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Cedar Health and Wildlife Tree Assessment

Perseverance Creek – Cumberland Community Forest Park

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Table of Contents

List of Figures

List of Tables

ACKNOWLEDGEMENTS

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The YER Program is funded by the BC Ministry of Children and Family Development. YER received additional funding for this YER II project through the Village of Cumberland, Community Grant Program. These funds supported a biologist (Tim Ennis) in study design and reporting, and CCFS funds supported field technician (Zoe Cilliers). Tyler Farley from the Village of Cumberland (the Village) assisted with teaching the youth about danger tree assessments.

YER II Cumberland Forest team (left to right): Graham Hillier, Jacob Cronk, PJ Hotchkiss, Zoe Cilliers.

INTRODUCTION

Background

This report summarizes data collected during an ecological assessment and inventory project in the Cumberland Community Forest Park (CCFP) from August 16th – 20th, 2021. The assessment and inventory were conducted by YER youth participants, Jacob Cronk and PJ Hotchkiss, Graham Hilliar (YER Youth Support Worker), and Zoe Cilliers (CCFS Stewardship Outreach Coordinator). Study design and reporting was completed by Tim Ennis (Latitude Conservation Solutions Company). Study design was done in consultation with Wendy Kotilla (YER Coordinator) and Meaghan Cursons (CCFS Executive Director).

The vision of the YER program is to engage vulnerable or at-risk youth in a wider circle of community relationships, in both the human and natural worlds. The program involves them with meaningful work and caring adults who support them in building self-esteem and who have the ability to transform their lives. In YER, youth travel a journey together with their community and experience a better relationship with the people and places of home (YER 2019).

The CCFP was selected as a study site for the 2021 YER Phase II project in consultation between YER and CCFS. The CCFP (201-hectares) is private land that was acquired in phases between 2005 and 2020 in four discrete transactions (phases). The Village purchased the land in each phase from Comox Timber with funds raised and provided by the CCFS. The lands are now Village of Cumberland parkland but are to be managed in a way that balances several objectives including low impact recreation, biodiversity conservation and source water protection (drinking water). Three conservation covenants are in place over the lands detailing specific activities that are prohibited (e.g., logging) or allowable (e.g., maintenance of Village utilities and trails), and in which locations and under what circumstances these will be permitted. The three covenants are similar, but there are differences between them, including differences in who holds the covenant. This project focuses on land that was acquired in the fourth phase (2020). On this land the Primary Covenant Holder is the Comox Valley Land Trust (CVLT). CVLT holds the responsibilities for monitoring compliance with the covenant as well as other responsibilities. The CCFS and the Comox Valley Regional District (CVRD) are also co-covenant holders on the phase-four lands. The covenant specifies the roles and responsibilities of these partners.

The covenant holders have specific responsibilities with respect to approval of a management plan that is to be developed for the CCFP by the Village. The management plan will be a pivotal document in finding the balance between low-impact recreation and the other identified values of the land. There can sometimes be tensions between these values. For example, dangerous trees located adjacent to popular recreational trails may present a hazard to trail users while also holding significant biodiversity values as habitat for wildlife. In addition, emerging threats such as climate change could negatively affect all values identified on the lands, and these emerging threats should also be considered in the management planning process and avoided or mitigated where possible and appropriate.

Purpose of the Study

1. To support vulnerable youth within the Comox Valley by providing them with hands-on opportunities to engage with nature and adult mentors through an ecological study;
2. To provide baseline ecological information and assessments to support the Village and covenant holders in park management planning and decision making by:
    a. Collecting baseline data pertaining to the health of Western Redcedar trees, and;

b. Completing a wildlife tree assessment along a section of existing trail.

