



# **CVC**

## **Sustainable Forest Management Plan**

Prepared by: Credit Valley Conservation

September 2020

*Draft*

## **Acknowledgements**

Effective forest management planning requires the perspectives, knowledge, experience and expertise of many people.

CVC would like to acknowledge the assistance of all those who have worked and commented on the Sustainable Forest Management Plan (SFMP):

- The support and engagement of the Mississaugas of the Credit First Nation; upon whose Treaty Lands and Territory CVC conducts its work.
- The contributions from many stakeholders who gave their time and energy to participate in workshops and review the draft technical report.
- The contributions of ArborVitae Environmental Services (AVES) Ltd. and the sub-consultant North-South Environmental for their work writing draft sections of the technical report, helping to structure and revise the document as it went through various draft stages and working with many CVC staff, especially during the development of the SFMP objectives.

The management of forests supports CVC's mission. This plan reflects efforts from CVC staff from all departments. Many CVC staff contributed to the SFMP, either by writing sections for early drafts, providing figures, tables, and maps, or through review and feedback. In particular, we would like to acknowledge the work of the SFMP's Steering Committee: Rod Krick, Aviva Patel, Scott Sampson, and Kate Hayes as well as the direction and feedback provided from Tim Mereu and Deborah Martin-Downs.

Although the objectives and actions of the SFMP are framed by the 20-year term of the plan, they are informed by a much longer-term perspective, recognizing that forests develop, evolve and change over centuries.

The SFMP has been written by Kyle Menken and Aaron Day.

Aaron Day, R.P.F.

Plan Shepherd

*Senior Coordinator of Forest Management, CVC*

September 2020

## Table of Contents

Acknowledgements.....	2
1 Introduction.....	1
1.1 Purpose and Scope .....	2
1.2 Plan Development and Engagement.....	3
1.3 Structure of the SFMP .....	4
2 Forests in the Credit River Watershed.....	4
2.1 A Brief History .....	4
2.2 The Forest Today.....	6
3 Forest Health .....	9
3.1 Stressors .....	9
3.1.1 Land use change, past and present .....	9
3.1.2 Climate change and severe weather .....	10
3.1.3 Invasive Species, Pests and Disease.....	11
3.2 Coniferous Plantation Management.....	12
4 Objectives of the SFMP .....	16
Theme one: maintain and restore forest health .....	17
4.1 Objective one: maintain, enhance and restore natural communities and stand conditions .....	17
4.2 Objective two: manage plantations to gradually convert to natural communities and stand conditions.....	19
4.3 Objective three: foster the development of old forest communities and maintenance of old trees .....	20
4.4 Objective four: increase forest cover in the watershed.....	20
4.5 Objective five: adapt restoration practices to climate change.....	21
4.6 Objective six: protect the forest from invasive species, pests and disease and restore impacted forests .....	21
4.7 Objective seven: protect forest soils.....	22
Theme two: protect natural values .....	23
4.8 Objective eight: protect wildlife .....	23
4.9 Objective nine: protect significant ecological features and functions.....	24
Theme three: connect with Indigenous communities, stakeholders and the public .....	24

4.10	Objective ten: protect and have regard for Indigenous peoples' values and interests .....	25
4.11	Objective eleven: protect and have regard for cultural heritage features	25
4.12	Objective twelve: consider recreational use and infrastructure on CVC properties .....	25
4.13	Objective thirteen: collaborate with NGOs, municipalities and other levels of government .....	26
4.14	Objective fourteen: provide education and outreach to landowners and the public on the needs and benefits of sustainable forest management .....	26
	Theme four: protect public health and safety .....	27
4.15	Objective fifteen: hazard trees .....	27
4.16	Objective sixteen: reduce the risk of forest fire .....	27
5	Implementing the Plan.....	28
6	References.....	31
	Appendix A - Timeline of SFMP Engagement and Development .....	A1
	Appendix B - Full List of Objectives and Actions.....	A2
	Appendix C - CVC Property Overview .....	A10

## 1 Introduction

Healthy forests contribute significantly to human well-being. They clean the air we breathe and filter the water we drink. They offer us places to play and to relax. They moderate temperatures and play a critical role in the natural water-cycle. In addition to providing us with these vital **ecological goods and services** and other benefits (**Figure 1**), forests are essential to biodiversity and provide habitat to many wildlife and plants that depend on forests in the Credit River Watershed ('the watershed').

Forests across the watershed face significant challenges that threaten their ecological health, biodiversity and their capacity to provide goods and services. Settlement, agriculture and other land uses have fragmented forests. Poor past practices such as unregulated harvesting have left many forests isolated and degraded. Droughts, damaging winds, intense

**Ecological goods and services** are benefits provided to people by forests, wetlands, soils, plants and animals. For more information on Ecological goods and services in the Credit River Watershed, visit <https://cvc.ca/watershed-science/our-watershed/ecological-goods-services/>

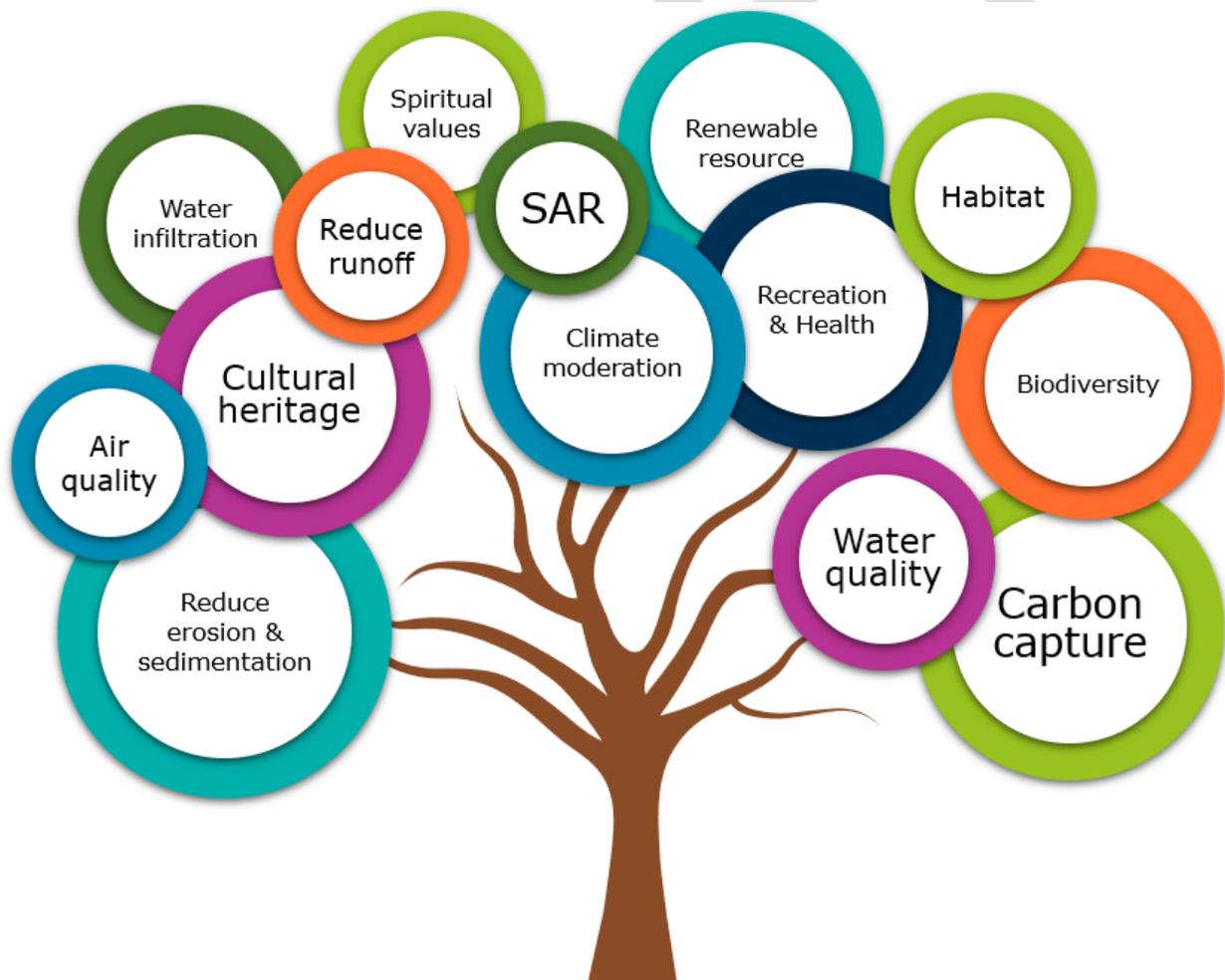


Figure 1: a few of the many benefits of healthy forests.

storms, warmer winters and other impacts linked to climate change, will continue to negatively impact forest health. Other stressors, such as invasive species, pests and disease, compound the effects of climate change and the loss of habitat connectivity, decreasing the diversity of our forests and lessening their ability to regenerate and maintain themselves.

Conserving and managing for healthy, diverse forest ecosystems can help maintain and enhance ecological goods and services and build **resilience**. Healthy forests perform a significant role in climate change mitigation by sequestering carbon through annual tree growth. Management of forests can encourage tree health and vigour, stimulate new growth and tree species diversity, adding to their sequestration potential and resilience. Forest management, such as periodic plantation thinning, can also help reduce the risk of wildfire, and accelerate their transition to more diverse forests.

**Resilience** is a forest's capacity to recover after disturbance and is critical to ensuring long-term sustainability. Fostering and strengthening forest resilience is a fundamental strategy for mitigating the impacts of climate change and other stressors such as invasive species, pests and disease.

### 1.1 Purpose and Scope

Forests cover 23 per cent of the land in the watershed. Of these 21,630 forested hectares (ha), Credit Valley Conservation (CVC) owns or manages 1721 ha, or eight per cent of forests, many of which are among the most sensitive and significant ecological areas in the watershed (CVC 2017). Maintaining and enhancing the ecological health of these forests is an important responsibility for all landowners, including CVC.

CVC's Sustainable Forest Management Plan (SFMP) provides direction for forest management for the next 20 years (2020-2040), with a review and update scheduled for 2030. The overarching goal of the SFMP is to maintain and restore forest health, improve biodiversity and strengthen the resilience of forests in the watershed - on lands owned by CVC, municipal partners, and private landowners. However, the plan has other important objectives. Providing people with safe places to appreciate and enjoy the natural world and engaging positively and productively with Indigenous communities and stakeholders - private landowners, municipal partners, and the general public - are also important parts of the plan.

CVC is responsible for the management of CVC-owned forests, but to achieve a greater impact, we must look across the landscape. The SFMP will direct CVC's forest management program at the watershed level to continue and enhance our work with partners such as municipalities and private landowners. The SFMP does not assume direction of properties not managed by CVC, including those leased to municipalities. However, many of the objectives apply to all forests, regardless of where the work is being done, and the practices CVC will use on its own properties are the same as those that will guide CVC when working with partners.

This version of the SFMP is intended for use by members of the public, CVC board members, and broader CVC staff. A *SFMP: Technical Report* is available on request and provides more detail on characterization and analysis of the state of forests, and greater direction for implementation, to be used as a supporting document for those implementing the SFMP.

## 1.2 Plan Development and Engagement

The SFMP has been developed in response to the challenges facing the forests of the watershed. It also responds directly to the goals and directions of the *CVC Strategic Plan: Our Future Taking Shape (2020-2022)*, including Goal 3: “Manage a healthy, resilient environment through protection, restoration and enhancement.” The SFMP also aligns with other CVC strategies and plans (*Credit River Watershed Natural Heritage System Strategy, 2015; Conservation Areas Master Strategy, 2018; CVC Climate Change Strategy, 2019a*, among others), as well as municipal plans such as the Region of Peel’s *Climate Change Strategy (2011)* and *Climate Change Master Plan (2019)*.

CVC’s properties are used by a wide array of people with a range of interests such as cultural and spiritual heritage, recreation, and environmental protection. CVC also works with numerous partners, ranging from provincial and municipal governments to naturalist groups and forestry organizations. In developing this plan, CVC drew on the diverse perspectives, expertise, and interests of CVC staff, stakeholders and Indigenous peoples, through meetings, workshops, plan review, and a CVC SFMP Steering Committee. These sessions helped to identify a wide range of issues and priorities for the SFMP and played a key role in developing the principles, objectives and actions. **Appendix A** provides a timeline of engagement and development.

Forest management guides developed by the Ontario Ministry of Natural Resources and Forestry (MNR 2000, 2010, 2015, 2018) were also researched and used to inform many of the practices and guidelines developed for the SFMP implementation.

Finally, the SFMP Technical Report is supported by an operating plan that will be updated every five years and includes a schedule for planned operations. The operating plan provides a blueprint for how CVC will carry out forest management activities on the ground, from **silvicultural** practices and prescriptions, and site level planning and monitoring, to the protection of important values such as wetlands and species at risk.

