

# Winnipeg Comprehensive Urban Forest Strategy

May 2022 | **DRAFT**



## ACKNOWLEDGEMENTS

Diamond Head Consulting Ltd. (DHC) has prepared this Strategy for the City of Winnipeg. DHC acknowledges the participation and support of City of Winnipeg departments and staff in preparation of the document.

### **Draft Date**

May 2022



**Prepared by:**



## Land and water acknowledgement

Winnipeg is located in Treaty No. 1 Territory, the home and traditional lands of the Anishinaabe (Ojibwe), Ininew (Cree), and Dakota peoples, and in the National Homeland of the Red River Métis. Our clean drinking water comes from Shoal Lake 40 First Nation, in Treaty No. 3 Territory.

# Executive summary

Winnipeg's urban forest is vital to the fabric of our city. Faced with the combined pressures of invasive pests and disease, climate change, and development, clear direction and outcomes are needed now more than ever to steer the management of Winnipeg's urban forest, ensuring its continuity for the enjoyment of future generations. This document is Winnipeg's first comprehensive urban forest strategy. It provides a 20-year vision for the City's urban forest, identifying key recommendations and strategic actions to help protect, preserve, and enhance Winnipeg's tree canopy towards achieving a canopy cover of 24 percent by 2065. Progress will be monitored and actions will be reviewed and updated every four years. This strategy is the product of two years of collaborative effort between City staff and consultants, and is rooted in an engagement process that involved local stakeholders and the broader community.



## WINNIPEG'S VISION FOR THE URBAN FOREST

**An abundant, healthy, diverse, and resilient urban forest that contributes to the health and wellbeing of all people and communities.**





**More than three million trees make up Winnipeg’s urban forest.** Over the coming decades, increasing pressures from pests and disease, climate change, and continued urban development will impose unprecedented strain on Winnipeg’s forest resources.

An analysis of the City’s public tree inventory identified that more than 50 percent of the City’s public trees are at risk due to current invasive pests alone. In Winnipeg’s native riverbottom forests, many American elms have already been lost due to Dutch elm disease and green ash are also at risk from emerald ash borer (an invasive pest). Unfortunately, once emerald ash borer has established itself in a centre, there is little hope for the local ash population. In Winnipeg, the pest is expected to kill most of the ash trees. This type of relatively sudden change in biodiversity representation has uncertain consequences on fragile riparian ecosystems.

**Winnipeg’s urban forest is facing unprecedented changes.** The Comprehensive Urban Forest Strategy will address these changes by guiding our approach to how we plan for our forest assets, where and what we plant, how we will manage, what we protect, and with whom we can partner to achieve our vision for an abundant, healthy, diverse, and resilient urban forest.

## Principles

Ten principles underpin the strategy and provide a foundation to guide future decision-making:

1	Contribute to a healthy and beautiful city
2	Mitigate and adapt to climate change
3	Provide equitable service delivery
4	Build strong partnerships
5	Protect our existing urban forest
6	Maintain healthy and safe trees
7	Support reconciliation
8	Respect cultural heritage
9	Learn and manage adaptively
10	Enhance biodiversity and ecological function

# Urban forest strategic framework

This strategic framework provides the vision, goals and targets to both proactively and adaptively manage our urban forest assets so that they may thrive in the future. The framework is aligned with the *Winnipeg Parks Strategy* and with urban forest management and planning best practices. A complete description of the framework and detailed recommended actions can be found in Section 4 of this document.




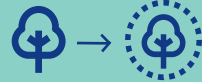
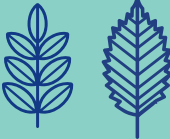



VISION FOR THE URBAN FOREST							
An abundant, healthy, diverse, and resilient urban forest that contributes to the health and wellbeing of all people and communities.							
GOALS							
Plan accountably	Plant strategically	Manage adaptively	Protect prudently	Partner purposefully			
To achieve an equitable distribution of connected tree and forest assets that will improve the health of our people and communities	To grow a robust and sustainable urban forest that will maximize benefits for human health and ecological function	To improve tree health and safety, achieve planned levels of service, and respond to unplanned demand for services	To preserve and protect Winnipeg's urban forest canopy where it will maximize benefits for human health and ecological function	To foster reconciliation and stewardship that will build capacity to achieve goals and respond to challenges			
TARGETS							
							
<b>Canopy cover:</b> 24%	<b>American elms lost annually:</b> No more than 2%	<b>Public planting:</b> No more than 5% potential planting sites vacant	<b>Public tree replacement:</b> 1:1 (one tree replaced for every tree removed)	<b>Public tree diversity:</b> No more than 10% species and 20% genus	<b>Public tree loss annually:</b> No more than 1.5%	<b>Pruning cycles:</b> 7-years for street trees 12-years for park trees	<b>Customer satisfaction:</b> at least 50% across all services

Figure 1 - Urban Forest Strategic Framework components

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# 1. Introduction

Winnipeg's urban forest plays a vital role in shaping the city's character and identity. Trees and forests are often the defining features of our river corridors, streets, parks, and neighbourhoods. In Winnipeg, colourful trees signal the changing of seasons. Trees and forests also provide critical ecosystem services like shade and cooling on hot days, rainwater interception to reduce localized flooding and clean stormwater, and habitat for animals. Municipalities are increasingly recognizing urban forests as an essential part of city infrastructure - a natural asset that delivers ecosystem services throughout communities. The urban forest is expected to play a significant role in our community and environmental health and wellbeing as climate change brings new challenges.



Urban forestry is the act of managing trees, forests, and natural ecosystems in and around urban communities to maximize the physiological, social, economic, and aesthetic benefits that these features provide<sup>1</sup>.

Three main interconnected components form the urban forest system, including: City-owned street and park trees, City-owned natural areas (including forests), and trees growing on private land. **More than three million trees** are estimated to be growing in Winnipeg - 300,000 of those are inventoried City-owned street and park trees, and the remainder grow in natural areas and on private land.

Many people may think of urban forest management as a municipal responsibility. In reality, management extends to the many stakeholders who have a role in the stewardship of trees on both public and private land, including private citizens.

The Urban Forest Strategy builds on the State of the Urban Forest report, which offers an evaluation of the current extent and composition of Winnipeg’s urban forest, as well as existing management practices<sup>2</sup>. The Strategy was also informed by input and feedback collected through two comprehensive phases of public and stakeholder engagement.

## What is the urban forest?

The urban forest is the combination of all trees and associated vegetation, soil, natural processes, and cultural elements on public and private land in an around towns, cities, and other communities (Figure 2).