With respect to 2a, Western Redcedars appear to be diminishing in health throughout southeastern Vancouver Island. While no peer reviewed studies in this geography have identified a specific cause of this apparent trend, drought-stress associated with climate change has been hypothesized by many in the local community as the causal factor. In the summer of 2021 for example, precipitation in the study area was 86% of normal in June, 0% of normal in July (a new record low) and 45% of normal in August (Watson 2021). Summer temperatures in 2021 were record-setting in many areas of the province and approached 40 degrees Celsius on several occasions in the study area (Ennis 2021). Western Redcedar health is likely a responsive indicator to changes in climate on eastern Vancouver Island. Establishing baseline data of Western Redcedar health in mature stands may enable long-term monitoring of climate change-related impacts to forest ecosystems and thus be of use to land managers.

With respect to 2b, the assessment area falls within what the covenant refers to as a *'biodiversity protection zone'*. In this zone, the protection of biodiversity is the paramount value. Mapping and describing the wildlife trees along side the trail section will provide useful information to land managers.

Study Area

The CCFP occurs within the Village municipal boundary, located on east-central Vancouver Island in the Comox Valley region (Figure 1). It is located within the Nanaimo Lowlands Ecosection (NAL) and the leeward variant of the very dry (xeric) maritime subzone of the Coastal Western Hemlock biogeoclimatic zone (CWHxm1). This biogeoclimatic subzone has warm, dry summers and moist, mild winters with little snowfall. The growing season is long, and moisture deficits are common during the summer months (Green and Klinka, 1994).