**Goal 3, direction 6** of the CVC Strategic Plan (CVC 2020a): *Complete the SFMP and implement priority actions on CVC lands while building capacity for private landowner forest management services.*

**Silviculture** is the art and science of controlling the establishment, growth, composition, and quality of forest vegetation to meet the diverse needs and values of landowners and society on a sustainable basis (Burke et al. 2011).

### 1.3 Structure of the SFMP

The following chapters of the SFMP are intended to provide the reader with an understanding of what is happening in the forest, and how forest management, guided by objectives, can ensure our forests are restored and remain healthy.

**Chapter 1** introduces the plan's purpose, development and reasons for undertaking it, particularly for the benefits that healthy forests provide.

**Chapter 2** provides a brief history and overview of the forests in the watershed and on CVC properties.

**Chapter 3** explores some of the major stressors that are impacting the health of our forests as well as the unique management issues of coniferous plantations. This sets up the issues and challenges that many of the objectives aim to address.

**Chapter 4** presents the 16 objectives, organized by 4 themes, and provides examples of the actions that will be taken to achieve those objectives. For a full list of the actions for each objective, see **Appendix B**.

Finally, **Chapter 5** discusses plan implementation and the operating plan.

**A note on forest terminology:** The word forest is used as a general term to describe all treed communities of at least 25% canopy cover and at least 0.5 hectares in size. 'Forest' is used interchangeably with 'woodland' and applies to all upland forest, cultural forest, and treed swamp community types described in the Ecological Land Classification (ELC) for Southern Ontario (Lee et al. 1998). Orchards and tree farms are considered agriculture and are excluded. **Chapter 2.2** describes the various types of woodland communities found in the watershed using the ELC.

## 2 Forests in the Credit River Watershed

The forests in the watershed have undergone substantial change, beginning with the retreat of the last glacier in southern Ontario over 10,000 years ago that created or altered the current landscape. The watershed is home to a variety of physiographic regions and landforms, most notably the Niagara Escarpment, as well as part of the Oak Ridges Moraine. The forests as we see them today, from their size to composition, have been influenced by human activity over many centuries.

### 2.1 A Brief History

Indigenous peoples have inhabited the watershed for thousands of years and their use of the land has influenced the forests in a variety of ways. As the climate warmed following the last glaciation period, the Iroquoian people who inhabited much of southern Ontario began to shift from a nomadic lifestyle to one of more permanence, centred around the cultivation of crops and hunting. Small forest areas were cleared and burned for agriculture and to create and maintain openings in the forest for hunting. As soil became depleted, villages would shift and restart

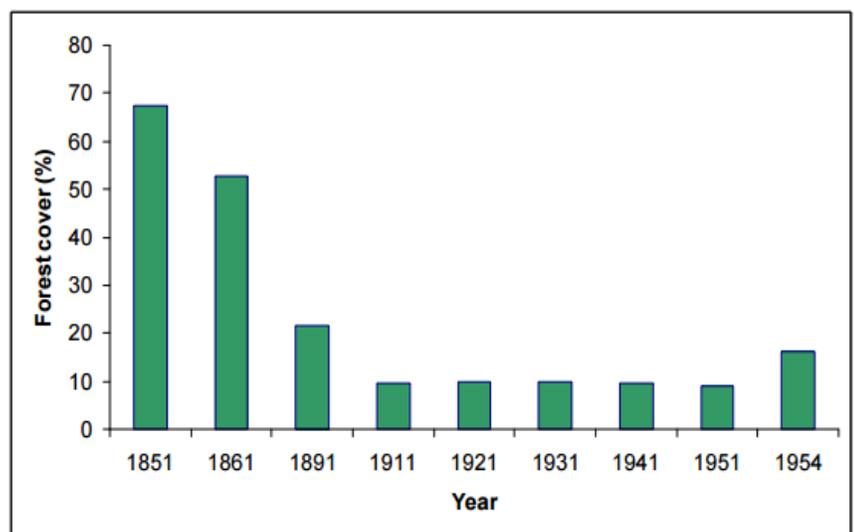
the process. This management created a patchwork of forest ages and composition across the landscape.

By the end of the 17<sup>th</sup> century following a series of wars, a group of Ojibwe (Anishinaabe) had moved from their former territory on Georgian Bay and Lake Superior to the western end of Lake Ontario, occupying a large territory that included the Credit River Watershed. This group would later become the Mississaugas of the Credit First Nation. The mouth of the Credit River became a favourite camping ground for the Mississaugas and was also a gathering place for French, and later English, fur traders to meet with the Mississaugas. However, European settlement brought with them disease, war and famine that would cripple First Nations populations. A series of treaties and pressure from increasing settlement would eventually displace the Mississaugas, and by 1847, their small village was relocated to the Six Nations Reserve south of Brantford (Wybenga and Dalton, undated).

Disease such as smallpox often arrived in First Nations communities before European settlers, transmitted through trade and missionary work. As a result, by the time settlement of the watershed began in earnest in the 19<sup>th</sup> century, much of the clearings managed by First Nations had overgrown, leaving the forest to appear untouched to the new arrivals. It is estimated that 80-90 per cent of the Greater Toronto Area (GTA), including the watershed, was composed of mature and old-growth forests and wetlands prior to European settlement (Puric-Mladenovic, 2011). The forests were dominated by sugar maple and beech, with scattered pockets of tall white pine and hemlock, and white cedar and tamarack in the valleys.

CVC estimates that 67 per cent of the watershed was covered by forests in 1851. As settlement grew over the next 50 years, this number fell to around 10 per cent, remaining there until the 1950s (**Figure 2**). Sawmills, grist mills, and dams were constructed, land was cleared for agriculture and the forest used for fuelwood.

Forests that were not cleared, such as the valleylands and escarpment that were difficult to farm, were often “high-graded” (removing the biggest and best trees) for timber - pine and oak for the naval industry (“masting”) and then later hardwood and pine sawlogs - undermining the ecological health of the forest. Fires were also used to clear land, causing widespread forest fires that burned the understories of “high-graded” forests (Elliott, 1998).



*Figure 2: estimated forest coverage in the watershed from 1851-1954 (CVC 1956).*

CVC has played a critical role in increasing forest cover across the watershed through its reforestation program. After its establishment in 1954, CVC assisted private landowners in reforesting fields which had been cleared for agriculture but were unproductive because of steep slopes, stoniness and sandy soils prone to erosion. While timber production was used as an incentive to gain landowner support, CVC determined that “the effect of reforestation on control of runoff, improved summer stream flow, and stabilization of wood-using industry justifies public assistance in such work” (CVC, 1956). From 1955 to today, CVC has worked with private landowners and municipalities to plant over 7 million trees, covering over 3,500 hectares, an area roughly ten times the size of the Toronto Islands.

CVC also began acquiring larger areas requiring reforestation to improve water storage and decrease the severity of floods, focusing on headwater areas, where reforestation would “have the most effect on stream flow” (CVC 1956).

CVC was also active in other aspects of forest management, including harvesting. In the late 1970s, coniferous plantations were thinned and pruned, while stand improvement thinning was undertaken in hardwoods, including at Terra Cotta. A series of plantation thinnings were also completed in the 1980s and 1990s in Alton Forest, Robert Baker Forest, and Caledon Lake Forest conservation areas. This marked the last period of management operations of this kind on CVC lands.

## 2.2 The Forest Today

CVC’s jurisdiction is at the border between two types of forest regions: the Deciduous Forest (also known as Carolinian; lower portion of the watershed) and the Great Lakes-St. Lawrence Forest (middle and upper portions of the watershed). Forests across the watershed come in many different types and are organized into three general community classes: upland forests, cultural forests, and treed swamps. These community classes are further defined by community series in the ELC. Upland forests are continuously treed areas with over 60 per cent canopy cover and include coniferous, deciduous and mixed types. Cultural forests are treed communities that were cleared at some point in the past and include plantations and cultural woodlands. Most plantations are established with coniferous trees and have over 60 per cent tree cover. Cultural woodlands have between 35 and 60 per cent tree cover, established through planting or natural regeneration. Finally, treed swamps include deciduous, coniferous and mixed swamps and have more than 25 per cent canopy cover, composed of either trees or shrubs.

**Figure 3** depicts the coverage of forest types in the watershed and on CVC properties. Upland forests are the most common type of forest found within the watershed at 53 per cent, and along with treed swamps, are often referred to as ‘natural’ forests. Many of these forests have naturally regenerated from past land clearing and unsustainable harvesting or burning. This means that the dominant canopy of many of our upland forests are of similar age in years, also known as even aged. Over time, upland deciduous forests begin to develop trees of all ages,

also known as uneven-aged, as individual or small groups of trees die and are replaced by young trees and saplings in the understory. Shade-tolerant deciduous trees such as sugar maple, American beech, and white ash are the most common species of these forests, with oaks, basswood, yellow birch, black cherry and poplars also present. Conifers, such as eastern white pine, eastern hemlock, white spruce, and eastern white cedar are also found in these forests.

On CVC properties, natural, upland forests make up 57 per cent of all treed communities. Most of these forests are mature with dominant canopy trees older than 60 to 70 years. Cultural forests make up 18 per cent of CVC forests with plantations comprising 11 per cent. Plantations are a variety of ages, from newly planted to 70 years or older. In the watershed, plantations comprise 15 per cent of the forest cover.

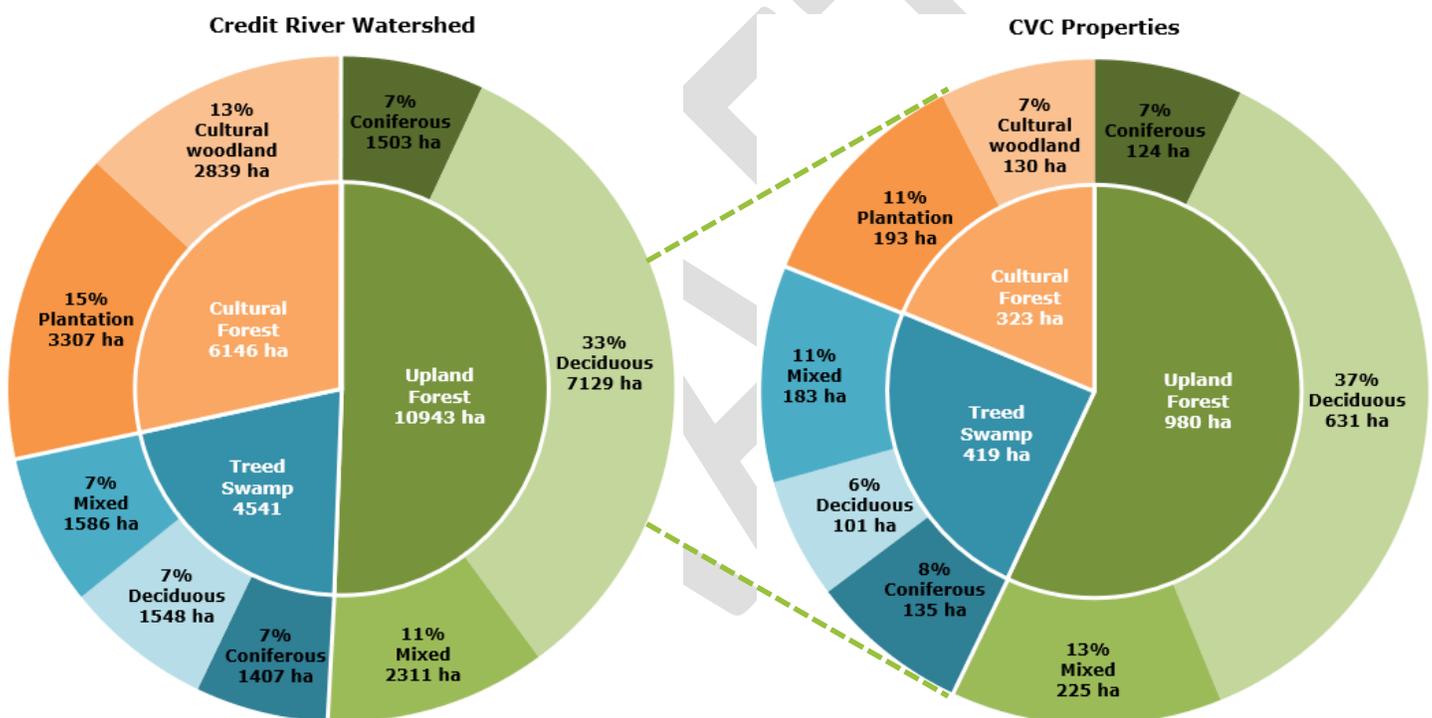


Figure 3: composition and area of forest communities in the watershed and on CVC properties. Watershed total forest cover is 21,630 ha, 1,720 ha of which are on CVC properties (CVC 2017).

Forest cover is unevenly distributed across the watershed. While the total watershed forest cover is 23 per cent (21,630 ha) of the land area, the cover changes significantly when broken into the three watershed zones (**Figure 4**). The middle and upper zones contain most of the watershed’s forests, while the lower zone has much lower forest cover because it is heavily urbanized. The largest, continuous forests of the watershed are found in the upper and middle zones and play a significant role for biodiversity, and many other benefits, such as stormwater retention, for those downstream in the lower watershed. While eight per cent of all forests in the watershed are on CVC properties, CVC owns less than three per cent of the watershed’s total land area.