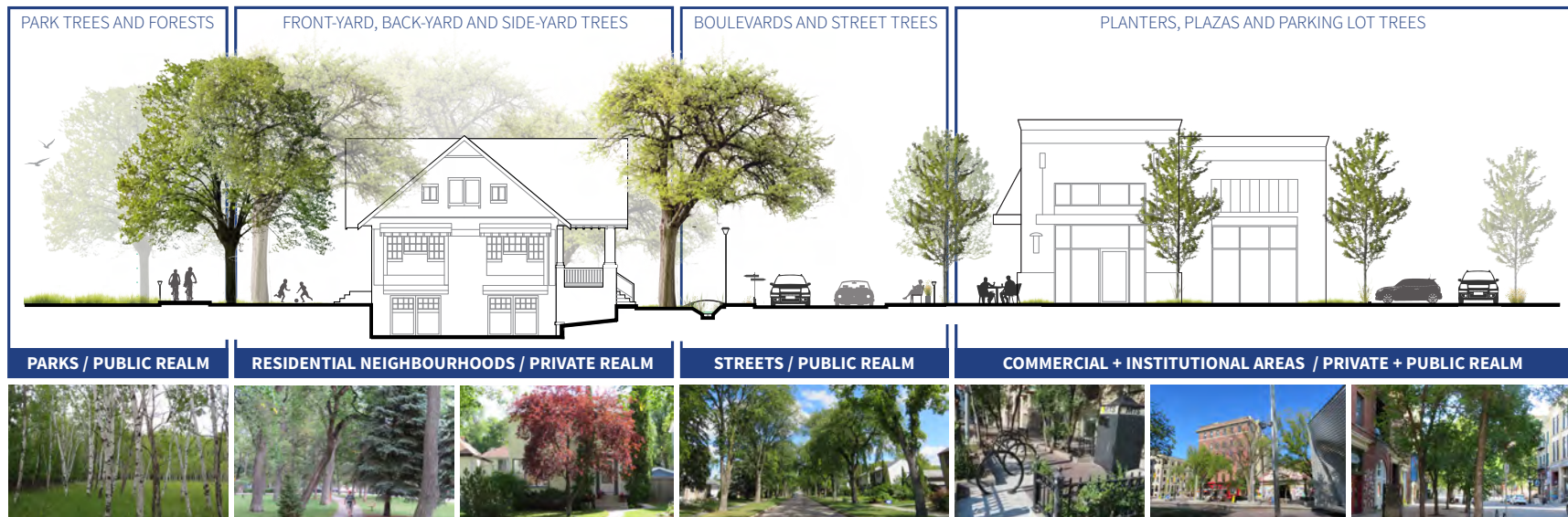


Figure 2 - Winnipeg’s urban forest includes all trees and associated vegetation, soil, natural processes, and cultural elements.



## Strategy purpose

Winnipeg's Comprehensive Urban Forest Strategy puts forward the broad long-term vision for the City's urban forest and provides clear direction and measurable outcomes necessary to achieve the vision. This document also contains goals, policies, and actions intended to improve the City's capacity to manage its urban forest assets to meet the needs of the community, adapt to change, formalize service delivery, and build partnerships.

The Urban Forest Strategy guides:

- How the urban forest will be planned to achieve an equitable distribution of benefits that will improve the health of our people and communities.
- Where and how trees will be planted to grow a robust and sustainable urban forest that delivers urban forest services where they are most needed.
- How trees will be managed to adapt to challenges, improve tree health and safety, and achieve planned levels of service.
- Where and how the urban forest should be protected to sustain urban forest canopy and community benefits.
- How to partner to increase capacity to grow and manage the urban forest raise awareness of its importance.

By implementing the Strategy, the City will prioritize resources, strengthen policy, and broaden partnerships to achieve a vision for an urban forest that contributes to the health and wellbeing of all people and communities.

## Document structure

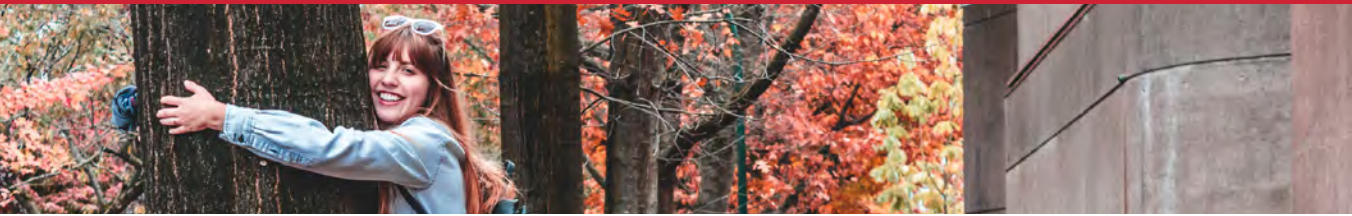
The Comprehensive Urban Forest Strategy is organized into seven main sections:

- 1. Introduction** – introduces the urban forest, the purpose of the Strategy, and the structure of the document.
- 2. Background and context** – identifies the value of trees to Winnipeg, provides relevant historical contexts, and presents the key urban forestry services and relationship to supporting City policies and plans.
- 3. Opportunities and challenges** – presents key opportunities and challenges for managing Winnipeg's urban forest reflected in the policies and actions included in the urban forest strategic framework.
- 4. Urban forest baselines and service level targets** – describes baselines and targets for the provision of healthy tree assets throughout Winnipeg.
- 5. Urban forest strategic framework** – outlines the vision, key values, defining levels of service, and associated goals for planting, management, protection, and stewardship including the strategies and actions needed to meet each goal.
- 6. Measuring progress** – summarizes the key targets set to measure progress and provides timelines for reporting.
- 7. Appendices**

## 2. Background and context

Section 2 presents the current state of the urban forest and informs the urban forest strategic framework. The section delves into the importance of Winnipeg's urban forest, relevant history, engagement results, management context, and how the Urban Forest Strategy relates to other policies and plans. The discussion expands on the i-Tree Eco benefit analysis work and reported in the State of the Urban Forest report (Appendix A).





## Winnipeg's urban forest

- Stores more than 500-thousand tonnes of carbon
- Removes 270 tonnes of pollutants annually
- Prevents more than 1 million cubic metres of stormwater from entering drains annually

### The importance of trees: benefits of Winnipeg's urban forest

Trees provide vital environmental, economic, cultural, and social benefits to the community. People have understood the value of trees and forests in a variety of ways throughout history. In the relatively new field of urban forestry, the benefits provided to humans by trees and ecosystems are often called **ecosystem services**. Increasingly, municipalities are managing trees in cities as assets, just like sewers and streetlights, to maximize benefits, reduce risks, and provide a satisfactory level of service for a sustainable cost. The following sections explore a sampling of the diverse benefits trees provide to people and communities.

#### Environmental benefits

Trees help moderate the environment and, as a keystone structure in natural ecosystems, create microclimates, increase soil nutrients, and support habitat for plants, animals, and insects. Along Winnipeg's rivers, trees and other plants are critical for reducing soil erosion and stabilizing the riverbanks. Trees can also help our community mitigate and adapt to climate change by storing and sequestering carbon, intercepting rainwater, and providing shade and cooling during hot days.

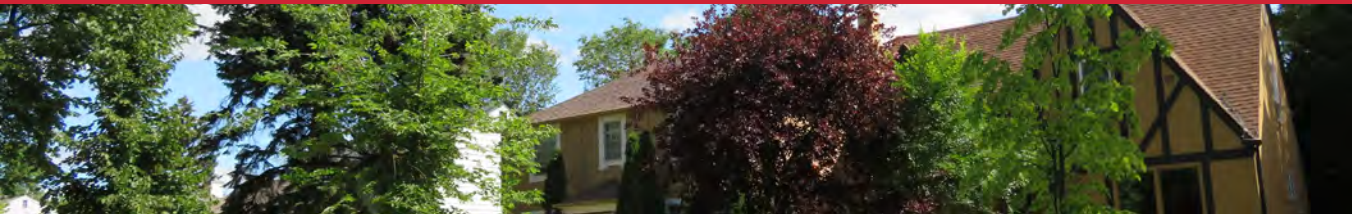
**Storing and sequestering carbon** – Trees sequester and store carbon, critical for reducing the atmospheric concentration of carbon dioxide contributing to greenhouse gas emissions to mitigate the effects of climate change. The plants and soils that make up native grasslands are also critical for carbon storage in the prairies. Winnipeg's entire urban forest stores an estimated 509,000 tonnes of carbon in trees, resulting in an estimated total value of \$39.2 million. Each year, trees sequester an estimated 39,000 tonnes of carbon dioxide which is roughly twice that generated annually from building electricity in Winnipeg<sup>3</sup>.

**Provision of habitat** – The urban forest provides critical habitat for native plants and animals, particularly in the city's naturalized areas that are home to hundreds of millions of native trees. These riverbottom aspen and oak forests foster high biodiversity of native species, including endangered species and habitats. Throughout Manitoba, there are 25 animals and eight plants listed as endangered under the *Endangered Species and Ecosystems Act* and many rely on the tall grass prairie ecosystems found within our natural areas<sup>4</sup>.