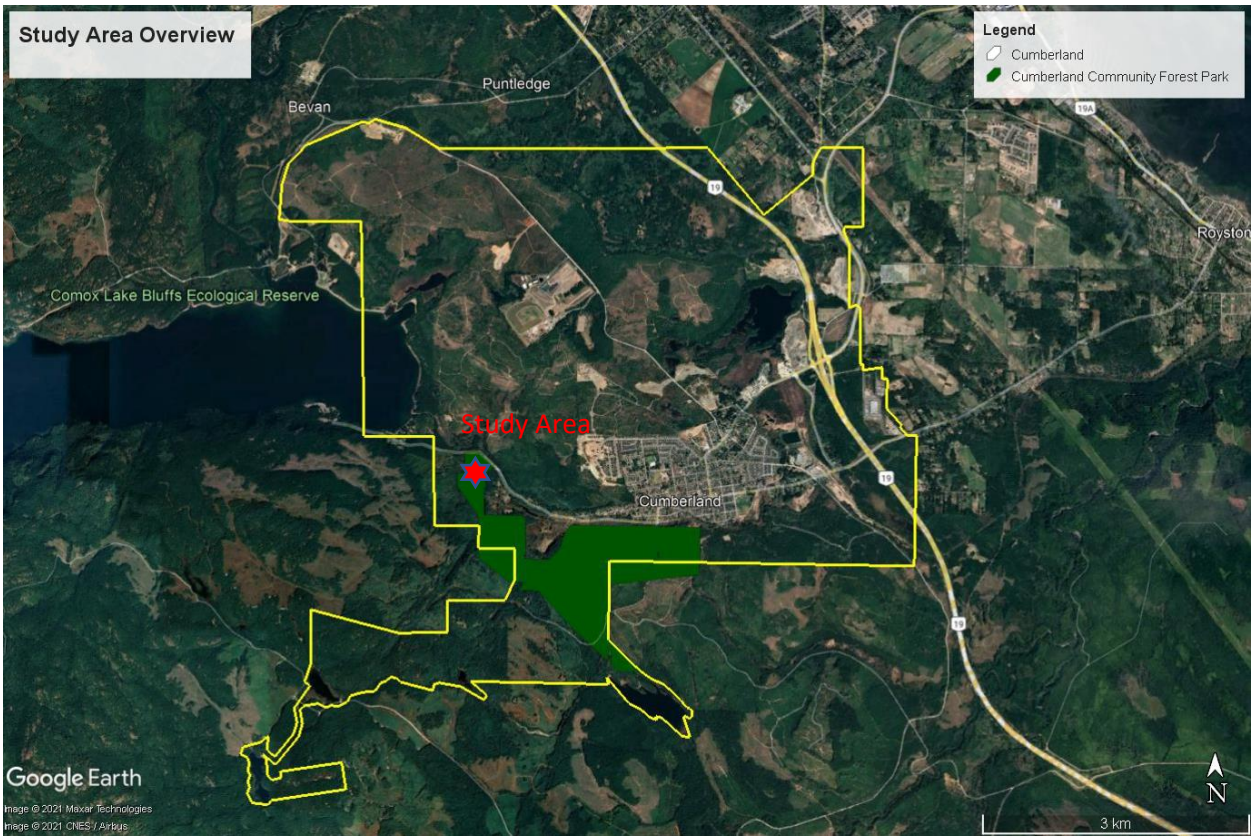

Figure 1. Study Area Overview

Due to the large size of the CCFP (201-hectares) and logistical constraints of the YER Phase II project, a subset of the larger CCFP was selected as a priority area to conduct baseline inventory and assessment in support of specific management planning challenges. The study area included a segment of trail locally known as "Martha's Trail" which roughly follows the top of an ancient river terrace above Perseverance Creek. The trail starts at Comox Lake Rd. and follows Perseverance Creek upstream along the right bank approximately 360 metres before dropping down into the floodplain of the creek.

Included in the study area is a well-developed grove of mature floodplain forest dominated by Western Redcedar adjacent to Martha's Trail (Figure 2).

Figure 2. Study Area

Martha's Trail is included in an area designated as the Biodiversity Protection Zone in the covenant for most of its length. Where it intersects with the floodplain of Perseverance Creek, it is included in the Watershed Protection Zone (Figure 3) of the covenant. The Western Redcedar grove is entirely contained within the Watershed Protection Zone. These two zones are to be managed in a way that de-emphasises recreational access with paramount management objectives oriented towards biodiversity conservation and water quality respectively. New trail creation is prohibited by the covenant in both zones, but some existing trails may be permitted to remain accessible to the public where the primary objectives of biodiversity conservation and the protection of water quality are not unduly compromised. These decisions will be considered through the management planning process.