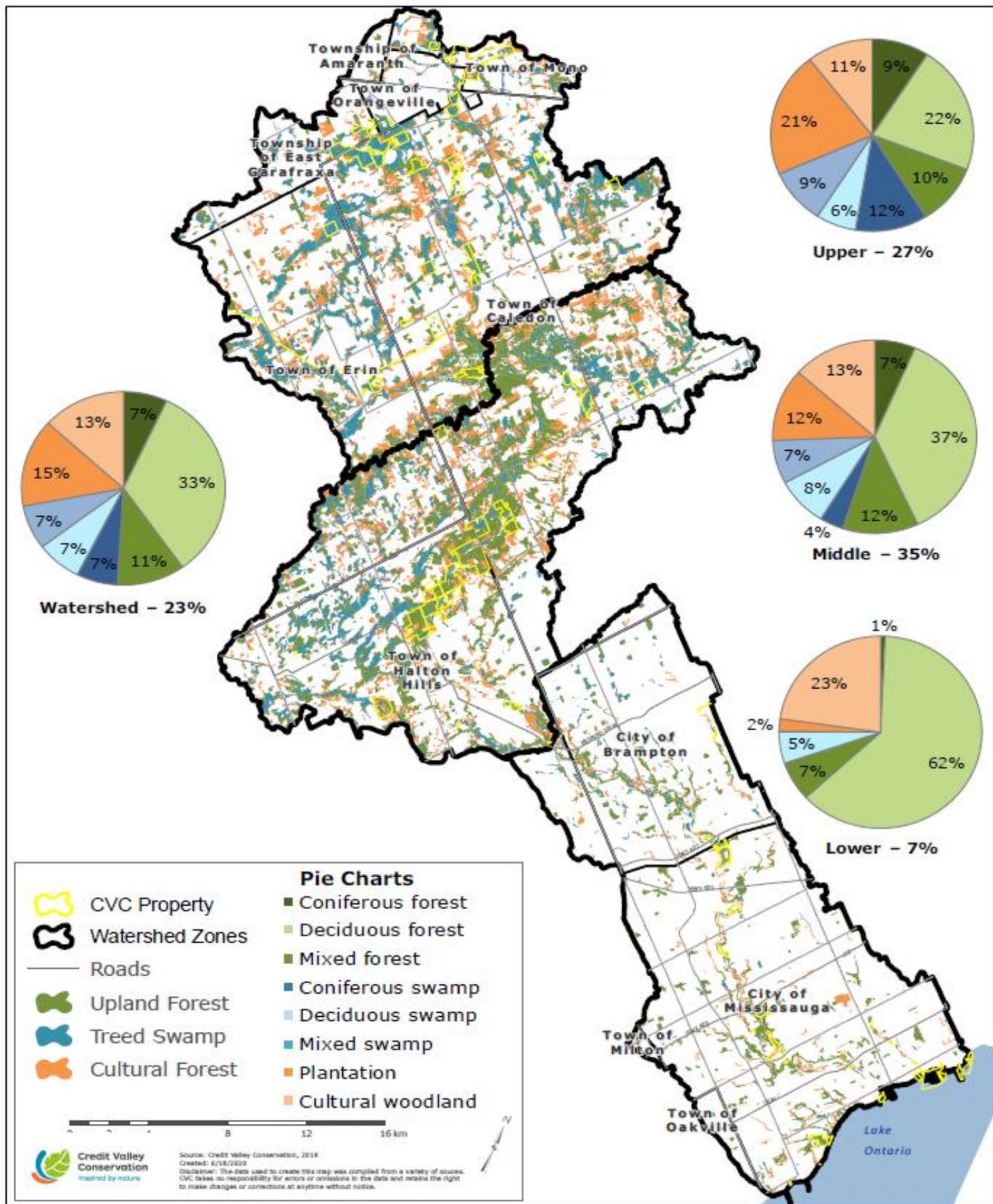


Figure 4: woodland composition of the watershed and by the 3 watershed zones, with total forest cover (% of land area) by zone and watershed (CVC 2017).

### 3 Forest Health

Healthy forests are stable and resilient to some level of disturbance and are generally self-maintaining. However, the magnitude and cumulative effects of stressors in the watershed can lead to significant declines in the ecological health, or integrity, of forests. For example, if a forest is damaged from an ice storm in the winter and a prolonged drought in the summer, it may be susceptible to invasive species or to disease and unable to recover and return to a healthy state. Any loss to a key component or changes in function can impact forest health and will therefore require some form of management to restore the forest to its desired state. Forests in the watershed are under varying levels of stress.

#### 3.1 Stressors

Stressors are anthropogenic or natural events, actions or factors that affect or change the natural balance and function of an ecosystem. Eliminating a stressor is often beyond our control, such as past land uses, climate change, or the arrival of invasive species. However, where a stressor cannot be removed, restoring and strengthening forest health can help build resilience to their effects or advances.

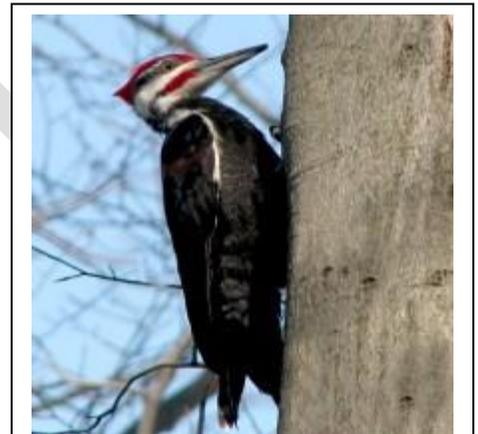
##### 3.1.1 Land use change, past and present

Past land clearing for agriculture and urban development has created many isolated, smaller patches of forest across our watershed. This isolation prevents species - from wildlife to trees in the form of seed - from moving from one forested area to another, which affects biodiversity. Small forest patches are less resilient to disturbance and more susceptible to other stressors such as invasive species.

In addition, smaller patches of forest have less **interior habitat** than larger, contiguous forest areas. These smaller forests have less species richness, diversity, abundance and biomass than larger forests and lack the interior space necessary for some species to thrive.

Urbanization will continue to exert pressure on forests by changing the land uses adjacent to the forest edge.

Some of the largest, contiguous forest areas are in the middle and upper watershed and often include and connect to CVC properties. Some CVC forests are significant islands of relative ecological stability, making it critical for CVC to manage these forests for current and future generations of people and wildlife.



The pileated woodpecker requires large, mature forest habitat to feed and nest. Large forests have higher ecological value. Forest habitat located more than 100 m from any edge is defined as forest **interior habitat**. Due to the patterns of land ownership and use, forests in the watershed have become highly fragmented, with most forest blocks measuring less than five ha and very few contiguous blocks of forest measuring larger than 100 ha. Forest interior habitat covers just three per cent of the watershed.

### 3.1.2 Climate change and severe weather

Historically, southern Ontario has experienced warm summers, relatively mild winters, a long growing season, and reliable annual precipitation. However, past weather patterns no longer have the predictive value they once did.

Between 1937 and 2016, average air temperatures in the watershed have increased by 1.8 Celsius, with the most significant increases seen in the winter (2.5 Celsius). The number of annual frost-free days has increased by 40 days, and the number of extreme cold days (less than 10 degrees Celsius) have decreased, while the number of extreme heat days (higher than 30 degrees Celsius) in the watershed has exceeded Canadian climate normal of 12 days per year in seven of the last 10 years (CVC, 2019b).

Most projections for future climate changes in southern Ontario include warmer winter temperatures, fewer days below freezing, warmer mean annual temperatures, increased precipitation volume and overall changes to the intensity, duration and frequency of precipitation events, including droughts.

Increasing frequency of intense wind, rain and ice storms are expected to cause structural damage to forests. Droughts will likely become longer and more frequent, and plants will experience more heat stress. Warming winters may benefit the northward expansion of invasive species that are currently constrained by temperature. These events coupled with changing conditions may favour the spread of invasive species and pest outbreaks.

Climate change will also affect tree species composition. Some tree species such as eastern hemlock and yellow birch may no longer be suited to the changing conditions and begin to disappear from the watershed while others such as hackberry and hickories may benefit from the changes. However, forest fragmentation and the rate at which our climate is changing may reduce or even prevent the natural migration of better suited, more southerly species into and across the watershed.

The most abundant tree in the watershed, sugar maple is not currently threatened or at risk. However, sugar maple is susceptible to drought and its fine roots can be damaged by soil-freezing, leading to crown dieback and decline. Snow cover is an important insulator of soils because it helps prevent soils from freezing, thereby protecting fine roots and other biological processes. However, climate change is predicted to bring more severe weather and drought, and fluctuating winter temperatures that melt the snow cover and expose soils to deeper winter freeze.

In short, climate change is and will continue to stress local ecosystems and have a major, largely negative impact on tree health. Healthy and well managed forests are more resilient to the predicted impacts associated with climate change.

### 3.1.3 Invasive Species, Pests and Disease

Invasive species, pests and disease have already changed the species composition of forests in the watershed. Chestnut blight and Dutch elm disease killed most American chestnut and American elm trees in the early and mid-twentieth century, permanently changing forests in the watershed. More recently, emerald ash borer (EAB), beech bark disease (BBD) and butternut canker have led to serious declines in ash, American beech and butternut trees.

#### Invasive Pests and Disease and the Decline of Tree Diversity

Through funding from Peel and Halton Regions, CVC has spent nearly two million dollars over the past five years on dealing with the impacts of EAB in the watershed. Over 11,000 ash trees killed by EAB have been cut down along trails on CVC properties. Forests like those at Rattray Marsh where ash had been a dominant species have been left with dead and dying canopies, creating openings for invasive plant species such as buckthorn, to become established. Many old fields in the watershed have naturally regenerated with ash as a significant part of the young canopy. As the ash matures, they will likely be attacked by EAB, meaning more stunted forests dominated by buckthorn and other shrub thickets, unable to continue natural succession towards a mature, healthy forest.

There are more than 55 native tree species found across the watershed. However, only three species account for over 65 per cent of trees in our deciduous and mixed upland forests - sugar maple, American beech and white ash (CVC 2020b). Evidence suggests that as ash and beech decline, our forests are becoming more simplified with sugar maple growing in greater abundance (CVC 2020b). The lack of diversity can lead to greater vulnerability to disturbance. If an outbreak of a pest targeting maple trees (e.g. Asian long-horned beetle) were to happen, the effects on watershed forests could be devastating.

Unfortunately, new introduced forest pests and diseases are also making their way towards the watershed area. Hemlock woolly adelgid (HWA), oak wilt and sudden oak death, are causing widespread decline in hemlock and all oak species in the U.S. At the time of writing, HWA has already been detected in Ontario outside of the watershed, and oak wilt is near the Windsor border. Beech leaf disease has been reported in southwestern Ontario and is compounding the effects of BBD. The combination of these pests and disease affecting beech, ash, oak, and hemlock make at least 23 per cent of all woodlands in Peel Region vulnerable.

The loss of many beech and ash has already reduced forest biodiversity. Adding the potential losses of hemlock and oak to this list will further undermine forest health and resilience. These losses are simplifying forest composition, reducing tree species diversity in the canopy and the regeneration layer and the food sources and habitats for wildlife that depend on them.

## Invasive Plants

While many invasive species attack trees, some species can come to dominate a forest's understory. If this occurs, it inhibits a forest from regenerating itself. For example, garlic mustard and dog strangling vine (DSV, **Figure 5**), can quickly cover a forest floor, crowding out native species and preventing them from taking root. Some invasive species such as buckthorn also alter soil chemistry, making it even more difficult for native species to sprout and survive.

More than 90 per cent of forest communities in the watershed surveyed since 2010 contain invasive plants that can displace native plant species and transform forest ecosystems. In urban forests, invasive plants are more abundant than in rural areas. Invasive species coverage in the lower watershed is more than double that of the upper watershed and is increasing 1.5 times faster (CVC draft Invasive Species Strategy, undated). In 2016, common buckthorn was the fourth most common tree species in the GTA behind ash and is likely now more abundant than ash due to the impacts of EAB (GIOCC 2016). As we lose mature trees in the canopy from pests and disease, there may not be a healthy layer of native saplings in the understory to take their place.



*Figure 5: a dense mat of DSV in a forest understory.*

## Native Pests and Disease

Finally, not all pests and disease are non-native. Insects such as forest tent caterpillar and fall canker worm eat the leaves of many deciduous trees in the watershed. Fungal pathogens like armillaria root rot, and necrotia and eutypella canker, cause decay and can spread from tree to tree. Approximately 13 per cent of all canopy trees in CVC monitoring plots have evidence of decay fungus or cankers, above the recommended 10 per cent threshold (CVC 2020b). Soil quality, as well as past, unsustainable tree harvesting practices that selected the best trees and left behind the weaker, slower growing, and diseased trees have contributed to a degradation in forest health.