**Cleaning air** – Clean air is important for human health. Trees remove particulate matter including carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone, and PM2.5 while producing oxygen for us to breathe. Our city's entire urban forest removes an estimated 274.2 tonnes of pollutants per year and produces approximately 15,000 tonnes of oxygen annually.

**Stormwater reduction and erosion control** – Urbanization increases the overall abundance of hard surfaces, which reduces rainwater infiltration into soil and increases surface runoff. The water that runs off these hard surfaces during storm events can overwhelm the drainage system resulting in surface flooding, contamination of waterways, and erosion of riverbanks. Trees can help reduce runoff by catching and slowing water with their leaves and stems, while their root systems hold soil together to reduce bank erosion. Trees in Winnipeg prevent an estimated 1 million cubic metres of stormwater from entering the stormwater system each year.

**Shading and cooling** – Trees are nature's air conditioners and, on hot summer days, provide shade and cool our city streets and buildings. Cooling benefits are especially important in urban areas where the abundance of hard surfaces (like pavement) results in a temperature several degrees higher compared to surrounding rural areas, known as the urban heat island effect. Climate projections indicate that heat waves in Winnipeg will increase from three to four days to seven days or more by 2051-2080<sup>56</sup>. Tree canopy can help offset the urban heat island effect, particularly once tree canopy exceeds 40 percent in a city block<sup>7</sup>.



## Trees support:

- Placemaking
- Spirituality
- Traditional practice
- Connection to local culture
- History of landscape

## Health and wellbeing benefits

Winnipeggers visit the urban forest to recreate, appreciate the landscape, and experience nature. Trees also encourage socialization and reduce feelings of isolation, observed through stewardship activities and recreation activities forming connections between individuals with the shared respect for the urban forest.

**Reducing stress and improving overall health** – Physical activity is well-known to improve overall health. Living close to a greenspace encourages outdoor exercise and increases opportunities for physical activity, which in turn helps to reduce anxiety, stress and depression. The act of forest bathing (known in Japan as Shinrin-Yoku) is the practice of fully immersing oneself in the natural world<sup>8</sup>. Studies show promising physical and mental health benefits of the practice including increasing immune system functioning by increasing natural killer cells; doctors are also starting to prescribe ‘nature’ to patients<sup>9</sup>. In 2020 during COVID-19, use of regional parks across Winnipeg increased by 51 percent<sup>10</sup>. Canada’s first national nature prescription program ‘PaRx’ was launched in 2021. Licensed health-care professionals can create nature prescriptions and offer patients a Parks Canada Discovery Pass free of charge.

**Connecting children with nature** – Research shows nature helps children develop connections to their surrounding environment and improves their mental, physical, and social health<sup>11</sup>. When asked to draw their favourite place in one study, 96 percent of children illustrated an outdoor scene<sup>12</sup>. However, an American study found the average child spends over seven hours a day in front of a screen, highlighting the importance of nearby, accessible nature<sup>13</sup>.

**Reducing heat-related illness** – Extreme heat can cause heat stroke and exacerbate underlying health conditions. Extreme heat events are increasing in duration across Canada and trees can mitigate risk factors by cooling temperatures and lowering the urban heat island effect<sup>14</sup>. Maximizing tree canopy is critical, especially in areas with vulnerable populations who are more susceptible to heat related illnesses<sup>15</sup>.

## Cultural benefits

Trees provide an opportunity for place-making, spirituality, traditional practices, and connection to local culture and heritage.

**Creating a sense of local identity** – Trees are iconic in Winnipeg and are part of the city’s identity. Sometimes called a ‘prairie oasis’ and an ‘elm city’, Winnipeg has a long-standing tradition of urban forestry with significant elm plantings occurring early in the city’s history. Place-making and memories are made through the shared experiences and stories of significant trees, heritage streets, and natural forests.

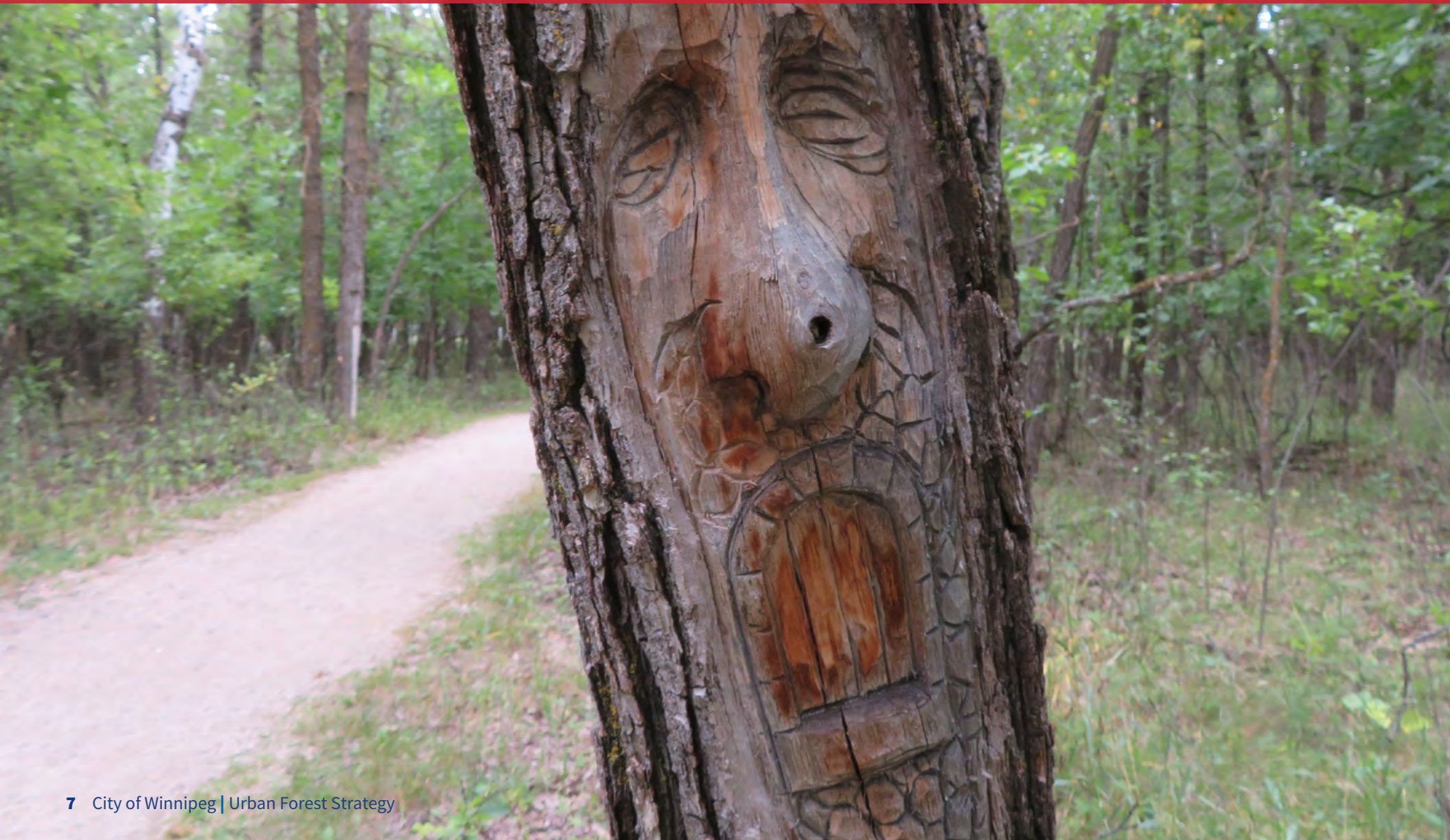
### **Connections to Indigenous culture and relationship to land -**

Winnipeg is located in Treaty No. 1 Territory, the home and traditional lands of the Anishinaabe (Ojibwe), Ininew (Cree), and Dakota peoples, and in the National Homeland of the Red River Métis. Our clean drinking water comes from Shoal Lake 40 First Nation, in Treaty No. 3 Territory. The tall grass prairie ecosystem has long been managed and utilized by Indigenous people, such as for growing and harvesting food and medicinal plants. This connection to the landscape and longstanding relationship to the land and land-based practices are held sacred today. Due to the conversion of these ecosystems to agriculture and urbanized land use with the onset of European colonization, only one percent of these tall grass prairie remains in central North America.