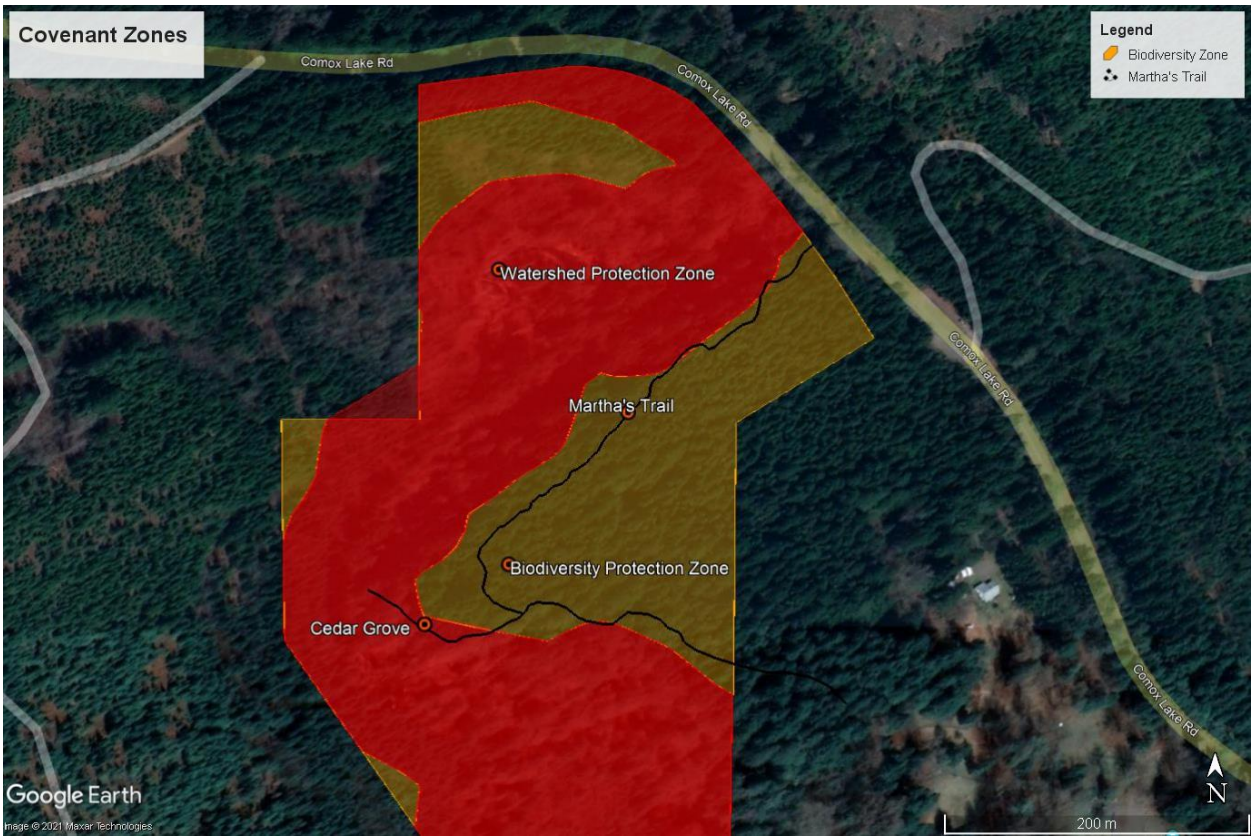

Figure 3. Covenant Zones

METHODS

Western Redcedar Health Assessment

The grove of Western Redcedar in the floodplain of Perseverance Creek alongside Martha's Trail was assessed for tree health. A subset (n=10) of the Western Redcedar's occurring in the grove were sampled. These trees were selected by the youth participants with some attention given to including mature trees in the main canopy as well as young trees in a subordinate canopy position. The selected trees (numbered C1-C10) were mapped with a Garmin eTrex 20 handheld GPS unit, and the Lat/Long coordinates recorded on a data sheet (Figure 4).