While not always significant on their own, these pests and disease can compound the impacts of other stressors, leaving large pockets of dead and declining trees, impacting forest cover, tree health and vigour in natural forests.

## 3.2 Coniferous Plantation Management

While much of the discussion on stressors has focused on the impacts to all forest types - and particularly upland forests - they are also impacting coniferous plantations in many of the same ways. However, plantations also present their own unique set of management challenges.

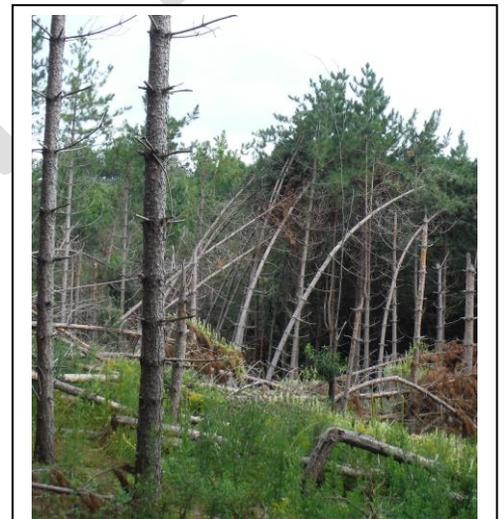
Most largescale planting occurred on former agricultural fields. Conditions on these open fields for most deciduous tree species are not ideal, as they often have poor quality, sandy soils and are subject to harsh open conditions such as drying winds and sun, and animal browse. Forest managers have primarily chosen pine and spruce varieties, since fast growing coniferous seedlings are more likely to survive these conditions. The long-term objective of these plantations is to establish forest cover and restore conditions for transition to a mixed forest dominated by native, deciduous trees.

As the trees in plantations grow over time, the canopy begins to close, shading the forest floor and reducing growing space between trees. Periodic thinning every 10-20 years, generally beginning around 25-35 years after planting, improves spacing to ensure healthy growth of the remaining trees, and allows sunlight to reach the forest floor, stimulating growth of native tree regeneration and vegetation. Deciduous tree species like maple, oaks, and hickory can establish themselves under protection of the coniferous canopy. The process can take over 70 years from initial planting as the conifers are removed over time to further increase sunlight for the understory and eventual transition to a young, mixed forest.

Without proper management however, plantations often have little to no regeneration in the understory. As the trees continue to grow, they can become spindly and susceptible to breakage from wind and ice damage. Weakened, unhealthy trees become targets for pests and disease. As trees in plantations die, often in groups, or 'pockets', the void can be filled with aggressive invasive plants like buckthorn and DSV.

**Table 1** shows the management status of the 3,300 ha of plantations across the watershed. Most of these plantations are not being adequately managed to ensure long-term sustainability. In a 2019 study, CVC found that 84 per cent of sampled plantations older than 30 years in the watershed had no history of management. 24 per cent of the sampled plantations were considered high risk for failure, while 74 per cent were medium risk. Most of these plantations needed management, had poor native understory development, and had invasive plant species present.

On CVC properties, over 160 ha of plantations are older than 30 years and require thinning to create conditions for succession into a deciduous forest.



Unmanaged plantations are susceptible to storm damage and pocket decline. Of the 200 hectares of plantation on CVC property, over 160 hectares are due or overdue for management, 80 hectares of which require immediate attention to prevent potential stand failure.

Table 1. area and management status of plantations in the watershed.

Plantations	Watershed (ha)	CVC Property (ha)
Area (ha)	3,300	200
Due or overdue for management	2,770 (84%)	160 (80%)
Requires immediate management	790 (24%)	80 (40%)

Without intervention, these plantations could deteriorate into thickets dominated by invasive species. If this were to happen, they would not provide significant ecological goods and services, would threaten the ecological health of neighbouring forests, and would be difficult and costly to convert into sustainable, healthy forests.

Furthermore, wildfire risk is generally highest in unmanaged coniferous plantations. Many of the watershed plantations are near or next to towns and villages (**Figure 6**), increasing risk to people and property. Unmanaged plantations will have higher fuel loadings due to natural mortality and fine, burnable material such as dead branches and needles. Unmanaged plantations also have higher densities of trees, with dead branches that may act as “ladders” facilitating more intense crown torching and crown fires. These combinations can make the stand and surrounding lands more susceptible to damaging fires. With climate change anticipated to result in longer periods of drought, fire risk is expected to increase.

As plantations continue to age without proper management, the risk of stand failure, growth of invasive plant species, and fire risk increases. Managing these plantations will ensure a return on investment of years of tree planting to establish forests throughout the watershed. Management will create healthier, diverse forests, maintain resilient forest cover, native regeneration and wildlife habitat, and reduce the risk of fire that can threaten public health, property and our green assets.

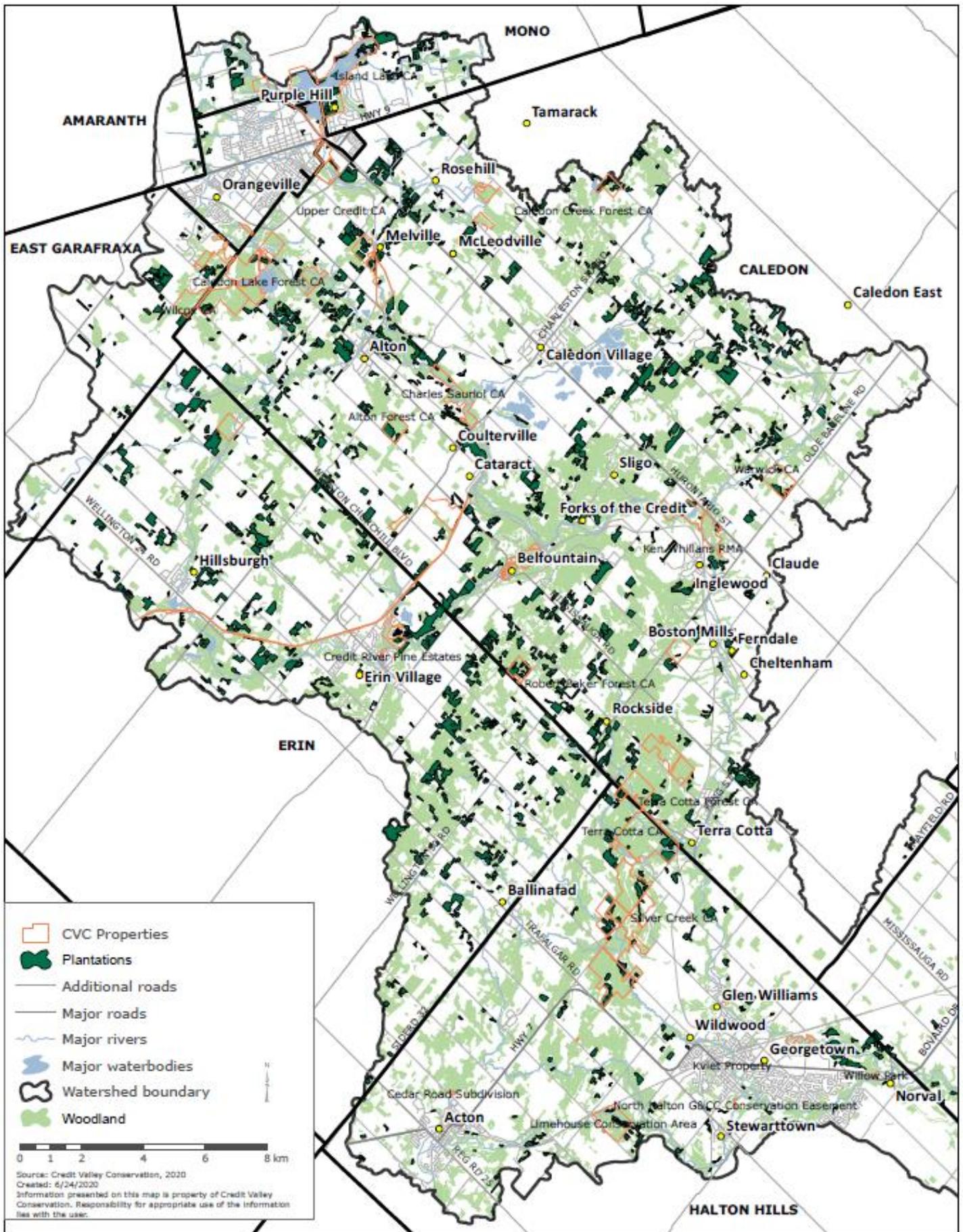


Figure 6: overview of plantations in the northern half of the watershed. There are more than 3,300 ha of plantation in the watershed, many of which are not being properly managed.

## 4 Objectives of the SFMP

Direction for CVC forest management has been organized by guiding principles, objective themes, the objectives, and actions to achieve the objectives (**Figure 7**).

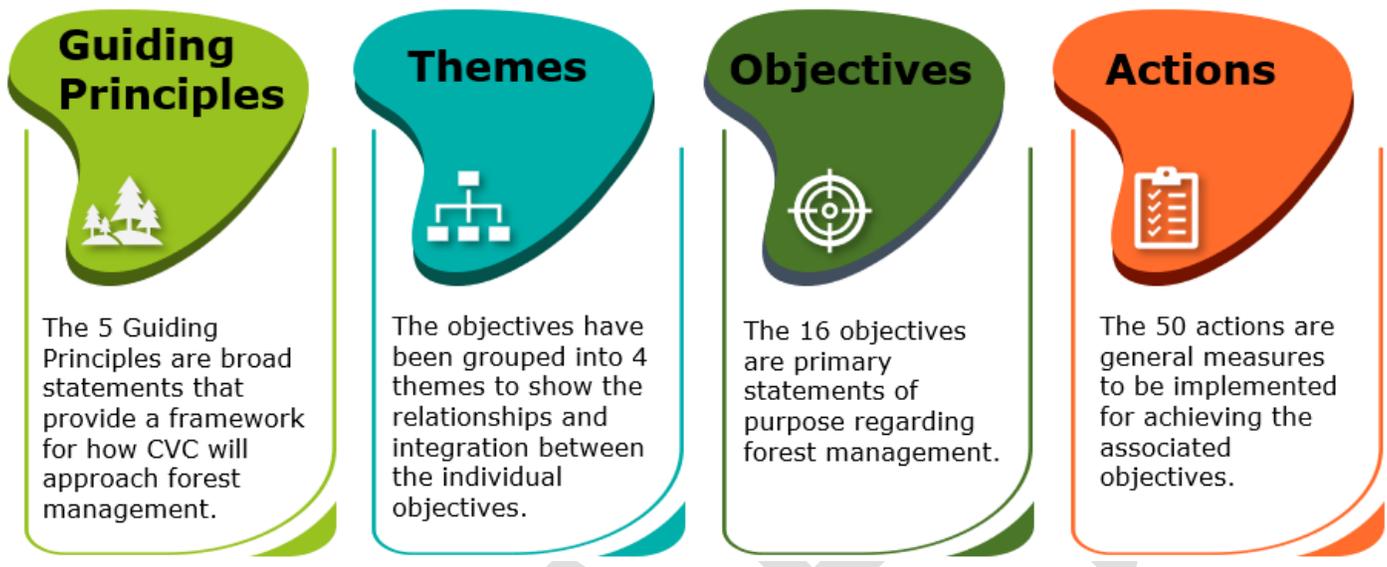


Figure 7: organization of the SFMP management direction.

CVC identified five guiding principles when developing the SFMP. It used these principles to develop the plan and will continue to use them to guide its implementation.

### Guiding Principles:

1. Manage the forest in a manner that puts a primacy on its long-term ecological health
2. Implement forest management practices that equal or exceed current standards of Good Forestry Practices in Ontario as defined in the provincial *Forestry Act*
3. Employ **adaptive management** to continuously improve forest management
4. Manage the forest in a fiscally responsible way
5. Integrate this plan with existing CVC strategies and plans and with those of the municipalities that have land under CVC's jurisdiction

**Adaptive management** is a structured, iterative process of environmental management that allows managers to make decisions in the face of uncertainty and fosters social learning through constant monitoring of the system being managed.

There are 4 themes within the SFMP, under which nest the 16 objectives that form the core of the plan:

1. *Maintain and Restore Forest Health*
2. *Protect Natural values*
3. *Connect with Indigenous Communities, Stakeholders and the Public*
4. *Protect Public Health and Safety*

The objectives do not exist in isolation. They are usually integrated with many other objectives during implementation. For example, when intervening in a plantation, practices will include, among others, adaptation for climate change (objective five), and measures to protect soil (objective seven), wildlife and features (objective eight and nine), and will also be helping to reduce fire risk (objective sixteen).