**Connections to horticultural heritage** – The land which now houses our city has a rich legacy of horticulture. Indigenous peoples’ cultivated corn and other plants with useful medicinal, food and material properties. European settlers in the late 19th and early 20th century started gardens and farms for food production, and planted trees for shelterbelts and street trees for civic beautification<sup>16</sup>.

*When Dutch elm disease began impacting trees in St. Vital's Bois des Ésprits, wood carvers and Save Our Seine members worked with the City to create a landmark from a 150 year old tree slated for removal. In 2004, wood spirits were carved into the north and south facing sides of the tree. The north face was named Woody, and the south facing side was given the name Mhitik in an Ojibway naming ceremony.*

*Bois des Ésprits was protected from development in 2003 through a cooperative effort on the part of Save Our Siene, the City, the Province, and the developer. While Woody-Mhitik is no longer standing, many wood spirits have been carved out of dead trees over the years to watch over the forest and raise awareness of the importance of land conservation.*





## Trees can:

- Reduce the need for air conditioning by 30%
- Cut heating bills by 20-50%
- Raise property value 3-15%
- Encourage shoppers to spend 9-12% more

## Economic benefits

The urban forest contributes to the city's economy by reducing building energy costs, encouraging spending in business areas, decreasing health costs, promoting tourism, and providing other cost-saving ecosystem services.

**Energy savings** – Planting the right tree in the right place can yield energy use savings for the building owner. Research shows planting trees can reduce air conditioning usage by 30 percent and cut heating bills by 20-50 percent<sup>17</sup>. Trees planted on the north, northwest and east side of buildings provide shade to reduce air conditioning costs. Trees planted as shelterbelts can shield against wind and snow.

**Increase shopping** - Trees can benefit the local economy by beautifying and shading streets. A 2005 study found shoppers spend 9-12 percent more in central business districts with high quality canopy cover<sup>18</sup>. The same study found shoppers travel greater distances and spend more time visiting districts with high quality trees.

**Health savings** – Research shows trees provide health benefits that can reduce hospital stays and risk of heat illness and improve mental and physical health<sup>19</sup>. Heat waves can cause heat stroke and exacerbate existing health conditions leading to higher instances of sudden death<sup>20</sup>. Blocks with higher tree canopy are cooler on hot days. Research has also shown living adjacent to a greenspace decreases illness and disease of people with similar income levels<sup>21</sup>. One study from Toronto found having 11 additional trees in a city block decreases cardiometabolic health conditions equivalent to those in a neighbourhood with a \$20,000 higher median income<sup>22</sup>. Research also found the spread of emerald ash borer across 15 American states was associated with 21,000 additional deaths from cardiovascular and respiratory disease, largely affecting wealthier areas with higher canopy<sup>23</sup>.

**Marketing the City** – Winnipeg's urban forest attracts tourists and new residents to Winnipeg who appreciate the forested parks and the shade and beauty of the mature boulevard trees in many areas. A treed city and the values associated with it can establish cities as green leaders and encourage other cities to follow suit.

**Value of ecosystem services** – Winnipeg's trees are estimated to have a compensatory value of more than \$3.3 billion, and store almost \$40 million worth of carbon. An i-Tree Eco study estimated the value of annual benefits provided by Winnipeg's whole urban forest at more than \$14 million per year. The 2019 i-Tree Eco analysis estimated the equivalent value of ecosystem services including pollution removal, carbon stored and sequestered, annual avoided runoff and building energy savings. More findings on the ecosystem services provided by the whole city and from trees in the City inventory can be found in the State of the Urban Forest report (Appendix A).

*In 1957, a group of 12 women took action to prevent the removal of a large elm at conflict with Wolseley Avenue. When City crews attempted to remove the tree, the women linked arms and formed a human chain around the tree, successfully preventing it from being cut down. The tree was eventually removed, but the legacy of community involvement in the protection of Winnipeg's urban forest can be observed to this day. You can visit the R.A. Steen Community Centre to see the Wolseley Elm Plaque commemorating the event just east of the community centre.*



1887

Arbor Day adopted as an official public holiday in Winnipeg

## A history of trees: growing Winnipeg's urban forest

Winnipeg's urban forest is part of the ancestral lands of the Anishnabe (Ojibway), Inineu (Cree), Oji-Cree, Dene, Dakota, and the Métis Nation. These Nations have rights and responsibilities to future generations to maintain and strengthen their distinct spiritual relationship with their traditional territories, lands, and waters. Native prairie ecosystems in and around Winnipeg have been altered by European settlement and colonial influences in westward expansion. Today, Winnipeg's population is nearly 767,000 people, of which over 85,000 are First Nations, Inuit, and Métis people, and is projected to add more than 55,000 people by 2025<sup>24</sup>.

Winnipeg has the largest Indigenous population of any city in Canada. Settler colonialism and residential schools disrupted Indigenous land management and connections to culture on the lands now known as Winnipeg. The appropriation of so-called vacant land and resources by settlers dispossessed Indigenous people of access to their land, and erased Indigenous presence to justify settler presence. Today's urban forest reflects the priorities and values of settler colonialism and more work must be done to create a more inclusive city that understands its past and commits itself to the principle of mutual respect.

### Becoming an 'Elm City'

Prior to colonial settlement, Winnipeg's landscape was dominated by tallgrass prairie maintained by Indigenous land management. Aspen and oak forests dotted the landscape and riverbottom forests of elm, ash and maple fringed the rivers. Forest cover increased with colonial settlement. The prairie was transformed into an 'elm city' through the concerted efforts of the provincial and municipal governments.

The first Arbor Day tree celebration was held in Nebraska in 1874, and it became a national event in the United States by the 1880s. Manitoba followed suit, adopting Arbor Day as a public holiday in 1887. During this time, Winnipeg nurseries began delivering trees throughout the city and



Figure 3 - Point Douglas area around 1875 showing the un-treed prairie landscape



Figure 4 - Photo depicts tree planting on Broadway Avenue looking west, circa 1916 (source: "Broadway Winnipeg", University of Alberta Libraries).





# 2016 to 2020

33,000 American elms lost in Winnipeg to Dutch elm disease

the City began dedicating land as parks (including the historic River Park and private Elm Park, which is now the Elm Park neighbourhood)<sup>25,26</sup>.

In the early 1900s, elm seedlings were transplanted from river valleys and planted along streets, creating today's legacy of mature elm tree canopies over Winnipeg streets<sup>27</sup>. In the early 20th century, American elm, Manitoba maple, and green ash were commonly planted.

The arrival of Dutch elm disease in 1975 posed a significant threat to Winnipeg's urban and natural forests. This devastating wilt disease is predominantly spread by Manitoba's native elm bark beetles, which carry the fungal spores from tree to tree.

The City and Province learned from the decimation of the American elm population in the United States, acting quickly to introduce legislation to protect elms and initiating a program of rapid detection and removal of infected trees annually to slow the spread of the disease. The program was effective, and today Winnipeg has the largest population of urban American elms of any city in North America and possibly the world.