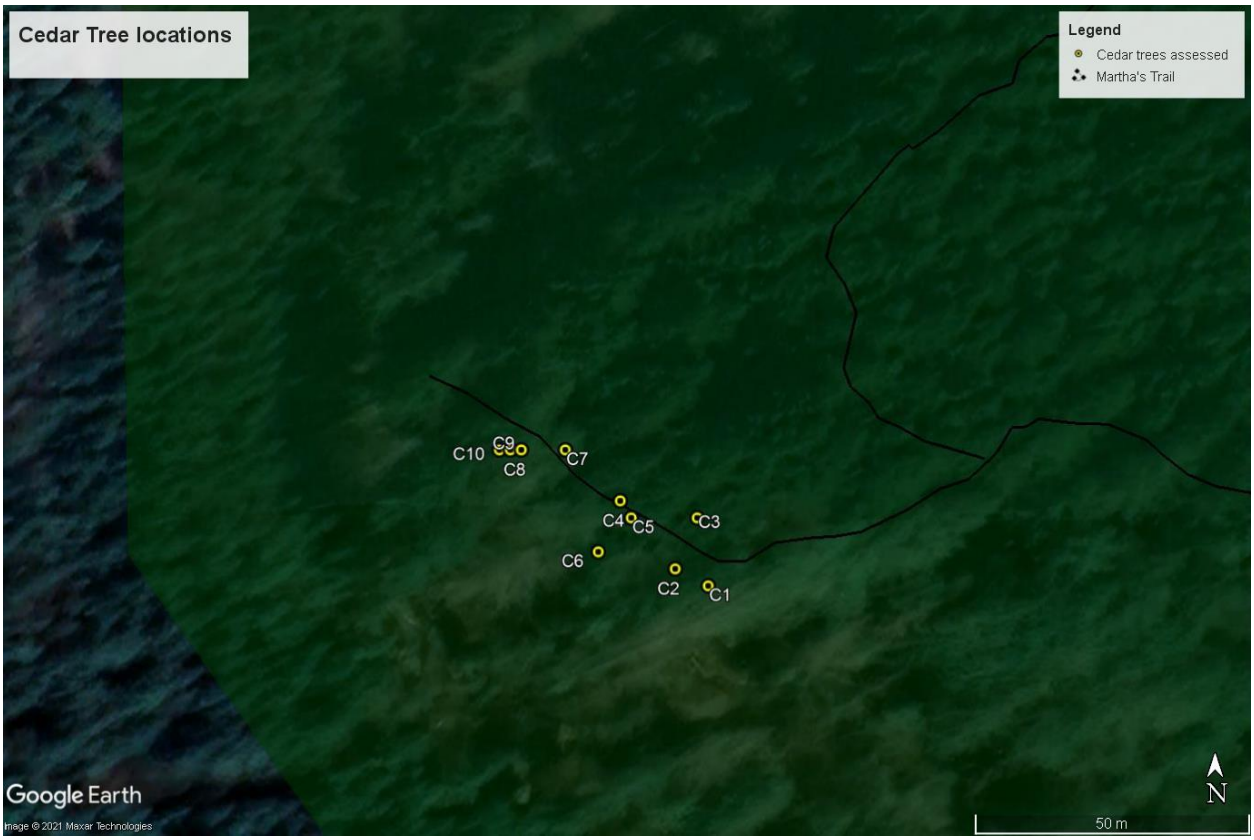

Figure 4. Location of Cedar Trees Assessed

YER II participants Jacob Cronk and PJ Hotchkiss measure Western Redcedar diameter.

Given the close physical proximity of the sampled trees to each other, and to mitigate for GPS imprecision, the distance and azimuth to each successive tree in the series was also recorded. For example, once the first tree to be assessed was determined (C1), the distance in meters from C1 to C2 was measured and recorded, as was the azimuth from C1 to C2 (in degrees). This will help subsequent researchers re-locate the correct trees with precision. The distances were measured using a Stanley nylon tape and the azimuth was measured with a Suunto Silva compass. The declination on the compass was set to 24 degrees. The correct declination should have been 15.5 degrees. The field data was subsequently transformed to present the correct values (Table 1).

Table 1. Cedar Locations

Youth and Ecological Restoration Program - Phase II - Western Redcedar Health Assessment				
Surveyors: Jacob, PJ, Zoe, Graham		**Location:** Perseverance Creek	**Date:** August 16-20, 2021	
Tree Number	Latitude	Longitude	Distance from prev. tree (m)	Azimuth from prev. tree (degrees)
C1	49° 37' 13.2"	125° 03' 50.7"	N/A	N/A
C2	49° 37' 13.3"	125° 03' 51.0"	17.9	80
C3	49° 37' 13.6"	125° 03' 50.8"	6.27	161
C4	49° 37' 13.7"	125° 03' 51.5"	12.8	200
C5	49° 37' 13.6"	125° 03' 51.4"	5.78	100
C6	49° 37' 13.4"	125° 03' 51.7"	11.12	98
C7	49° 37' 14.0"	125° 03' 52.0"	2.45	200
C8	49° 37' 14.0"	125° 03' 52.4"	4.26	17
C9	49° 37" 14.0'	125° 03' 52.5"	14	90
C10	49° 37" 14.0'	125° 03' 52.6"	8.1	180

The methods for describing the health of the cedars employed by this study were adapted from the Describing Ecosystems in the Field methodology for tree mensuration (MOE 1998) in consideration of a review of Field Guide to Forest Damage in British Columbia (MOF 2001). A datasheet was developed which included basic survey parameters (e.g., date, surveyors' names), as well as descriptive parameters about the tree (e.g., diameter at breast height (DBH), crown class, age class) and tree health indicators (e.g., conks, scars, woodpecker holes, insect boring holes, forks/crooks, root damage, dead tops, flagging, drought stress, cedar leaf blight – all Y/N).

Wildlife Tree Inventory and Description

A subset of wildlife trees occurring alongside Martha's Trail were mapped and described (Figure 5).

