soil types; tolerates wind, salt, and air pollution.	Highly attractive to bees and the nectar can have a narcotic effect on them.

Part 5-Trees for Wide Boulevard or Wide Median

Trees listed in Part 1-4 may also be used.

Trees require a minimum available root zone of 20 cu.m. per tree with a minimum width of 3.5m.

Common Name	Scientific Name	Features	Mature size (metres)		Light and Soil Tolerances	Comments
			Height	Width		
	All non-dwarf coniferous sp.					
Pacific white dogwood cultivar	Cornus Nuttallii "white wonder"	Greenish flowers, tipped with purple grow in tight clusters surrounded by six large, showy, white bracts.	10-25	8-10	Full sun to part shade; Moist, humus rich, deep, well-drained soil.	Red fruits provide food for birds and other wildlife; grows best along forest edges with its roots protected from late afternoon sun.
European beech	*Fagus Sylvatica* (sp., & full size cultivars)	Green leaves; upright oval growth habit; three-sided pointed nuts; small, husky and prickly fruits; in Autumn it reveals small, three-sided, pointed nuts that are consumed by wildlife.	15-19	10-13	Full sun to partial sun; performs best in deep, rich, evenly moist, well-drained, slightly acidic soils; tolerant of other soil conditions.	Slow to medium growth; shade tree focal point, or wildlife attraction tree; can be used as a hedge.
Sweetgum	*Liquidambar styraciflua*	Deep green, maple-shaped leaves; oblong or rounded shape.	18-23	12-16	One of the most adaptable hardwood species in its tolerance to different soil and site conditions; grows best in moist, slightly acidic soil; full sun.	Can transplant but it takes time for the tree to re-establish; can be used as a lawn, park, or street tree, but needs a large area for root development.
Tulip tree	*Liriodendron tulipifera*	Oval to round tree with several large branches; bright green leaves turn yellow in fall; greenish-yellow flowers.	21-28	10-16	Moist, well drained soil, slightly acidic; full sun.	Prune in winter; not a tree for small residential property or streets; needs large areas.

London planetree	*Plantanus x acerifolia*	Open wide-spreading outline with massive branches; medium to dark green leaves.	21-30	20-25	Deep, rich, moist well-drained soils, but is highly adaptable; full sun or very light shade.	Medium growth, but needs large area; withstands pollutants in cities; useful for open areas in parks, golf courses and campuses; too large for a street tree.
Pin oak	*Quercus palustris*	Pyramidal shape; glossy dark green narrow and pointed oak leaves, changing to russet, bronze or red in the fall; acorns.	18-22	7-12	Moist, rich, acidic, well drained soils; full sun.	Easily transplanted; good lawn shade or street tree; lawns, golf courses, streets, commercial areas.
Fastigiate English oak	*Quercus robur* 'Fastigiata'	Dark green oak leaves, acorns, massive open-headed tree with a short trunk.	18-21	5-6	Tolerates poor soils (but prefers well drained); pH adaptable; full sun.	Needs large space; good for parks and other large areas.
Red oak	*Quercus rubra*	Round topped and symmetrical; green oak leaves changing to red in the fall; acorns.	18-23	18-23	Well drained, slightly acidic soils; full sun.	Fast growing oak for lawns, parks, golf courses and commercial areas.

Part 6-Native Trees for Public or Private Planting

Common Name	Specific Name	Features	Mature size (meters)		Light and Soil Tolerances	Comments
			Height	width		
Arbutus	Arbutus menziesii	Heavy branches; bark is brownish-red and peels off; dark green oval leaves; white urn-shaped flowers; orange red berries.	15-30	To 15	Full sun; dry, infertile, extremely well-drained soil.	Important for deer, bees and hummingbirds; have peeling bark, dropping leaves and berries; generally do not survive transplanting, unless done with particular care.
Pacific dogwood	Cornus nuttallii	Much branched-irregular form; leaves are oval and pointed at the tip; greenish-white flowers tipped with purple surrounded pinkish white large showy bracts; bright red berries.	12-20	8-10	Moist, rich, deep, well-drained soil; full sun to part shade.	Easy to transplant; require little watering in summer months; try not to prune, unless removing dead, diseased or dying branches.
Gary oak	Quercus garryana	Heavy limbed tree often short and crooked in rocky habitats; shiny green round-lobed oak leaves; tiny flowers; acorns.	12- 25	9-15	Oaks are most often grown from seed; no pre-treatment is necessary; need deep rich well-drained soil; often grow on dry rocky slopes or bluffs; full sun	Many oaks require cold temperatures to initiate shoot development.