In recent years, removal rates have been increasing due to the aging elm population, several years of drought, and a backlog in removals of diseased trees.

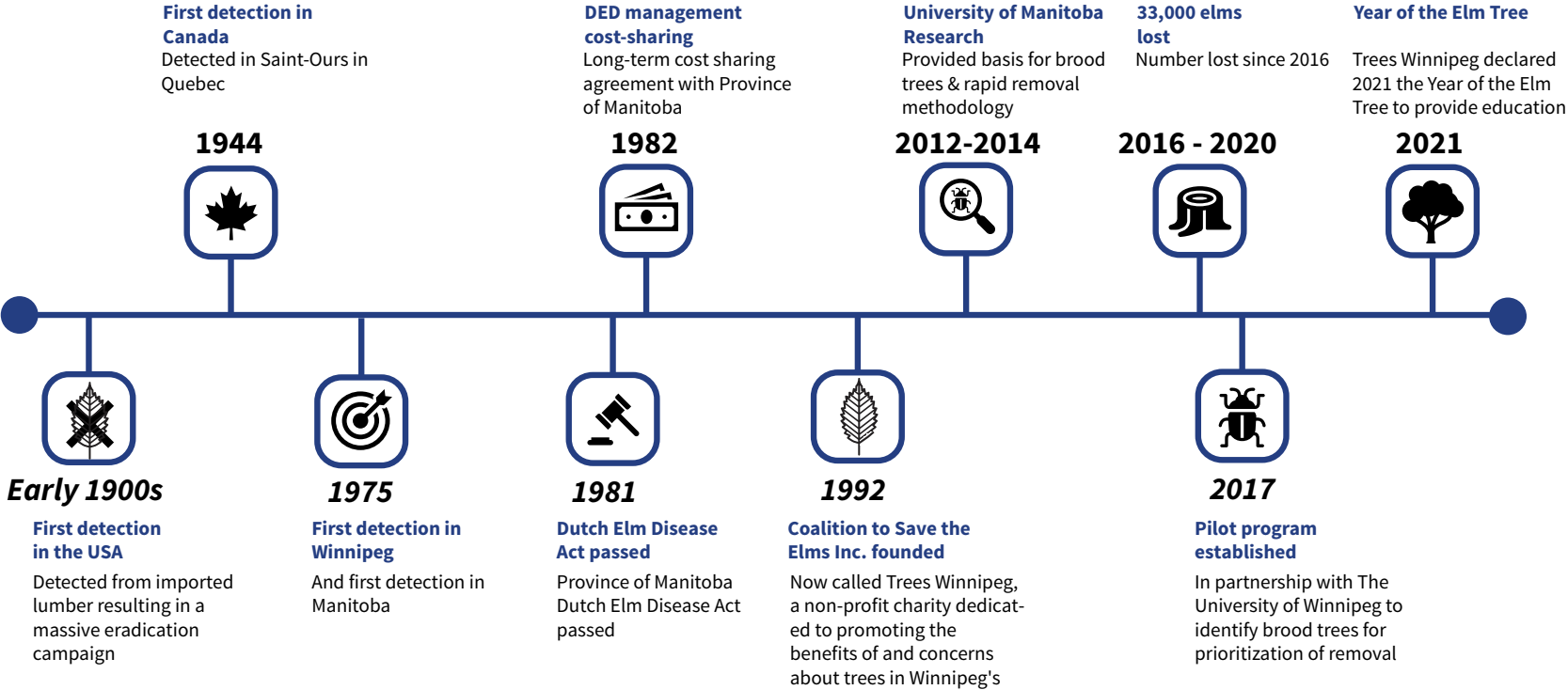


Figure 5 - A timeline of Dutch elm disease in Winnipeg

# The oversight of trees: managing Winnipeg's urban forest

Management of the more than three million trees in Winnipeg's urban forest is a responsibility shared by many stakeholders (Figure 9). The City primarily manages trees on streets and in parks but also works with a range of stakeholders to help plan, manage, and plant trees in general.

Property owners are primarily responsible for managing trees on their respective lands; however, the City has a role in regulating private land through the development process and providing Dutch elm disease management. Other stakeholders also support tree planting and tree care on private land.

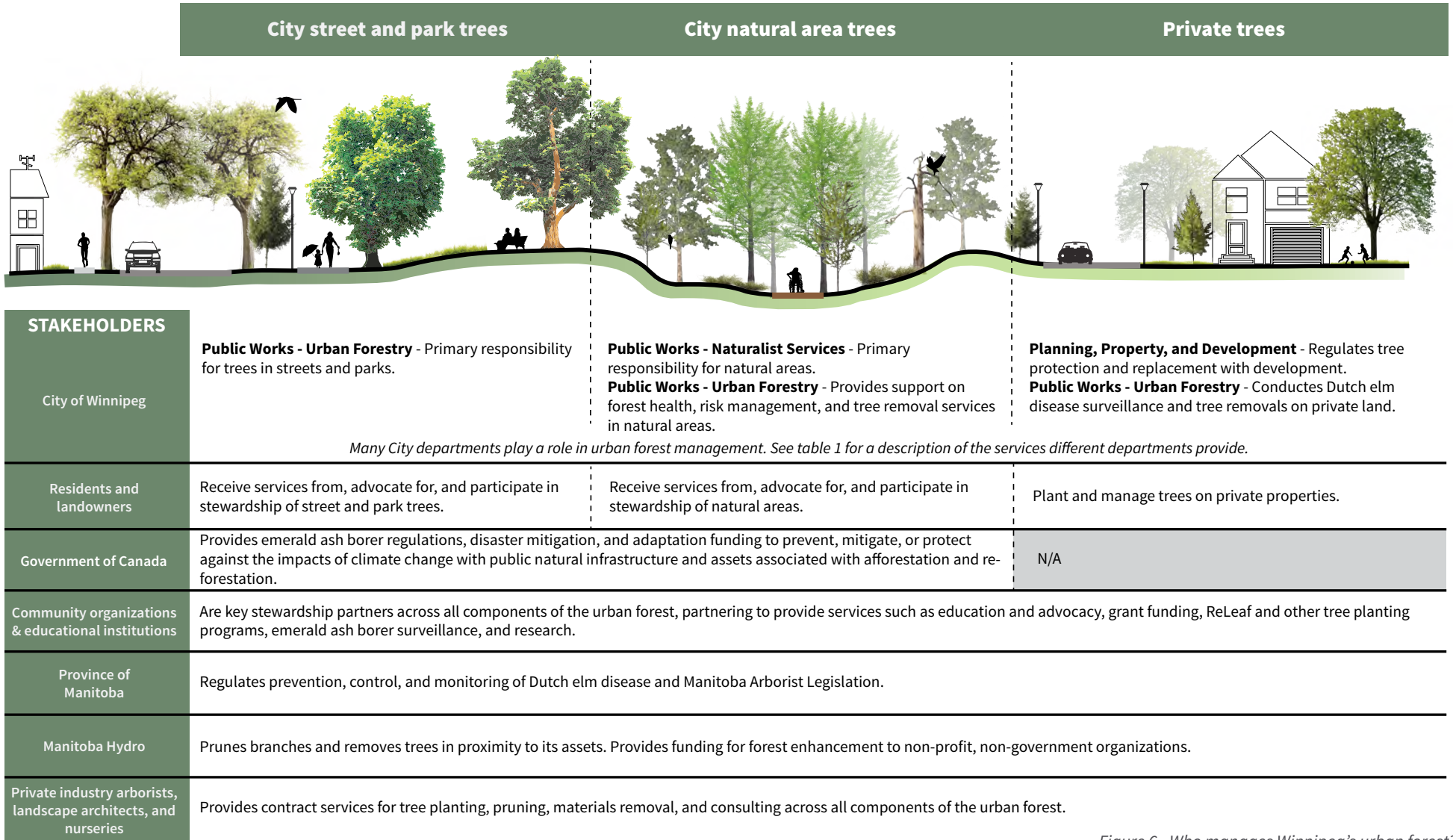


Figure 6 - Who manages Winnipeg's urban forest?