Figure 5. Wildlife trees identified and assessed

Wildlife trees were identified by walking the trail and visually inspecting trees on either side. Trees (alive or dead) less than 20 cm DBH were not included as wildlife trees. Mapping each wildlife tree that was assessed was done with a Garmin eTrex 20 handheld GPS unit. Lat/Long coordinates were also recorded on a data sheet. The parameters assessed and recorded for each wildlife tree included species, DBH, crown class, age class, decay class (all according to Describing Ecosystems in the Field, MOE 1998), root damage, stem damage and crown damage (Y/N) as well as wildlife tree types (physical attributes) (Keisker 2000) (Table 2.). Any wildlife tree may have one or more of the physical attributes important to wildlife.

YER II participants Jacob Cronk and PJ Hotchkiss standing near a decaying Douglas-fir stump.

Table 2. Wildlife tree types

Wildlife Tree Types (Keisker, 2000):
WT1: Hard outer wood surrounding decay-softened inner wood
WT2: Outer and inner wood softened by decay
WT3: Small excavated or natural cavities
WT4: Large excavated or natural cavities
WT5: Very large natural cavities and hollow trees
WT6: Cracks, loose bark or deeply furrowed bark
WT7: Witches' broom
WT8: Large branches, multiple leaders or large-diameter broken tops
WT9: Arthropods in wood or under bark
WT10: Open-structured trees in or adjacent to open areas

RESULTS

Western Redcedar Health Assessment

The Western Redcedar health assessment data is reported in Table 3 below.

The trees assessed ranged in diameter from 67.0 cm DBH to 140.5 cm DBH and included dominant trees taller than the main canopy (n=4), codominant trees comprising the main canopy (n=4) and intermediate trees below the main canopy (n=2). Most were mature trees (n=7) but some were young (n=3). No pole/sapling or shrub/seedling trees were assessed, and no old-growth trees were present. None of the trees had conks, scars, woodpecker holes, or showed signs of cedar leaf blight or drought stress. Only one had a dead top, one a fork/crook and two showed signs of insect boring. Six of the trees assessed demonstrated flagging of the leaflets and seven had damage to their roots.

Table 3. Western Redcedar Health Assessment Data

Youth and Ecological Restoration Program - Phase II - Western Redcedar Health Assessment													
Surveyors: Jacob, PJ, Zoe, Graham					**Location:** Perseverance Creek				**Date:** August 16-20, 2021				
Tree Number	DBH (cm)	Crown Class	Age Class	Conks	Scars	Root Damage	Woodpecker Holes	Insect Boring	Fork/Crook	Dead Top	Flagging	Drought Stress	Cedar Leaf Blight
C1	116	C	M	No	No	Yes	No	No	No	No	No	No	No
C2	87	C	M	No	No	Yes	No	Yes	No	No	Yes	No	No
C3	67	I	Y	No	No	Yes	No	No	No	Yes	Yes	No	No
C4	91.3	C	M	No	No	No	No	No	Yes	No	Yes	No	No
C5	43.3	C	Y	No	No	Yes	No	No	No	No	Unk	Unk	Unk
C6	114.4	D	M	No	No	Yes	No	No	No	No	Yes	No	No
C7	17.6	I	Y	No	No	No	No	No	No	No	Yes	No	No
C8	128.9	D	M	No	No	No	No	Yes	No	No	Yes	No	No
C9	117.2	D	M	No	No	Yes	No	No	No	No	No	No	No
C10	140.5	D	M	No	No	Yes	No	Yes	No	No	Yes	No	No

Wildlife Tree Inventory and Description

The wildlife tree description data is reported in Table 4 below.

Table 4. Wildlife Tree Description Data

Youth and Ecological Restoration Program - Phase II - Wildlife Tree Assessment									
Surveyors: Jacob, PJ, Zoe, Graham						**Location:** Perseverance Creek		**Date:** August 16-20, 2021	
Tree Number	Decay Class	DBH (cm)	Crown Class	Age Class	Species	Root Damage	Stem Damage	Crown Damage	Wildlife Attributes
WT1	8	47.8	C	Y	Hw	No	Yes	Yes	1, 3, 9
WT2	6	28.4	C	Y	Fd	No	No	Yes	8, 1
WT3	8	60.2	C	M	Fd	No	Yes	Yes	2, 4, 9
WT4	7	33.8	C	Y	Fd	No	Yes	Yes	2, 3, 6, 9
WT5	6	36.5	C	Y	Fd	No	No	Yes	1, 3, 8, 9,
WT6	7.5	49.7	C	Y	Fd	No	Yes	Yes	1, 3, 9
WT7	5.5	32.2	I	M	Fd	No	Yes	Yes	1, 3, 9
WT8	8	30.8	I	M	Fd	No	Yes	Yes	2, 3, 6, 9
WT9	8	50.1	I	M	Fd	No	Yes	Yes	1, 3, 6, 9
WT10	5	46	C	M	Dr	Yes	Yes	Yes	2, 4, 6, 8, 9, 10