Each objective has multiple actions that will be implemented to work towards achieving the objective. The actions (complete list in **Appendix B**) are summarized in the text for each objective, below. These actions can involve gathering more information, preparing and implementing silvicultural prescriptions, developing a monitoring protocol or standard operating procedure, or a specific guideline for achieving the associated objective. In the end however, implementing the actions results in on-the-ground forestry operations—going into a forest and directly intervening. Examples include cutting down a tree or thinning a forest, planting native vegetation, using various treatments to suppress unwanted species, and monitoring and responding to the results.

The 16 objectives and their associated actions are the steps CVC and our partners must take to ensure our forests are healthy.



## **Theme one: maintain and restore forest health**

### **Objectives 1-7:**

- 1. Maintain, Enhance and Restore Natural Communities and Stand Conditions*
- 2. Manage Plantations to Gradually Convert to Natural Communities and Stand Conditions*
- 3. Foster the Development of Old Forest Communities and Maintenance of Old Trees*
- 4. Increase Forest Cover in the Watershed*
- 5. Adapt Restoration Practices to Climate Change*
- 6. Protect the Forest from Invasive Species, Pests and Disease and Restore Impacted Forests*
- 7. Protect Forest Soils*

The SFMP's first theme contains most of the objectives directly related to forest management, including upland forest and plantation management. CVC will manage forests on our properties and work with partners such as municipalities and private landowners to increase and improve healthy forest cover.

#### **4.1 Objective one: maintain, enhance and restore natural communities and stand conditions**

Biodiversity is at the heart of sustainable life on earth. A variety of tree species, size and ages, in differing compositions that form a mosaic of stand conditions and structure are important to healthy forests and biodiversity. These forests also have snags, down woody debris, understory herbs, shrubs and young trees that provide

habitat for wildlife. CVC will work to restore, maintain and enhance the diversity of these natural conditions within CVC and watershed forests.

Not all forests necessarily require intervention. Where, when, and how CVC operates will be based on inventory, monitoring and prioritization and must be flexible. Identifying and prioritizing forest management opportunities on lands outside of CVC ownership will also inform targeted outreach and communications initiatives, as part of actions associated with objective 14.

Although CVC has set a general management target of 20 ha per year of CVC-owned upland forests - along with projects with partners - the actual amount of area and partner projects each year will vary based on need, availability and requirements of the site. In some forests, restoration work will be reactive to poor forest health conditions, while in others, it may be proactive in order to further enhance forest resilience by improving tree species diversity and structure. Data such as CVC's Forest Resource Inventory (FRI) will be used to develop silvicultural prescriptions to achieve objective one, fine-tuned to unique site conditions.

Silvicultural practices can help increase tree species and structural diversity. Removing diseased or unhealthy trees increases light and resources for healthy trees and natural regeneration (**Figure 8**). Not all unhealthy trees will be removed however, because some level of pest and disease is normal and important to a forest ecosystem's function. Some dead and dying trees will be retained where safe to do so for wildlife. Where these features do not already exist, trees can be girdled and cut, or 'stubbed' high in the bole to create snag features, and others felled and left on site to contribute to down woody debris.

Small groups of trees can be removed to encourage the growth of tree species such as hickory, red oak and black cherry that require lots of sunlight. In stands impacted by beech bark disease for example, removing susceptible and diseased beech trees through single tree selection while retaining healthy trees showing signs of resistance to the disease can improve stand genetics. Improving tree



*Figure 8: a sugar maple forest following a harvest treatment removing unhealthy trees to promote the growth of natural regeneration.*

health and species diversity, as well as promoting multiple ages and structure, is an important action that promotes forest resilience to a changing climate.

#### **4.2 Objective two: manage plantations to gradually convert to natural communities and stand conditions**

Considerable investment has gone towards the establishment of plantations within the watershed with the long-term goal to return natural forest communities to the landscape. To meet this objective, silviculture prescriptions will be developed and implemented to transition plantations into naturalized upland forests. These prescriptions will include direction for the tree marking and harvesting, or 'thinning', of the planted conifers to improve tree growth and vigour and promote natural regeneration of deciduous tree species.



A red pine plantation (left) that has not been thinned. In an unmanaged plantation, the lack of sunlight reaching the understory prevents deciduous tree species and associated shrubs and herbaceous plants from taking root. In plantations that are being managed by marking trees for removal (right), species associated with deciduous forests can establish themselves.

Various approaches will also be taken when implementing plantation operations to speed up the transition, create more variable forest structure and improve forest resilience. For example, larger gaps within a plantation can be created during thinning operations in areas around advanced regeneration of tree species that may require higher levels of light. Natural regeneration can also be supplemented by tree planting to increase species and structural diversity as well as to introduce future seed source for the remaining understory. In plantations where there may not be adjacent upland forests to provide natural seed for regeneration, additional planting in the understory following later thinnings may also be required to ensure

successful transition. Other activities such as invasive species management and monitoring will be essential in ensuring the long-term success of management.

CVC will prioritize plantation management based on indicators such as age, stocking, species composition, location, and previous management history. A rolling, ten-year plantation thinning schedule has been developed for the SFMP Operating Plan, which targets around 20 hectares of plantation each year for thinning so that all CVC-owned plantations will be thinned in the next ten years and continue to be managed on an appropriate schedule beyond that timeframe. CVC will also prioritize and schedule its work with partners to ensure resources are being applied to plantations that require immediate attention and have important ecological value such as woodlands within the Credit River Watershed Natural Heritage System (CRWNHS).

#### **4.3 Objective three: foster the development of old forest communities and maintenance of old trees**

Old growth forests, as defined by the MNRF, have an undisturbed canopy dominated by species whose average age is over 120 years. Older forests have unique conditions and support species diversity only found in these forests. Old declining trees and tree mortality creates a habitat-rich multi-layered forest.

While CVC does have individual and small groups of trees that meet the age threshold, other characteristics that shape old growth forests, such as abundance of down woody debris, are still developing. Using CVC FRI, forest areas on CVC properties that have older trees will be identified and further investigated for old growth potential. These areas will be maintained and protected so that they can continue to develop from mature to old growth forest with management intervention typically reserved for serious forest health issues and to encourage old-growth features.

#### **4.4 Objective four: increase forest cover in the watershed**

While CVC has worked hard to plant new forests in its watershed, its current 23 per cent forest cover falls short of the 30 per cent minimum within a watershed recommended by Environment and Climate Change Canada (EC 2013). To achieve the aspirational target of 30 per cent, more than 6,800 hectares of new forest will need to be managed and planted - that's up to 12 million new trees sequestering carbon, retaining stormwater, and providing habitat for wildlife. This will mean a sustained effort by CVC and its partners over the long term, and well beyond the 20-year term of this plan.

CVC will continue to work on its own lands and with private landowners to develop and implement tree planting plans and management of natural, successional areas - which make up nearly 9 per cent of the watershed area - to ensure they are moving towards a future forest. It will prioritize these efforts based on opportunity and the potential to increase ecological goods and services.

Planting trees and managing new and established forests are essential actions for many climate change strategies, such as Peel's *Climate Change Master Plan* (2019). Although new CVC land acquisitions may present some opportunity for planting, most new planting areas will be on privately owned lands. Most of these opportunities are in the middle and upper portions of the watershed because heavy urbanization in the lower watershed has left little room for new forest. Managing existing forest and increasing forest size in areas with a relatively high existing cover - such as the middle watershed - will help connect fragmented forest patches, expand forest interior and maintain and enhance forest health.

#### **4.5 Objective five: adapt restoration practices to climate change**

Expanding and connecting forest cover, maintaining and improving biodiversity, and restoring forest health and resilience are key objectives, since healthy forests will better withstand disturbance and stressors, including climate change. However, we can also help our forests prepare in more specific ways.

Our forest management and restoration practices need to be adaptive and in tune with our changing conditions. CVC will review and update its forest monitoring and inventory methodologies to ensure that the effects of climate change are being measured. Identifying changes, trends, as well as disturbance from storm events will allow us to respond with appropriate levels of management.

CVC will also adapt species selection for planting based on ongoing tree and shrub species vulnerability research. Both a changing climate as well as susceptibility to increased events such as drought and ice storms will be considered when choosing which species to plant.

To prepare for warmer temperatures, CVC will continue to explore techniques to assist migration of select species northward. For example, one method may include planting genetic variants of species common to the watershed (e.g. sugar maple) from more southern climates. CVC Seed Guidelines will be completed under direction of the SFMP to address assisted migration science within CVC's nursery stock production systems.

#### **4.6 Objective six: protect the forest from invasive species, pests and disease and restore impacted forests**

Whether in a plantation in the northern part of the watershed, or a small, urban forest in the south, forest management often begins and ends with managing for invasive species, pests and disease. The management of this stressor is typically a



As temperatures increase, Carolinian species like hackberry and tulip trees (pictured above) may become more suited to the watershed.

component of several integrated objectives. For example, prioritizing forest management to meet objective one will be based on forest health indicators such as the presence of invasive species, or high levels of native disease that affect tree health. Monitoring and inventory will be reviewed to ensure that the right information is being collected and reported on to inform us where we need to work.

Disturbing a forest can help initiate natural regeneration, but it can also leave it open for colonization by invasive species. Before thinning a coniferous plantation, it may be necessary to manage for invasive species, such as buckthorn. This can mean cutting down the species in question and treating them with pesticides or manual removal. Otherwise, these undesirable species could dominate an area, preventing regeneration of desired, native species.

Smaller forests in urbanized areas such as the southern portion of the watershed often have higher abundances of invasive plant species. Forest management here may include control of the invasive species, some thinning to improve tree health and light conditions, followed by planting to ensure forests have adequate regeneration for a sustainable future.

The SFMP will also integrate and align with the CVC Invasive Species Strategy (forthcoming update fall 2020) when prioritizing areas for management and implementing recommendations and practices to ensure a consistent approach.

#### **4.7 Objective seven: protect forest soils**

Forest operations often require heavy machinery such as harvesters, skidders and forwarders. However, bringing this heavy equipment into a forest can compact the soil. This can make it difficult for native species to grow and cause damage to roots. Run-off and erosion are other unwanted side-effects that can result from poorly planned operations.

CVC will plan its forestry work to avoid compaction and erosion by using existing paths and roads wherever possible (**Figure 9**). Some soil disturbance is beneficial however, because it can create the right soil conditions for smaller seeded trees like yellow birch that have a tough time penetrating through thick leaf layer. CVC will follow recognized standards and take measures to mitigate and repair any damage that exceeds those standards. These measures include conducting operations during dry or winter conditions, using brush mats on skid trails, keeping skid trails out of low-lying or wet areas, repairing any excessive ruts created by machinery, and stabilizing exposed soils in areas such as landings with weed-free seed.



*Figure 9: a forwarder using an existing trail during dry conditions.*



## Theme two: protect natural values

### Objectives 8-9:

- 8. Protect Wildlife
- 9. Protect Significant Ecological Features and Functions

The second theme contains objectives which will ensure that forest management operations are conducted in a way that protects the natural values and functions that support biodiversity while managing to improve forest health.

Healthy forests provide critical habitat for wildlife. Many of the watershed forests, including lands CVC owns or manages, also have significant ecological features, such as wetlands, vernal pools (**Figure 10**), and habitat for species at risk. Part of CVC's purpose is to serve as stewards and protectors of these features.

The SFMP Operating Plan provides specific guidelines and prescriptions to protect many of the values and features that would be encountered in the forests of the watershed. These guidelines are consistent with those established by the MNRF. Features and values are identified through operational planning, inventory and information sharing when developing site level plans - within CVC and with partners such as the MNRF and the Ministry of Environment, Conservation and Parks (MECP).



*Figure 10: vernal pools are temporary, seasonal waterbodies found in forests. Salamanders use them for breeding in the spring. Any forestry work required near vernal pools will be conducted in the late summer or fall.*



*Figure 11: cavities like this one provide valuable habitat for birds and small mammals.*

### 4.8 Objective eight: protect wildlife

Most species carry out critical phases of their lifecycles at specific times of the year. Spring and early summer are important times for returning migratory birds to nest and breed such as warblers and wood thrush. Other wildlife like red-tailed hawks build stick nests while red foxes use dens to raise their young. Dead and dying trees are important for feeding woodpeckers. Woodpeckers, owls and bats also find refuge and nest in cavities in trees (**Figure 11**). CVC has also identified several areas on its properties which are known to be habitat for species at risk. For these reasons, sites designated for forestry work will be inventoried and activities scheduled at certain times of the year and completed with caution in areas of sensitive

habitat. Valuable wildlife features like stick nests, dens and cavity trees will be protected during operations.

#### **4.9 Objective nine: protect significant ecological features and functions**

Features such as seeps and springs, or old growth forests, and Areas of Natural and Scientific Interest (ANSIs) play significant ecological roles and are sensitive to disturbance. These areas will be identified prior to operations using existing inventory and field verification so that the appropriate measures are taken to protect those features. For example, waterbodies and Provincially Significant Wetlands (PSW) will have operational buffers that restrict activities such as machine travel and ensures enough canopy cover remains to protect and maintain the integrity and hydrological function of these features.