Table 1. City departments and divisions that work with the Urban Forestry branch to manage Winnipeg's urban forest

Urban Forestry branch				
Key interactions	Street and parks	Natural areas	Private	Service interactions
Department, division, or branch				
<b>Public Works divisions</b>				
Asset Management	●	●		Tree and green infrastructure asset management
Communications	●	●	●	311, service request process, 311 scripts, media, public engagement
Engineering	●	●		Road renewal, construction planning and design, project management, underground structures/services
Finance	●	●		Budgeting, expenditures, accounts payable, and recoveries
Fleet Management Agency	●	●		Procurement, rental, life cycle management of equipment
Human Resources	●	●		Support for recruitment and human resource concerns, collective agreement, training (includes Operator Training Branch)
Safety	●	●		Safety management program
Innovation and Technology	●			Tree inventory, data compilation, technology procurement and support, timekeeping
Parks and Open Space	●			Home of Urban Forestry Services, input and support in planting, protection and management of street and park trees
Insect Control	●			Provide elm bark beetle monitoring and control, tree defoliator monitoring and control, emerald ash borer monitoring and tree injections, technical support - street and parks
Naturalist Services		●		Planting - Natural areas restoration on public land and input to development planning Protection - Protection and preservation of trees in natural areas related to development and construction Management - Input to disease management and removals in natural areas, invasive pest management, trail maintenance Engagement - Living Prairie Museum, habitat restoration and volunteer groups
Streets Maintenance	●			Construction and maintenance of streets, winter road and sidewalk maintenance
Transportation	●			Transportation planning and design (complete streets, walking, cycling, transit, road network), managing visibility on rights-of-way, school zones
<b>Other departments</b>				
City Clerk	●	●	●	Supporting work of Council, reporting to Council
Corporate Finance	●	●		
Materials Management	●	●		Procurement, sustainable procurement policy
Risk Management	●	●	●	Claims, risk management
Office of the CAO	●	●	●	
Corporate Support Services	●	●	●	Information services and project management, employee development, safety management program
Legal Services	●	●	●	Contracts, bylaws
Planning, Property and Development	●	●	●	Zoning, urban design, park planning, development permit landscape review, planning checklists, inspections, tree planting securities, tree protection and preservation, land acquisition and sale, leases, easement (regarding Real Estate Division - which may impact or preserve trees); secure parkland dedication, impose conditions of development for boulevard tree planting (Land Development Branch).
Water and Waste	●	●		Stormwater and land drainage planning and construction, underground utility maintenance, resource/waste management, emergency services support
Office of Sustainability	●	●		Climate adaptation planning, ecosystem services evaluation

*(Left) Native plant nursery located behind the Naturalist Services Branch office in Charleswood. Most plants are grown from seed or cuttings collected within the city limits. This ensures that the plants are adapted to local conditions.*



*(Right) Native plant nursery showing a variety of trees, shrubs, grasses and forbs. Many of the species grown in the Naturalist Services Branch nursery are not available from the commercial nursery trade. Growing a wide variety of locally adapted species promotes biodiversity during habitat restorations.*



*(Below) Preparing the nursery for winter. Since the plants are still in pots their roots require extra protection and insulation in order to survive the winter. Plant pots are stacked and covered with flax straw and plastic to ensure the plants survive the winter.*



*Members of Naturalist Services plant nursery-grown trees at a volunteer planting in Charleswood.*





## Supporting trees: integrating Winnipeg’s policies and plans

The Urban Forest Strategy sits within a hierarchy of existing City policies and plans that enable and guide implementation. Existing plans, strategies, and policy tools supporting trees in Winnipeg are outlined in this section and categorized by those which enable, guide, and are associated with the Strategy, as well as bylaws and other policies.

### Enabling legislation

Three pieces of legislation primarily define the City’s authority to act on issues related to urban forest management: the *City of Winnipeg Charter*, the *Planning Act*, and the *Forest Health Protection Act*. The relationship between urban forest management and enabling legislation is illustrated in Figure 10.

#### City of Winnipeg Charter

The City of Winnipeg Charter enables Winnipeg to enact bylaws that may relate to the growing, control, and removal of trees, soil, and vegetation, and the protection of sensitive lands such as riparian areas. Council may pass bylaws regarding the physical impacts of development including establishing a system to require permits for development and impose terms and conditions on approvals.

The Planning Act is the provincial legislation that authorizes, describes, and identifies the hierarchy of Winnipeg’s land use planning framework. Under the law, Winnipeg must adopt a development plan to guide plans and policies respecting the City’s purposes and physical, social, environmental, and economic objectives, as well as plan implementation. Secondary plans are adopted by Council to address any matter or matters within Council’s authority or within the *Development Plan By-law*. Secondary plans have great influence on the physical form of the City and the shape of its forest environment, by dealing with subdivision and building standards, land use and development practices, and sensitive lands protection.

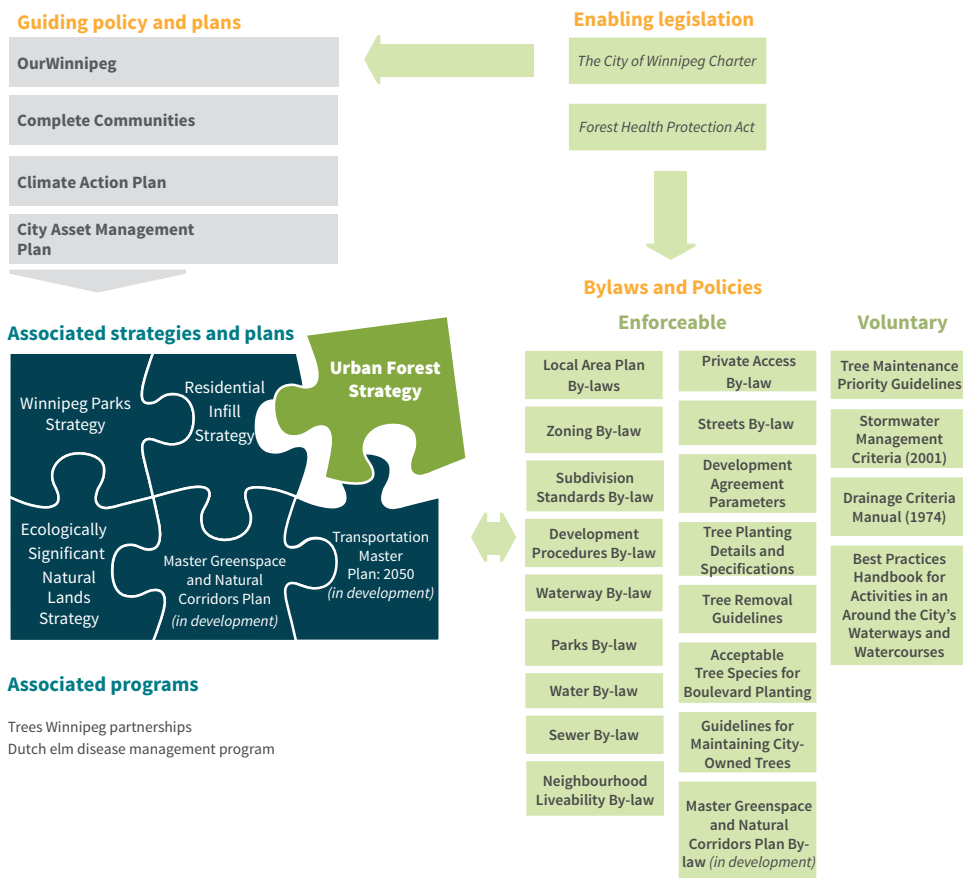


Figure 7 - The diagram above outlines Winnipeg’s plans and policies that have been reviewed towards developing Winnipeg’s Urban Forest Strategy. Guiding policy and plans such as Our Winnipeg provide broad direction and support for the Urban Forest Strategy. Associated plans, such as the Ecologically Significant Natural Lands Strategy, complement and will be complemented by the implementation of the Urban Forest Strategy. Bylaws, policies and guidelines are tools to implement the various plans and strategies on the ground.