All wildlife trees assessed were standing dead trees ranging from decay class 5 to decay class 8. They ranged from 28.4 cm DBH to 60.2 cm DBH. Nine of the ten were coniferous, primarily Douglas-fir (*Pseudotsuga menziesii*) (n=7). Most had been a component of the main canopy (codominant) (n=7), the others were intermediate trees (n=3). Of the wildlife tree types presented by Keisker, most had hard outer wood surrounding decay-softened inner wood (n=6) and the rest had outer and inner wood that were both softened by decay (n=4). Most had small excavated or natural cavities (n=7), a few had large excavated or natural cavities (n=2), but none had very large natural cavities or were hollow trees (n=0). The presence of arthropods (Phylum *Euarthropoda*) in the wood or under the bark was common (n=9). Few trees demonstrated physical characteristics such as open structure, witch's broom, large branches, multiple leaders or large diameter broken tops.

DISCUSSION

Western Redcedar Health Assessment

Overall, the health of the Western Redcedar grove appeared good, but with a risk of declining health in the future. Drought stress was not apparent, however damage to root systems was common in the trees assessed. The cause of the damage was not thoroughly assessed but seems likely to be associated with high peak flows of Perseverance Creek. Bank erosion exposing roots, gravel deposition (channel aggradation) and physical damage from bedload transport are all potentially causal factors. Adjacent to the grove but closer to the river channel are several large, dead Western Redcedar trees that appear to have been killed by these kinds of hydro-geomorphic influences.

Cedar flagging, cedar leaf blight and drought stress all bear a superficial resemblance associated with leaflets turning orange. Cedar leaf blight is caused by the fungus *Didymascella thujina* and can be differentiated from drought stress and cedar flagging by the presence of visible black cavities on the upper (orange) leaf surface resulting from the fruiting bodies of the fungus drying up and falling off. Drought stress can be differentiated by the discolouration of foliage occurring from the outer tips of the branches inwards and from the top of the tree downward. These specific traits were assessed for each tree sampled and no evidence of either was observed. Cedar flagging is distinguished by the orange dead/dying leaflets being scattered over the whole tree and originating at the same time. It is a normal condition of the Western Redcedar leaflet replacement process but is most evident during or following the summer drought stress period. Most (n=7) of the trees assessed displayed some degree of cedar flagging.

Wildlife Tree Inventory and Description

The wildlife tree data collected in this study confirms that the recently protected area holds significant wildlife habitats available to a variety of biodiversity elements across a wide range of taxonomic groups. Decay classes 5-8 are known to be valuable habitats for weak primary cavity nesters such as nuthatches and chickadees, secondary cavity users such as some of the smaller owls and bats as well as insect feeders, salamanders, and small mammals. Most wildlife trees described (n=9) support Arthropods within the wood or under the bark, providing important ecological services to the forest. The decay of either heartwood and sapwood (or both) in all the wildlife trees assessed (n=10) is suggestive that fungi may be playing a significant role in individual tree mortality and facilitating habitat attributes for other wildlife.

The study area was logged in the early 1900's and is characterized by a forest that is transitioning from young to mature (approx. 80 years) with pockets of mature forest (>100 years). It is therefore not surprising that the wildlife tree description data does not include very large natural cavities and very large hollow trees. Large branches and large diameter broken tops (WT8) were also uncommon (n=3). These would be more likely to occur in later seral stages (mature to old-growth stands). Large diameter wildlife trees in decay classes 1 through 4 were not observed, limiting the potential for primary cavity nesters, larger secondary cavity users and other species that require these habitats.