Important habitat features such as dead standing trees (“snags”) and down woody debris that support a diversity of dead-wood dependent wildlife will be retained where they do not pose a health and safety concern. Some portions of cut trees will also be left on site during cutting operations to increase down woody debris, and where machinery is used, it will avoid disturbance of existing large woody debris.



#### **Theme three: connect with Indigenous communities, stakeholders and the public**

##### **Objectives 10-14:**

- 10. Protect and have regard for Indigenous Peoples' Values and Interests*
- 11. Protect and have regard for Cultural Heritage Features*
- 12. Consider Recreational Use and Infrastructure on CVC Land During Forest Operations Planning*
- 13. Collaborate with Municipalities, NGOs, and Others*
- 14. Provide Education and Outreach to Landowners and General Public on Needs for Forest Management*

The third theme sets out how CVC will interact with groups which have interests in how CVC manages its forests.

The Credit River Watershed is the traditional territory of the Huron-Wendat, Haudenosaunee (Iroquois), Métis, and most recently, the Mississaugas of the Credit First Nation. As citizens, we continue to be party to the treaties made with Canada's Indigenous peoples and we recognize their enduring presence on this land.

CVC strives to be an organization that connects people with nature and brings people together to enhance and protect it. An essential part of this approach is partnering with the Mississaugas of the Credit and other First Nations or Métis communities with connections to the watershed.

CVC will also continue to place a high priority on outreach and engagement related to sustainable forest management with landowners, the general public and our key partners including government- and non-government- organizations. Collaboration

allows us to share ideas, information and practices, consider other perspectives, align our goals and integrate our work to increase efficiency and improve outcomes.

#### **4.10 Objective ten: protect and have regard for Indigenous peoples' values and interests**

CVC strives to collaborate with First Nations and Métis communities in a respectful and mutually beneficial manner. To this end, CVC will share operating plans and annual schedules with the Mississaugas of the Credit prior to project implementation to identify any known sites of importance or other concerns. Measures to incorporate Indigenous knowledge in inventory and to mitigate any impacts to known Indigenous cultural sites and features from forest operations will be developed through collaboration with First Nations. The approach to sharing this information will be set out in CVC's Indigenous Engagement Guidelines (under development).

#### **4.11 Objective eleven: protect and have regard for cultural heritage features**

CVC properties contain features of historical and cultural interest, such as the limestone kilns and associated ruins at the Limehouse Conservation Area (**Figure 12**). Operational planning and inventory within CVC will identify areas of concern. Measures to protect and mitigate impacts from operations will be developed and implemented based on the unique feature and type of forestry activities. Often, these measures will include a non-operational buffer to ensure that no equipment or felled trees impact the site. Where work must be completed closer to a feature, advanced falling techniques, for example, may be used.



*Figure 12: a lime kiln at Limehouse Conservation Area.*

#### **4.12 Objective twelve: consider recreational use and infrastructure on CVC properties**

When forestry operations require using trails and other recreation features for work staging or access, trail closure notices will be posted on site and through other communications tools such as social media. Operating during winter when trail use is lower and only closing necessary trails to protect public safety are some examples of how CVC will minimize the disruption to our public users. When damage to trails is anticipated, it will make plans to quickly rehabilitate them.

This will require annual workplan integration with individual conservation area management plans and regular communication with appropriate CVC staff. Collaboration within CVC will also identify opportunities to integrate various planned activities across departments. For example, trail creation or access maintenance can be timed with a planned thinning on CVC property to increase efficiency.

#### **4.13 Objective thirteen: collaborate with NGOs, municipalities and other levels of government**

CVC will work with partners such as other conservation authorities and municipal forestry groups to share data and collaborate on projects for more efficient and effective use of resources. CVC will develop yearly reports on forest health and SFMP progress and deliver its results to municipal partners and local and environmental groups - like those who were part of the SFMP development - who have an interest in maintaining forest health in the watershed.

CVC will also continue to participate in groups such as the Peel Urban Forest Working group to share and develop best practices, provide support and technical expertise, align work and to further develop its relationships with municipal forestry and parks departments.

#### **4.14 Objective fourteen: provide education and outreach to landowners and the public on the needs and benefits of sustainable forest management**

CVC has many communication vehicles it can use to inform and educate the public about forest management and to encourage action on their own properties:

- Interpretative signs and model forest sites at CVC's conservation areas
- Pamphlets, brochures and factsheets
- Workshops
- Site visits and restoration services
- Signage and public notices to make conservation area visitors aware of ongoing work, trail closures and pesticide application
- Targeted outreach to private landowners to address forest management priorities

Outreach and education will also target landowners with forests that have been identified through the prioritization described in objectives one and two. Effective outreach can help build awareness and encourage action on properties outside of CVC ownership and through CVC's forest management services. Building this capacity will help move CVC towards achieving the objectives of theme one on private lands.

Finally, to ensure that its communications efforts are coordinated and effective, CVC will develop and implement a comprehensive communications plan before work is undertaken at individual properties. These plans are essential in preparing and notifying the public of operations occurring on CA lands, as well to educate the public on 'why' we are doing the work and 'how' in order to build understanding and support.



## Theme four: protect public health and safety

### Objectives 15-16:

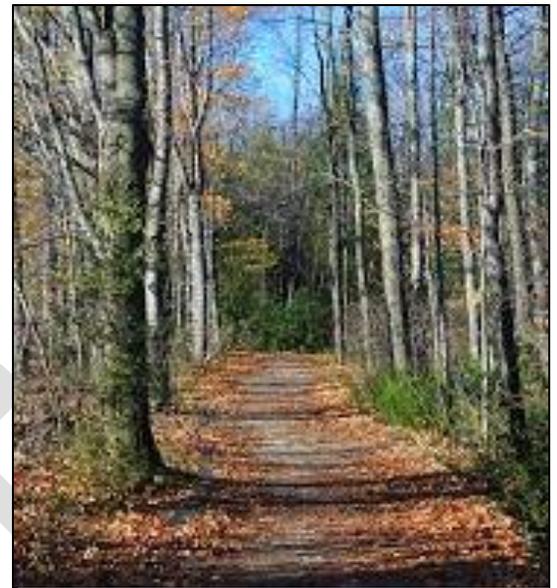
15. Manage Hazard Trees

16. Reduce the Risk of Forest Fire

The final theme will ensure that CVC's properties remain safe places for the public to visit and are managed for forest fire risk. Ensuring the safety of the users of CVC's property, infrastructure, and its natural assets is paramount.

#### 4.15 Objective fifteen: hazard trees

CVC will continue to identify and remove hazard trees, defined as weakened trees, that could fall and damage infrastructure (trails, roads, neighbouring properties etc.) and pose a safety issue to staff and visitors. CVC will also continue to develop and refine its hazard tree program to streamline delivery through a review of the program and implement resulting recommendations. The current model generally focuses on immediate hazards and is shared across multiple departments within CVC. Improvements may include a single-window approach to coordinating the program, enhanced inventory by technical experts such as certified arborists, identifying future potential hazards, and mitigating risk such as proactive pruning to prevent a growing problem. These activities can help to deal with issues before they become major hazards. The benefit will also be that more trees along trails are preserved to benefit the public's use of recreation areas (**Figure 13**).



*Figure 13: tree-lined, forest trails are a major attraction at CVC conservation areas. Managing for healthy trees, and removing hazards promptly are important in keeping the public safe.*

#### 4.16 Objective sixteen: reduce the risk of forest fire

Historically, wildfire has been infrequent within the types of forest present in the watershed. However, climate change may increase fire risk in natural areas with prolonged drought. Generally, fire risk is highest in unmanaged plantations, which have high fuel loadings that can lead to crown torching and crown fires. Thinning of these plantations will reduce this risk, in addition to helping achieve objective two. Maintaining healthy, natural forests can also reduce risk. Conducting a fire risk assessment of CVC's forests will also aid in planning mitigative operations such as thinning. Other measures such as timing of operations, and best practices that include on site response equipment and procedures will also help to minimize the risk of fire ignition in our forests during operations.

## 5 Implementing the Plan

CVC will implement the SFMP through a series of successive five-year operating plans, annual work plans, and a variety of CVC programs to allow for flexibility to respond as conditions change and new information becomes available. The implementation of the 50 actions to achieve the 16 objectives will be through a variety of approaches. Many of the actions are associated with site-level, operational activities (theme 1) such as management direction for plantations (**Figure 14**), as an example. Protecting values like wetlands (theme 2) or cultural heritage features (theme 3) are considered on-going or “routine” actions that are integrated with any planned project to ensure an objective (e.g. protect forest soils) is met during all forest management activities.



Figure 14. An example (using Objective 2) showing the SFMP's implementation structure from objective through actions that result in on-the-ground forestry operations.

The five-year SFMP Operating Plan sets out a schedule of planned silviculture operations for CVC properties. The operating plan provides details on methods, approaches, and standards for implementing and monitoring many of the actions and objectives related to forest health and conserving and protecting natural and cultural values. The Operating Plan will be updated every five years to support an adaptive management framework. This will provide an opportunity to use the results of inventory and monitoring to update changes to planned operations and practices, report on progress and review advances in science, information and lessons learned.

The first five years of implementation will focus heavily on plantation management and will include a rolling, ten-year thinning schedule for CVC properties. This will allow for much needed management and to ensure they are scheduled for future work at the appropriate intervals. Managing invasive species within plantations and coordinating with the implementation of the Invasive Species Strategy when managing in other forests types will also be a priority.

It is intended that all CVC plantations (approx. 200 ha) that require thinning will be managed in the next ten years. CVC will also develop a prioritization framework, along with other actions such as adaptation practices for climate change, to schedule the management of other forest types in subsequent operating plans.

A similar prioritization framework and annual work planning will be used to schedule and implement work with partners and private landowners based on opportunity and capacity. This includes:

- Providing technical advice, recommendations, and participation in working groups and in plan development with municipalities and other partners;
- Supporting and leading joint forest management projects on public lands;
- Developing and implementing management plans and prescriptions for private landowners, with a focus on plantations; and
- Continued tree planting on private and public lands.

Addressing the 2,700 ha of watershed plantations that need management will be a priority for forest management when working with private landowners. Continued tree planting and managing successional areas will also contribute towards the long-term goal of 30 per cent forest cover, or 6,800 ha of new forest.

Many non-operational actions, such as the development of guidelines, tools, or program reviews, are scheduled to be completed in the first five-year term of the plan so that they can inform and guide operational actions. The 10-year review of the SFMP will assess where CVC is at in achieving the objectives of the plan. At this point, most of the non-operational actions will have been completed, while others may be adjusted, and new ones added.

CVC will use a variety of resources to implement many of the actions, particularly the more resource intensive ones associated with theme one. CVC will begin to implement the first five years of the plantation operating schedule, among other key actions such as continued tree planting, under current operating budgets. Although modest, some plantations will also generate some revenue for forest products while being thinned.

As we begin to expand into other actions such as natural, upland forest management, CVC will look to additional opportunities for funding, such as compensation funding from development projects, grants, special levy, and developing a 'green' asset management reserve as part of the CVC Asset

Management Plan. Additional funding opportunities, paired with cost recovery charges, can also help offset the cost of management offered for private lands.

Some of the objectives and actions, such as those related to monitoring, outreach, communications and engagement are already part of CVC programs. Collaboration and integration between CVC departments will ensure alignment on these shared goals.

Creating, restoring and managing forests for biodiversity and climate change is an objective shared with many of CVCs partners. Caledon's Climate Change Plan update, *Resilient Caledon*, for example, may offer opportunities to partner and share resources and expertise on projects, to ensure trees are planted and forests are being managed to help improve carbon sequestration.

CVC will also consider engaging in carbon offset markets which has the potential to provide significant revenue to support the SFMP's implementation. Pursuing Forest Stewardship Council (FSC) certification is the best first step as 3<sup>rd</sup> party certification is typically a requirement of most carbon sales agreements. Certification has the added benefit of connecting CVC with a strong community of practice in community forest management and can also help maintain public confidence in CVC's sustainable forest management practices.

Achieving the objectives of the SFMP will not happen overnight. Implementing the full plan and acquiring the resources to do so will be an ongoing, pragmatic, and flexible endeavour. The ongoing commitment to our forests also goes beyond the 20-year term of the plan. By prioritizing and implementing the full SFMP over time, we are taking the necessary steps towards a healthier forest - one that supports biodiversity, is better prepared for climate change, and helps clean the air we breathe and the water we drink. The reward will be a healthier watershed for generations to come.