					to part shade.	
Oregon ash	Fraxinus latifolia	Oval shaped tree; long oval leaves; seeded winged fruits.	18- 25	8-10	The Oregon ash prefers damp, loose soils at low elevations; full sun.	Low maintenance; works well for streamside and wetland plantings.
Pacific crab apple	Malus fusca	Shrub or small tree; armed with sharp spur shoots; white to pink, showy fragrant blossoms; tart yellow-reddish apples.	2-12	2-12	Moist to wet nitrogen-rich soils; full sun.	Pick apples; birds eat fruits.
Shore pine	Pinus contorta	Often has crooked trunk and irregular dense green crown; long needles; small reddish green pollen cones; egg-shaped seed cones.	12- 20	8-14	Can grow in soils that vary widely but are better in moist, well drained soil; part shade to full sun.	Highly adaptable; tolerant of low-nutrient conditions; needles shed and cones drop.
Western white pine	Pinus monticola	Slender and flexible needles; yellow pollen cones; long seed cones.	15-40	3-9	Moist valleys to fairly open and dry slopes, from near sea level to subalpine.	Pick up needles and fallen cones; wildlife habitat.
Pacific yew	Taxus brevifolia	Branches are spreading to drooping in flat sprays; has needles and yellow pollen cones.	2-15	1-9	Adapted to medium textured, moist rich soils; full sun to partial shade.	Needle clean-up, cone clean-up.
Douglas maple	Acer glabrum	Many-stemmed; maple leaf shaped leaves which turn bright yellowish-orange to crimson in fall; greenish-yellow flowers and small; winged seeds.	5- 10	1-4	Succeeds in any soil; preferring a good moist well-drained soil; full sun to part shade.	Leaf clean-up; seed clean-up.
Douglas fir	Pseudotsuga menziesii	Branches spreading to drooping; bark is very thick, rough and brown; flat yellowish-green needles, small reddish brown pollen cones, and green seed cones.	15-90	8-20	Sunny location with a moist well-drained soil.	For large landscapes and reforestation only; needle and cone pick-up.
Western red cedar	Thuja plicata	J-shaped branches and turned up at ends; leaves are green and overlap in a shingle arrangement; numerous tiny reddish pollen cones; brown and woody seed cones.	15-60	10-15	Tree grows in part shade/part sun/ full sun; tolerant of many soil types, moist well drained area; low-medium elevations.	For large landscape, low maintenance; tolerating shearing quite well; ideal for use as a hedge or screen, or a specimen for a large landscape.
Yellow cedar	Chamaecyparis nootkatensis	Often has slightly twisted trunk; branches tend to hang down vertically and appear limp; bluish-green leaves; pollen cones and	20-50	8-12	Large area with moist well drained soil; at middle to high elevation; full sun to shade.	Soften landscape; use near water or around a patio or as a lawn specimen in residential or commercial landscapes.

		round, light green seed cones.				
Bigleaf maple	Acer macrophyllum	Often multi-stemmed tree; large dark-green 5-lobed maple leaves; greenish yellow flowers hanging in cylindrical clusters; winged seeds	18-30	18-21	Dry to moist rich soil, full sun; low to middle elevations	Leaf clean-up; seed clean-up.
Pacific silver fir	Abies amabilis	Tall narrow tree; flat needles; small reddish pollen-cones; seed cones- erect, deep purple, barrel-shaped.	30-70	20-30	On a variety of sites, most commonly in moist forest, on deep, well drained soils; full shade to full sun.	The best specimens grow in deep moist soils and cool wet air conditions such as fog belts.
Grand fir	Abies grandis	Tall straight tree; flat needles; yellowish pollen cones; long, erect, yellowish-green seed cones.	20-80	5-10	Moist, well-drained soils; part sun to part shade.	Needle clean-up.

Street Tree Size, Spacing, and Location

Trees shall be minimum 5 cm calliper measured at 300 mm above root ball at the time of planting and of uniform size if planted in a boulevard row.
Minimum number of boulevard trees shall be calculated as follows:

Tree Size	Single Family
Medium Trees (± 10-20 m ht.)	Greater of 1 per lot or 15 m
Small Trees (Under 10 m ht.)	Greater of 1 per lot or 10 m

Plantings of trees closer than 6 m on center shall require written approval from the Park Planner or the Urban Forest Coordinator.