## The Forest Health Protection Act

The Forest Health Protection Act is the provincial legislation that grants the City authority to carry out Dutch elm disease management and enforcement on all properties, including private property. It also regulates qualifications and activities of arborists in the arboriculture and urban forestry industry. The Forest Health Protection Act also identifies a Heritage Tree Program for the province including permitting municipalities to enact bylaws to protect heritage trees on municipal land.

## Guiding policies and plans

### OurWinnipeg 2045

*OurWinnipeg 2045* is the City's development plan, authorized under the Planning Act and adopted as *Our Winnipeg Plan By-law No. 67/2010*. It establishes the urban structures that define Winnipeg and will accommodate its growth in various forms.

OurWinnipeg 2045 lays the groundwork for the development of the Urban Forest Strategy by contemplating several key directions, including: management of City-owned trees as a capital asset; public realm improvements and park acquisition; biodiversity protection, pest management, and conservation of environmentally sensitive lands; collaboration with neighbouring municipalities, and; enhanced stormwater management and green infrastructure. Additional directions supporting the Urban Forest Strategy are provided in associated plans to OurWinnipeg 2045, such as *Complete Communities*.

### Complete Communities

*Complete Communities* is a secondary plan adopted following the approval of OurWinnipeg 2045. It is a secondary plan that provides direction to the City's urban form and development and establishes the urban structures that advance specific policies within the city's land use and zoning framework. The Urban Forest Strategy must address Winnipeg's defined urban structure in advancing policy to manage and grow the city's trees.

## Climate Action Plan

The *Climate Action Plan* provides a framework to proactively, meaningfully, and effectively mitigate climate change by reducing greenhouse gas emissions. The plan highlights several initiatives for city-wide deployment under an integrated urban forest strategy, including using advanced site improvements like structural soil cells in constrained planting environments, implementing integrated stormwater management planning, and supporting tree planting on private land through partnership with community programs.

The Climate Action Plan broadly directs the Urban Forest Strategy to:

- Prepare an urban forestry strategic plan that includes key indicators based on public health and climate mitigation considerations, with recommendations tailored to Winnipeg's diverse communities and urban structure
- Develop a Citizen Engagement Strategy to amplify and support urban forestry initiatives and the work of community partners
- Support equity in urban forestry program and service delivery among Winnipeg's neighbourhoods and communities
- Develop a methodology to quantify the value of ecological goods and services and natural assets

## City Asset Management Plan

Winnipeg's *City Asset Management Plan* (published in 2018) summarizes the inventory, overall replacement value, age, and condition of all the City's major asset groups. The asset management framework attempts to describe the value and scope of Winnipeg's infrastructure, the condition and remaining service life of city assets, and the funding deficit in relation to restoring or continuing city assets in acceptable condition.

Trees are only partly accounted for within this plan. Tree data represents assets located in parks and on boulevards only; trees in natural areas are not inventoried, other than elm and ash species. Tree asset values are reported as the average replacement value from City policy multiplied by the number of inventoried trees. Asset valuation for trees is currently limited in scope and application.

*(Left) Winnipeg is trying a unique approach to landfill management by piloting soil fabrication in support of the City's Biosolids Master Plan. The City is currently in the process of making the program permanent. The photo on the left depicts the fabricated soil spread on the closed Summit Road Landfill.*



*(Right) The photo on the right depicts the established native prairie landscape at the closed Summit Road Landfill. The goal is to establish a native prairie landscape using biosolids from wastewater treatment, woodchips from trees impacted by Dutch elm disease and emerald ash borer, and sand and grit from spring operations.*







The Asset Management Plan identified that resources are insufficient for necessary maintenance within Parks and Open Space. Developer-provided trees are being added to the City’s tree inventory without a long-term view to urban forestry program capacity.

#### Biosolids Master Plan

The *Biosolids Master Plan* (2014) was developed to identify options to recover and reuse nutrients and such as composting and soil products, and land application. Some of these options utilize wood chips generated from the management of Winnipeg’s urban forest.

### Associated strategies and plans

#### Residential Infill Strategy

Winnipeg’s *Small-scale and Low-Rise Residential Development Guidelines for Mature Communities* guidelines influence the capacity for tree preservation and replacement in areas where infill development is envisioned. The retention of mature trees with infill is prioritized, particularly for front yard and boulevard trees; an arborist report is required to guide tree preservation and protection during development. The quantity and size (at maturity) of new trees required with each development is dictated by lot width or linear feet. The requirement for new trees can be satisfied by preserving existing trees. The guidelines also include minimum percentage lot areas and setbacks that must be reserved for soft landscaping. Encroachment of underground parking beneath setback areas required for landscaping is discouraged to ensure the long-term viability of mature trees and vegetation.

#### Ecologically Significant Natural Lands Strategy

The *Ecologically Significant Natural Lands Strategy* (ESNL) defines criteria for designating natural areas for protection through development agreements, easements, or acquisition by the City. Natural areas are lands and/or waters having natural or native biotic communities representatives of the natural ecology of the region, significant animal or bird communities, cultural or historical significance, connectivity between natural areas for both wildfire and the public, and/or proximity to waterways.

The foundation of the ESNL is the inventory process, which identifies areas needing assessment to develop appropriate protection and management actions. The inventory process, directed by the City of Winnipeg Naturalist Services Branch, applies a consistent methodology to determine the relative value of a natural area. Assessed sites are rated for their habitat characteristics and classified into one of four grades. A risk determination is made in consideration of habitat quality and scarcity to guide designation. Distinct natural habitat types within the City include riverbottom forest, aspen forest, and oak forest. The ESNL provides a framework for identifying significant natural lands, including natural forests.

#### Winnipeg Parks Strategy

Winnipeg has developed strategies for each recreation and parks services to help guide investments in facilities, services, programs, standards, and procedures over a 25-year term. The *Winnipeg Parks Strategy*, in particular, supports the Urban Forest Strategy goals through policies related to demonstrating exemplary land stewardship by preserving, protecting, and enhancing significant and high-quality natural areas and urban forests.



## Bylaws

A summary of the key bylaws that regulate trees is shown in Figure 11, and all bylaws are summarized below.

### Development Procedures By-law 104/2020

The *Development Procedures By-law* outlines the process for development applications and related matters and differentiates development application types with associated approval bodies along with the associated governance structure and public hearing process.

### Zoning By-law No. 200/2006

The City's *Zoning By-law* determines building setbacks and minimum lot sizes throughout the City of Winnipeg. The bylaw also establishes general requirements for landscaping during the design of developments, including that all yards must contain a minimum of one tree for every 30 feet of linear street frontage. The bylaw presents a credit system for trees retained on site during development, though credits from preserved trees cannot offset the number of trees already required in street frontage landscaping on public land.

### Subdivision Standards By-law No. 7500/99

The *Subdivision Standards By-law* No. 7500/99 specifies that development must meet requirements under the Development Agreement entered by the City and a developer. The Development Agreement requires the developer to construct or install all required services and improvements as provided for in the Development Agreement Parameters, which detail the size and shape of street boulevards, utilities, and other public realm elements. The Development Agreement requires the developer to sell lands to the City to provide for land drainage flow as well as requiring the developer to dedicate lands to the City for parks or provide an equivalent cash payment. Standards, policies, and guidelines produced by the City regarding tree planting and care may be inserted as attachments into the Development Agreement.