*Figure 15: an ash dominated forest at Rattray Marsh, killed by EAB, being restored through cutting, invasive species management, and native tree and shrub planting.*

## 6 References

- Burke, D., K. Elliott, K. Falk, and T. Piraino. 2011. A land manager's guide to conserving habitat for forest birds in southern Ontario. Ontario Ministry of Natural Resources, Science and Information Resources Division.
- Credit Valley Conservation (CVC). 1956. Credit Valley Conservation Report 1956. Credit Valley Conservation.
- Credit Valley Conservation (CVC). 2010. Monitoring Forest Integrity within the Credit River Watershed. Chapter 4: Forest Vegetation
- Credit Valley Conservation (CVC). Undated. CVCA Forestry
- Credit Valley Conservation (CVC). 2011 & 2015. Credit River Watershed Natural Heritage System Strategy.
- Credit Valley Conservation (CVC). 2017. CVC ELC and Land Use Mapping.
- Credit Valley Conservation (CVC). 2018. Conservation Areas Master Strategy.
- Credit Valley Conservation (CVC). 2019a. CVC Climate Change Strategy.
- Credit Valley Conservation (CVC). 2019b. CVC Climate Change Trend Projections Factsheet.
- Credit Valley Conservation (CVC). 2020a. CVC Strategic Plan 2020-2022: Our Future Taking Shape.
- Credit Valley Conservation (CVC). 2020b. Integrated Watershed Monitoring Program Technical Bulletin: Status and Trend Analysis of Tree Health and Dead Wood.
- Credit Valley Conservation (CVC). Undated. Draft Invasive Species Strategy (ISS) (update).
- Elliott, K.A. 1998. The Forests of Southern Ontario. The Forestry Chronicle: Vol. 74 (6).
- Environment Canada (EC). 2013. How Much Habitat is Enough? Third Edition. Environment Canada, Toronto, Ontario.
- Green Infrastructure Ontario Coalition (GIOC). 2016. State of the Urban Forest in the Greater Toronto Area Report. Available at: [https://greeninfrastructureontario.org/app/uploads/2016/02/2876-GTA-UrbanForest\\_REPORT-May27\\_web.pdf](https://greeninfrastructureontario.org/app/uploads/2016/02/2876-GTA-UrbanForest_REPORT-May27_web.pdf)
- Lee, H.T., WD Bakowsky, J Riley, J Bowles, M Puddister, P Uhlig and S McMurray. 1998. Ecological Land Classification for Southern Ontario: First Approximation and its Application. Ontario Ministry of Natural Resources, Southcentral Science Section, Science Development and Transfer Branch. SCSS Field Guide FG-02.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2000. A Silvicultural Guide to Managing Southern Ontario Forests. Queen's Printer for Ontario.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2010. Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales. Toronto: Queen's Printer for Ontario.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2015. Forest Management Guide to Silviculture in the Great Lakes-St. Lawrence and Boreal Forests of Ontario. Queen's Printer for Ontario.

Ontario Ministry of Natural Resources and Forestry (MNRF). 2018. Afforestation Guide for Southern Ontario. Toronto: Queen's Printer for Ontario.

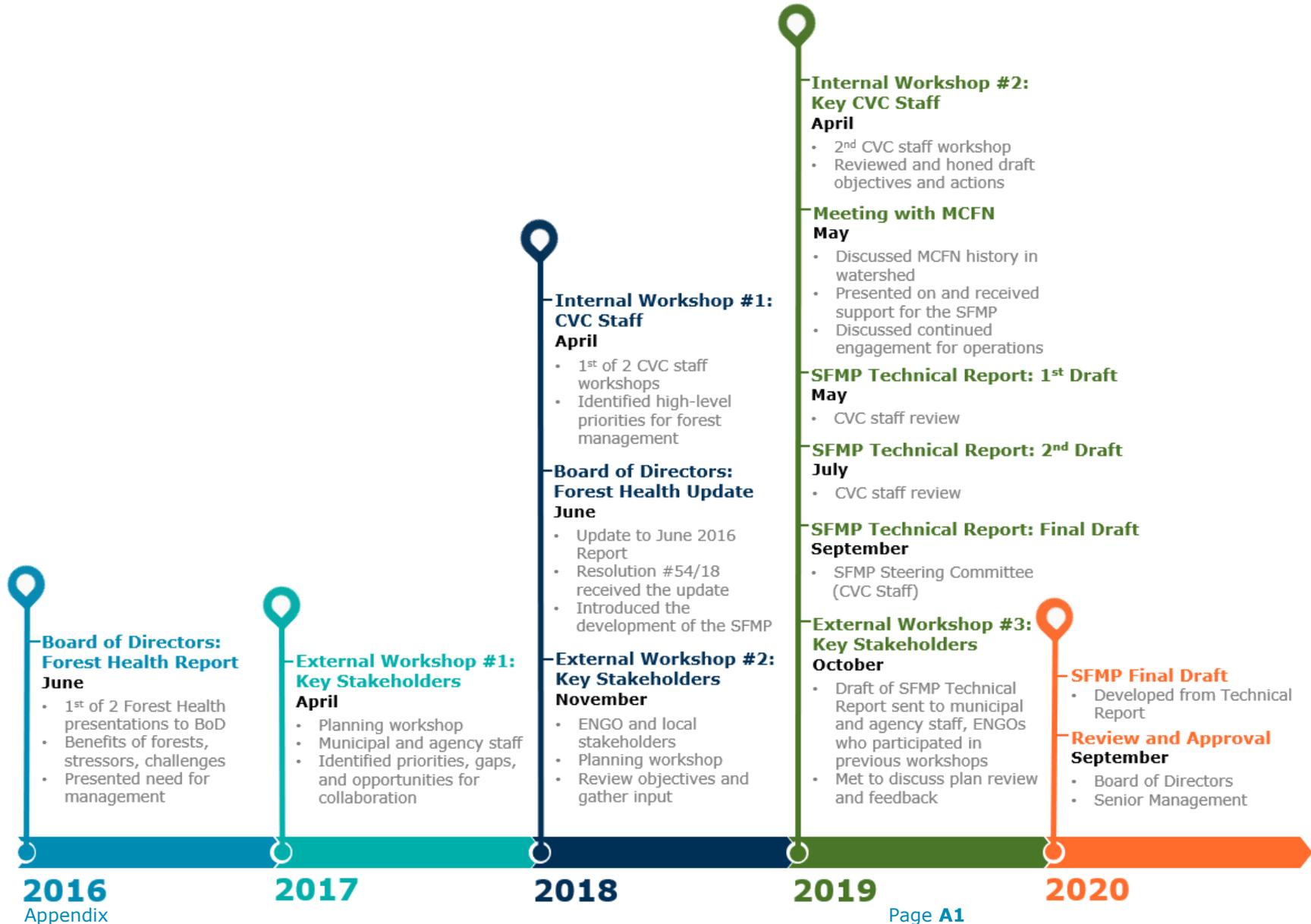
Puric-Mladenovic, D., J. Buck, and A. MacIntosh. 2011. Pre-settlement Vegetation Mapping for the Greater Toronto Area, including the Regions of Hamilton, Halton, Peel and York and the Credit Valley Watershed. Ontario Ministry of Natural Resources, Peterborough.

Region of Peel. 2011. Peel Climate Change Strategy.

Region of Peel. 2019. Climate Change Master Plan: 2020-2030.

Wybenga, Darin P. and Kaytee Dalton. Undated. Mississaugas of the New Credit First Nation: Past and Present. New Credit Administration.

## Appendix A - Timeline of SFMP Engagement and Development



## Appendix B - Full List of Objectives and Actions

Theme 1: Maintain and Restore Forest Health			
Objective	Action	Implementer (CVC)	Timeline <sup>1</sup>
1. Maintain, enhance and restore natural communities and stand conditions	1.1 Develop and implement management prescriptions to: a. Restore, maintain or enhance a natural diversity of forest types, species composition, and tree ages b. Restore, maintain or enhance structural elements, including snags, coarse woody debris, and understory herbs, shrubs and young trees.	Lead: Restoration	2020-2025
		Lead: Restoration	2020-2025
	1.2 Develop a tool(s) to prioritize forest management in natural forests that addresses: a. CVC properties (managed)  b. Lands outside of CVC ownership that may then guide both internal planning and targeted outreach and communication initiatives as part of actions for objective 14.	Lead: Restoration Support: Ecology	2025-2030
		Lead: Restoration Support: Ecology, Outreach and Communications	2025-2030
2. Manage plantations to gradually convert to natural communities and stand conditions	2.1 Develop and implement management prescriptions to encourage native species regeneration to achieve the target species composition.	Lead: Restoration	2020-2025
	2.2 Develop a plantation monitoring protocol to assess effectiveness of prescription outcomes and targets in developing natural stands.	Lead: Restoration Support: Monitoring	2020-2022
	2.3 Develop a tool to prioritize plantation management that address lands within public/private ownership. <sup>2</sup>	Lead: Restoration	2021-2022

<sup>1</sup> Objectives and actions are set for the life of the plan but may have timelines from 2020-2025. The 5-year term is to coincide with the 5-year Operating Plan and review period, though some actions will be considered ongoing.

<sup>2</sup> Note that the SFMP provides a prioritization of CVC plantations through its operating plan and 10-year schedule.

Theme 1: Maintain and Restore Forest Health			
Objective	Action	Implementer (CVC)	Timeline <sup>1</sup>
3. Foster the development of old forest communities and maintenance of old trees	3.1 Identify and manage stands with a high potential to become old forest through a planning and prioritization process (link to Action 1.2).	Lead: Restoration Support: Ecology and Monitoring	2025-2030
	3.2 Implement prescriptions and silvicultural practices that encourage the development of old growth characteristics where forest conditions and types exist to support this objective.	Lead: Restoration	2025-2030
4. Increase forest cover in the watershed	4.1 Implement tree planting plans to support new CVC land acquisitions, where appropriate.	Lead: Restoration Support: Lands Management	2020-2025
	4.2 Implement tree planting on suitable private and public lands based on opportunity, and ecological merits and impact (e.g. enhancing connectivity, expanding interior forest in riparian areas):  a. Review and update the reforestation prioritization tool that defines priorities on both CVC and other public/private lands and develop and refine tools for naturalization programs that includes managing successional areas  b. Ecology and Restoration staff to work with CA management staff to develop tools to guide land acquisition targets and priorities	Lead: Restoration  Lead: Restoration  Lead: Lands Management Support: Ecology and Restoration	Ongoing  2022  2020-2025
5. Adapt restoration practices to climate change	5.1 Adapt silvicultural prescriptions to feedback from monitoring and incorporate up-to-date science and approaches to promote forest resilience to mitigate the effects of climate change. This will include:  a. Review monitoring programs to ensure the methods adequately measure the effects of climate change in order to inform proactive forest management.	Lead: Restoration	Ongoing
		Lead: Monitoring Support: Restoration	2021-2024

Theme 1: Maintain and Restore Forest Health			
Objective	Action	Implementer (CVC)	Timeline <sup>1</sup>
	b. Review inventory (FRI) program for potential to incorporate measures to inform adaptive management and silvicultural practices.	Lead: Restoration Support: Monitoring	2021-2024
	5.2 Consider species vulnerability to climate change when selecting for planting plans.	Lead: Restoration Support: Ecology	2020-2025
	5.3 Consider and implement assisted migration in restoration programs as appropriate to better prepare future plantings for climate change which includes: a. Finalize Seed Guidelines to address assisted migration science within CVC Nursery stock production systems. Completion will occur under the direction of this SFMP.	Lead: Restoration Support: Ecology	2020-2022
	5.4 Respond to potential incentives where/when available at both the provincial and federal levels (and municipally where appropriate) associated with fostering carbon sequestration to promote and incent good forest management and reforestation. a. Consider Forest Stewardship Council (FSC) Certification for CVC forests, which will allow CVC easier entry into carbon offset markets.	Lead: Restoration and Ecosystem Goods and Services	2021-2025
6. Protect the forest from invasive species, pests and disease and restore impacted forests	6.1 Integrate and coordinate with the recommendations of CVC's Invasive Species Strategy to respond to invasive pests and disease as it relates to forest management and monitoring.	Lead: Restoration Support: Monitoring	Ongoing
	6.2 Review effectiveness of FRI program's ability to assess forest health conditions (i.e. pests and disease) and inform management actions.	Lead: Restoration Support: Monitoring	2020-2025

<b>Theme 1: Maintain and Restore Forest Health</b>			
Objective	Action	Implementer (CVC)	Timeline <sup>1</sup>
	6.3 Implement prescriptions to manage stands and forested areas affected by stand-altering stressors, establishing thresholds where impacts to biodiversity and forest health are within acceptable limits (linked to Action 1.2)	Lead: Restoration	2025-2030 <sup>3</sup>
	6.4 Consider the development of an Integrated Pest Management (IPM) strategy consistent with the Invasive Species Strategy (Update, 2020)	Lead: Restoration	2020-2025
	6.5 Integrate invasive species management in forest management prescriptions. Removal of invasive, non-native plant species will be implemented where practical.	Lead: Restoration	2020-2025
	6.6 Use chemical treatment following integrated pest management strategies to avoid significant ecological degradation.	Lead: Restoration	2020-2025
	6.7 Monitor to determine the efficacy of treatments intended to control invasive species and pests.	Lead: Restoration	2020-2025
7. Protect forest soils	7.1 Implement best management practices to avoid causing damage to soils (e.g. compaction, erosion).	Lead: Restoration	2020-2025
	7.2 Implement measures to mitigate and repair damage where standards have been exceeded.	Lead: Restoration	2020-2025

<b>Theme 2: Protect Natural Values</b>			
Objective	Action	Implementer (CVC)	Timeline
8. Protect wildlife	8.1 Conduct forest operations during appropriate timing windows to avoid or mitigate impacts to sensitive taxa (e.g. migratory bird nesting, salamander breeding and migration).	Lead: Restoration	2020-2025

<sup>3</sup> This timeline is associated with the prioritization tool established in Action 1.2. Plans to address severe stressors (e.g. stand-altering outbreak) will be created on an as-needed-basis in the interim if required.