Locate trees at least 1 m offset from the curb face.
Locate trees fronting on single-family lots at the center of the lot frontage unless otherwise approved by the City Engineer.

Trees Planted in Pavement

Select urban trees in pavement in accordance with tables above with the exception of Acer rubrum sp., which may not be used as they have very aggressive roots which cause problems in sidewalks. Select the site which will eliminate long-term above or below ground conflicts with utilities, buildings and structures and pedestrian and vehicular traffic. All urban trees in pavement must be in accordance with section 14.07 URBAN TREES IN PAVEMENT, in the City of Nanaimo Engineering Standards and Specifications.

Appendix 5: City of Surrey Yard Waste and Refuse Management Strategy

Yard Waste and Refuse Management Strategy

Surrey's natural areas are frequently viewed as vacant, derelict lands and are often used for disposal of unwanted refuse. With its large inventory of natural areas in an urbanized environment, Surrey experiences a high incidence of illegal dumping. Residents and commercial and industrial contractors often opt for illegal dumping as an easy method of waste disposal. Such dumping in natural areas results in a very high cost to the environment. In most cases, the wastes contain harmful substances that will negatively affect the fragile habitats of natural areas. These negative impacts include unsightly messes, unpleasant odours, pollutants, pest rodents and insects, erosion, invasive species, hazard trees, and root damage—with the further effects being lowered property values and costly clean up.

Principles for Yard Waste and Refuse Management

The following principles provide the platform for the development of a strategic direction, goals, objectives and management program for yard waste and refuse debris management in park natural areas. The informing principles are that:

- Ecological and social values of natural areas are to be preserved
- Yard waste and refuse threaten natural area ecological and social values

Strategic Direction for Yard Waste and Refuse Management

The primary strategic direction for managing the deposition of yard waste and refuse in natural areas is to implement programs that change public perception and attitude to reduce the incidence of dumping in natural areas and conduct activities to reverse the impact of dumping in natural areas.

Recommendations

To achieve this direction it is recommended that the City:

- Conduct educational and informational initiatives aimed at changing public perceptions and attitudes toward natural areas
- Implement the yard waste and refuse management operations program found in the *Yard Waste and Refuse Management Strategy* document
- Develop strong community and neighbourhood relationships for stewardship of natural areas
- Immediately devote resources to removing waste from natural areas
- Change current park operation and maintenance practices where 'spoil' is indiscriminately deposited in natural areas
- Adopt a zero tolerance for the deposition of wastes into natural areas unless approved by the land managers, currently the Urban Forestry and Environmental Services Section of the Parks Division
- Develop a Parks Division organic-waste disposal program
- Utilize existing regulations and by-laws to fine and prosecute offenders"[19]

[19] The Natural Areas Management Plan, City of Surrey Parks Recreation & Culture Department pages 30, 31

Appendix 6: Vancouver Protection of Tree Bylaw 9958

Protection of Trees Bylaw 9958

This bylaw affects all private property owners in Vancouver wanting to remove a tree. If you want to remove a tree, you need a permit to do so for every tree that has a diameter (width) of 20 cm (8") or greater, measured at 1.4 meters (4'6") above the ground. A tree trunk with a diameter of 20 cm (8") will have a circumference of approximately 64 cm (25").

Permit display

The tree permit must be posted in a visible location during tree removal.

Single tree removal

Property owners can normally apply to remove only one tree during a 12-month period, and they are required to replace the tree removed from the site.

Multiple tree removal

Under certain conditions, property owners may be granted permission to remove more than one tree in a 12-month period, but only if one of the following conditions applies:

- The tree on a development site is located within the building envelope.
- The tree is located such that a proposed garage or other accessory building cannot be located so as to retain the tree.
- An accredited plumber certifies that the roots of the tree are directly interfering with, or blocking, sewer or drainage systems.
- An arborist certifies the tree is dead, dying, or hazardous.
- An arborist certifies the tree is directly interfering with utility wires and cannot be pruned and still maintain its reasonable appearance or health.

Property development and trees

All property development, whether it's renovation or new building, requires you to retain all the existing trees located on your property.

All trees to be retained on the site require protection during any construction or development. All trees on adjacent properties or boulevard trees that are in danger of being damaged must be protected as well."

It is important that local citizens understand the relationship between urban forestry goals and specific actions taken to achieve these goals. Once the Town knows the inventory data on private land, has the opinion from the public about their urban forest, implements some attainable targets within this goal, the volunteer compliance will occur because the citizens understand and agree to the management approaches implemented.