SUMMARY AND RECOMMENDATIONS

Western Redcedars

While the health of the Western Redcedars assessed in this study appears to be good, there are ongoing stressors and emerging threats that may negatively impact mature cedars in the floodplain of Perseverance Creek in the near future. Damage to root systems was pervasive and was assumed to be associated with unusually high peak flows in the rainy season. If this assumption is correct, we would hypothesise that the trend of unusually high peak flows will intensify in the future as climatic changes bring more frequent and intense precipitation associated with mid-latitude cyclonal systems. Additional damage to the root systems of all trees in the riparian zone including Western Redcedar could result.

In addition, prolonged and extreme summer droughts are also predicted for the region in the future, and the weather conditions of the summer of 2021 seem to verify this prediction. This could cause drought stress for all tree species in the study area including the Western Redcedars. Individual trees with root systems connected to moist soils in hydroriparian areas or poorly drained sites may be less susceptible to drought stress. This would be particularly true of larger, mature trees with well developed root systems compared to younger seedlings, or understory trees.

The following recommendations relate to the retention of healthy stands of Western Redcedar in the riparian zone of Perseverance Creek.

1. In areas where root damage to Western Redcedars is evident, land managers should consider avoiding additional damage to roots that may result from human activities such as the creation and use of recreational trails. Compaction of the soil, loss of soil over time, and physical damage to exposed roots are all potential sources of stress to Western Redcedars which could result from recreational public access.
2. Western Redcedar could be a meaningful indicator of climate change-induced drought stress to the forests of our region. Continuing to monitor the health of Western Redcedar in the study area over time could assist land managers to understand the rate and severity of climatic changes to forest health.

Wildlife Trees

The study area contains important wildlife trees that are essential to maintaining native species diversity. Large diameter wildlife trees such as those which occur in old-growth forests are absent from the study area but will recruit into the forest with time. The following recommendations relate to wildlife tree management in the context of biodiversity protection zone of the covenant.

1. Retain all wildlife trees in the Biodiversity Protection Zone. In the event of competing values, manage the user and not the hazard.

2. Allow natural processes to continue that will recruit larger diameter wildlife trees as the forest matures. At this time, it does not seem necessary to create additional wildlife trees or artificial structures to enhance habitats for biodiversity.

Youth Successes

The two YER II youth participants, Jacob Cronk and PJ Hotchkiss, worked successfully with the field project leaders, Zoe Cilliers and Graham Hilliar. Together they formed an incredible team where the youth learned how to document the Western Redcedar and Wildlife Trees, and to better understand the ecology of this Cumberland Forest. On the final day, the two youth led a public tour for eleven people. This is where the youth transform into teachers and pass on their acquired knowledge to our community.

YER II participants Jacob Cronk and PJ Hotchkiss lead a public tour of the Cumberland Forest.

Here are quotes, one from each youth participant:

"It was fun teaching people and walking through the forest. I like teaching because it is satisfying passing knowledge onto others. I passed knowledge on about the forest. They know more about the plants and wildlife. I taught them about wildlife trees and different plant species and different animal species that live in the forest." – Jacob Cronk

Jacob Cronk receives YER II certificate from Graham Hilliar for completion of the program.

“I learned how important the Cumberland Community Forest Society is to the community. If it weren’t for them the forest we were gathering data in would have been logged. Basically, they buy land that is supposed to be logged and they sort of help preserve the wildlife. I mean that forest would have been a road and I think that is sort of the worst and not to mention that the water there goes into our drinking water. – PJ Hotchkiss

PJ Hotchkiss receives YER II certificate from Graham Hilliar for completion of the program.

These words from the two youth are the best way to illustrate and bring forward some of what they learned and taught in this YER II project. Their acquired scientific research and communication skills will benefit them throughout their lives. This positive partnership between CCFS and YER brought together the youth and the forest. Our whole community is made better through creating these ecological and human relationships.

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