<b>Theme 2: Protect Natural Values</b>			
Objective	Action	Implementer (CVC)	Timeline
	8.2 Implement species-specific measures to protect SAR and their habitats using Area of Concern (AOC) <sup>4</sup> prescriptions and/or timing restrictions.	Lead: Restoration	2020-2025
	8.3 Conduct modified operations in areas of important wildlife habitat (i.e. AOCs).	Lead: Restoration	2020-2025
	8.4 Protect wildlife features, such as stick nests, animal dens, etc. using AOC prescriptions.	Lead: Restoration	2020-2025
9. Protect significant ecological features and functions	9.1 Share operational workplans internally to allow for natural feature inventory that may identify significant features or functions that may inform the development of silvicultural prescriptions and operational plans.	Lead: Restoration Support: Ecology	2020-2025
	9.2 Protect important environmental features (e.g. waterbodies) using AOC prescriptions and best management practices (BMPs).	Lead: Restoration	2020-2025
	9.3 Manage wildlife habitat, including elements such as snags, wildlife trees, and coarse woody debris, and significant habitat features, using silvicultural and ecologically appropriate prescriptions and coarse-filter approach guidelines.	Lead: Restoration	2020-2025
	9.4 Protect the natural processes that support important environmental features and ecological functions (e.g. hydrological regime).	Lead: Restoration	2020-2025
	9.5 Remediate anthropogenic drainage issues (e.g. agricultural tile drains) that impair natural conditions where possible.	Lead: Restoration	2020-2025

<sup>4</sup> Area of Concern (AOC): A geographic area associated with an identified natural resource feature, land use or value that may be affected by forest management activities and may require operational modifications.

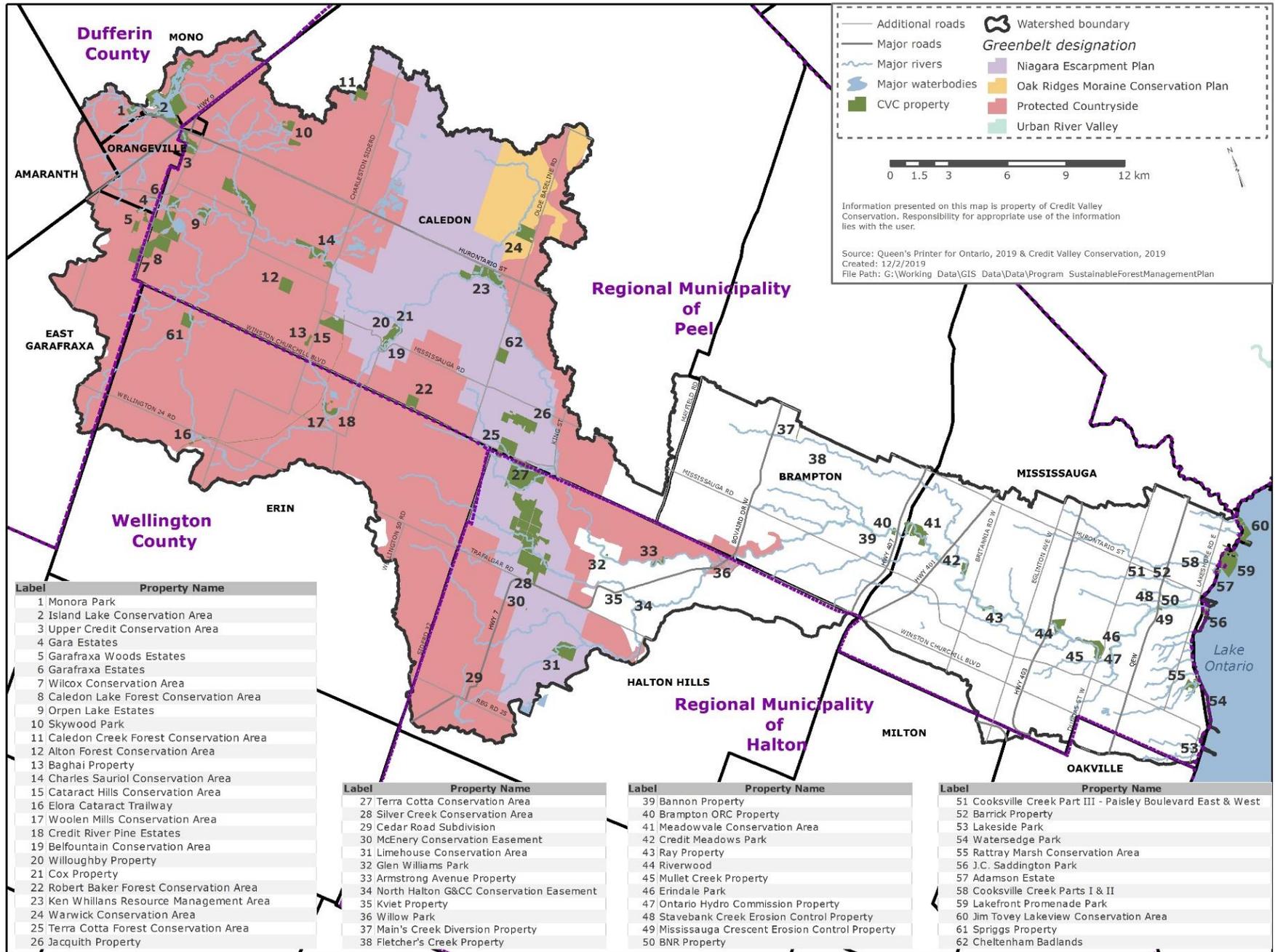
<b>Theme 3: Connect with Indigenous Communities, Stakeholders, and the Public</b>			
Objective	Action	Implementer (CVC)	Timeline
10. Protect and have regard for Indigenous peoples' values and interests	10.1 Share Operating Plans and annual schedules with Mississaugas of the Credit First Nation (MCFN).	Lead: Restoration	2020-2025
	10.2 Identify and mitigate potential impacts to known Indigenous cultural features during site identification and planning, and operations.	Lead: Restoration	2020-2025
	10.3 Collaborate with First Nations in a respectful and mutually beneficial manner.	Lead: All staff that engage	2020-2025
11. Protect and have regard for cultural heritage features	11.1 Share operational workplans internally to allow for identification of cultural heritage features and values to inform prescriptions and operational plans.	Lead: Restoration	2020-2025
	11.2 Protect cultural heritage features using AOC protection measures and guidelines.	Lead: Restoration	2020-2025
12. Consider recreational use and infrastructure on CVC land during forest operations planning	12.1 Implement measures for the use and rehabilitation or protection of trails and other recreational features during forest operations, using available best management practices and through cross departmental work plan integration.	Lead: Restoration	2020-2025
	12.2 Integrate site level planning of operations with CA (site level) management plans where they exist and to the extent possible	Lead: Restoration	2020-2025
	12.3 Collaborate with appropriate CVC property management staff during the preparation and implementation of management activities on CVC lands.	Lead: Restoration	2020-2025
13. Collaborate with municipalities, NGOs, and others	13.1 Collaborate with other conservation authorities, municipal, provincial and federal partners where appropriate to share management of public lands for more efficient and effective use of combined resources through:		
	a. Consult with municipal forestry and parks staff through ongoing, annual and bi-annual working groups.	Lead: Restoration	2020-2025

Theme 3: Connect with Indigenous Communities, Stakeholders, and the Public			
Objective	Action	Implementer (CVC)	Timeline
	b. Explore data sharing opportunities of forest resource data with local municipal forestry and parks operational staff identified in SFMP consultations.	Lead: Restoration	2020-2023
	13.2 Support and leverage partnerships with community partners and local environmental, non-governmental organizations to achieve shared goals. a. Develop and deliver yearly updates on forest health and SFMP progress to environmental and other non-governmental groups that may also promote greater collaboration	Lead: Restoration	2020-2025
	13.3 Continue to support Peel Urban Forest Working Group and support/develop opportunities to expand on this relationship operationally and with other local and regional partners	Lead: Ecology and Restoration	2020-2025
14. Provide education and outreach to landowners and general public on the needs and benefits of sustainable forest management	14.1 Leverage CVC's monitoring and inventory data (e.g. forest health) to promote and advance support for forest stewardship and management:  a. Provide forest health updates and information to the public and to identify issues on public and private lands.  b. Educate the public (e.g. schools) on the practice and benefits of forest management and restoration.  c. Develop messaging and campaigns to promote greater understanding and calls to action around both public and private land forest management.	Lead: Restoration Support: Monitoring  Lead: Education Support: Restoration  Lead: Outreach and Communications Support: Restoration	2020-2025  2020-2025  2020-2025
	14.2 Leverage CVC Conservation Areas to build appreciation for forests (esp. to urban residents) and to promote good forest management practices through the development of model sites.	Lead: Outreach Support: Restoration, Lands Management	2020-2025

<b>Theme 3: Connect with Indigenous Communities, Stakeholders, and the Public</b>			
Objective	Action	Implementer (CVC)	Timeline
	14.3 Communicate forest management science widely with CVC stakeholders, partners and the community and engage practitioners through training and knowledge transfer (e.g. workshops).	Lead: Restoration Support: Outreach and Communications	2020-2025
	14.4 Prepare and disseminate public notifications and other communications in concert with the annual operational workplan regarding proposed operations on CVC lands to forewarn the public, including any restrictions on access or use.	Lead: Restoration Support: Communications, Lands Management	2020-2025
	14.5 Develop targeted campaigns and communications to address restoration priorities for private land reforestation and forest management developed through restoration programs.	Lead: Outreach and Communications Support: Restoration	2020-2025

<b>Theme 4: Protect Public Health and Safety</b>			
Objective	Action	Implementer (CVC)	Timeline
15. Manage hazard trees	15.1 Continue to develop and implement a Hazard Tree Program and review the current program to assess its effectiveness and make recommendations for improvement.	Lead: Restoration Support: Lands Management	2020-2022
16. Reduce the risk of forest fire	16.1 Implement preventive measures such as timing of operations, risk abatement through thinning and slash management through CVC Best Management Practices Guidelines.	Lead: Restoration	2020-2025
	16.2 Develop approach to assess future liabilities and risks related to forest types within CVC land holdings and develop recommendations.	Lead: Restoration	2020-2023

# Appendix C - CVC Property Overview



Label	Property Name
1	Monora Park
2	Island Lake Conservation Area
3	Upper Credit Conservation Area
4	Gara Estates
5	Garafraxa Woods Estates
6	Garafraxa Estates
7	Wilcox Conservation Area
8	Caledon Lake Forest Conservation Area
9	Orpen Lake Estates
10	Skywood Park
11	Caledon Creek Forest Conservation Area
12	Alton Forest Conservation Area
13	Baghai Property
14	Charles Sauriol Conservation Area
15	Cataract Hills Conservation Area
16	Elora Cataract Trailway
17	Woolen Mills Conservation Area
18	Credit River Pine Estates
19	Belfountain Conservation Area
20	Willoughby Property
21	Cox Property
22	Robert Baker Forest Conservation Area
23	Ken Whillans Resource Management Area
24	Warwick Conservation Area
25	Terra Cotta Forest Conservation Area
26	Jacquith Property

Label	Property Name
27	Terra Cotta Conservation Area
28	Silver Creek Conservation Area
29	Cedar Road Subdivision
30	McEnery Conservation Easement
31	Limehouse Conservation Area
32	Glen Williams Park
33	Armstrong Avenue Property
34	North Halton G&CC Conservation Easement
35	Kviet Property
36	Willow Park
37	Main's Creek Diversion Property
38	Fletcher's Creek Property

Label	Property Name
39	Bannon Property
40	Brampton ORC Property
41	Meadowvale Conservation Area
42	Credit Meadows Park
43	Ray Property
44	Riverwood
45	Mullet Creek Property
46	Erindale Park
47	Ontario Hydro Commission Property
48	Stavebank Creek Erosion Control Property
49	Mississauga Crescent Erosion Control Property
50	BNR Property

Label	Property Name
51	Cooksville Creek Part III - Paisley Boulevard East & West
52	Barrick Property
53	Lakeside Park
54	Watersedge Park
55	Rattray Marsh Conservation Area
56	J.C. Saddington Park
57	Adamson Estate
58	Cooksville Creek Parts I & II
59	Lakefront Promenade Park
60	Jim Tovey Lakeview Conservation Area
61	Spriggs Property
62	Cheltenham Badlands