### Waterway By-law No. 5888/92

The *Waterway By-law* creates a regulated area within 350 feet of the normal summer water level of specified rivers and 250 feet of the normal summer water level of specified creeks, subjecting these areas to additional development permit review by the City's Director of Planning or designate. No work is permitted within regulated areas that will restrict or impede surface or sub-surface water flow, endanger the stability of any land, including the bed of a waterway, cause land to slip into a waterway, or adversely alter the channel of a waterway. The bylaw provides indirect protection to trees within regulated areas.

### Park By-law No. 85/2009

The *Park By-law* stipulates behavior prohibited in City parks, including damage to and unauthorized removal of trees.

### Water By-law No. 107/2015

The *Water By-law* governs the provision of potable water to properties in the City of Winnipeg, including the design of irrigation systems using City water.

### Neighbourhood Liveability By-law No. 1/2008

Winnipeg's *Neighbourhood Liveability By-law* governs public nuisance and safety hazards on private properties in the city. Hazards can include deficient drainage, erosion, tree hazards, and conflicts with City works. The bylaw also regulates the use of open-air fire, requiring a permit from the Fire Chief for most burning not related to domestic cooking or heating. The bylaw further prohibits damage to and unauthorized removal of boulevard trees.

### Private Access By-law No. 49/2008 + Streets By-law No. 1481/77

The *Private Access By-law* and *Streets By-law* prohibit unauthorized removal of public right-of-way trees. The *Streets By-law* also regulates private trees posing safety risks to public rights-of-way.

*Soil cell systems are one method of stormwater management used in various hardscapes throughout Winnipeg. These systems provide sufficient soil volume for roots to grow, and also slow down and clean stormwater runoff before it enters the sewer system. The systems are designed to create sustainable growing sites for trees to thrive for the benefit of residents and business patrons who enjoy areas that would otherwise be treeless spaces. One example of soil cell systems in place is on James Street to accommodate new tree plantings within the hardscape.*





## Other policies

### Tree Planting Details and Specifications (in review)

The City of Winnipeg is currently reviewing guidelines to direct planting in the downtown area and on regional streets. Appendices to these specifications include detailed design drawings and construction information. Minimum soil volumes outlined in the guidelines are 8.5 m<sup>3</sup> to 12.75 m<sup>3</sup> per tree. The specifications also provide general instruction on the use of four “preferred” hardscape tree planting options: structural cells, vaults, raised planters, and structural soils. Tree protection during construction is also guided under this standard, and pre-calculated tree protection zones based on tree size determine the placement of required tree protection barriers around City-owned trees, however smaller barriers may be approved on a case by case basis. Installation of tree protection barriers is guided by the Urban Forestry branch and barriers cannot be removed without City authorization.

### Tree Removal Guidelines

The City applies these guidelines under the authority of the Private Access By-law, Neighbourhood Liveability By-law, and Park By-law to evaluate requests for the removal of City-owned trees. In general, the City prohibits the removal of healthy trees larger than 30 centimetres in diameter at breast height (DBH) due to the benefits these trees provide, but trees of any size may be approved for removal pending further consultation with the City Forester. Removal requests are granted on a case-by-case basis and only after receipt of the required compensation. Trees less than 10 centimetres DBH can be replaced at approximately the same size and the customer is responsible for removal and must forward the replacement cost to the Urban Forestry branch. Trees of 10-30 centimetre DBH are not easily replaced and are valued according to methods provided by the Council of Tree and Landscape Appraisers. In natural stands, replacement is 1:1 for trees of five centimetres, or one replacement tree for each 7.5 centimetres of DBH for trees 10 centimetres or larger.

### Acceptable Tree Species for Boulevard Planting

Planting species of trees other than those listed in this standard requires the written approval of the City Forester. All trees planted must meet the specifications in the policy and stock must be of the quality specified in the most recent edition of the Canadian Standards for Nursery Stock as published by the Canadian Nursery Landscape Association. The standard includes the general provision that all tree seed source and rootstock must be capable of surviving in hardiness zone 3 or lower. No species of ash (*Fraxinus* spp.) is acceptable for planting due to the high risk of damage and decline associated with emerald ash borer.

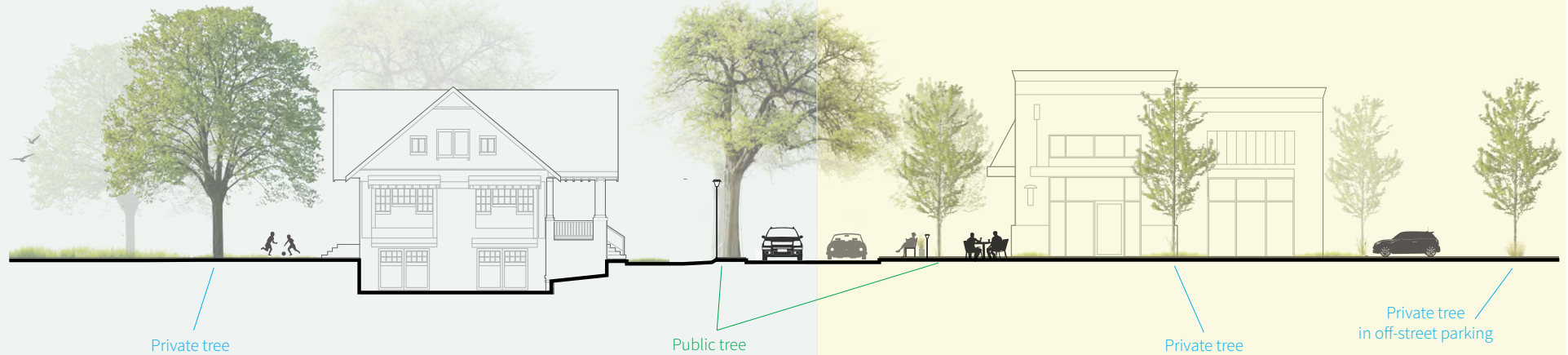
### Boulevard Tree Planting Guidelines as Required under Development Agreements

This standard applies to the default development agreement entered by the City and a developer, and requires the developer, in accordance with plans and specifications approved by the City Forester, to plant boulevard trees that will become City-owned. The developer must stake the proposed planting locations for review by the Land Development branch prior to any planting taking place. Following planting, City technicians from the Planning, Property, and Development branch will inspect the planting to confirm it has been completed to the satisfaction of the City’s tree planting details. The approval issued at this stage commences the maintenance period, which is generally no less than two years. The final inspection takes place to verify trees are acceptable to the City. Approval at this stage signifies the Land Development branch will accept the trees in writing, releasing the developer from further maintenance obligations. The guidelines also instruct developers to meet requirements for species diversification and spacing within boulevards.

# Bylaws and policies that apply to...

## Outside downtown

## Downtown



<p><b>Tree planting</b></p>	<p>The <b>Zoning By-law</b> requires tree planting outside of one- or two- family residential zones. The <b>Small-scale and Low-rise Residential Development Guidelines for Mature Communities</b> requires tree planting with infill development. Planting requirements are based on lot width or linear feet of frontage.</p>	<p>The <b>Downtown Zoning By-law</b> may require a development application to include a <b>Landscape Plan</b>. There is no specific requirement for tree planting, unless the permit relates to an off-site parking facility. <b>Urban Design Review</b> may consider and make recommendations for landscaping.</p>	<p>The <b>Downtown Zoning By-law</b> requires a development application for an off-street parking facility to incorporate tree planting as part of a <b>Landscape Plan</b>. The bylaw contains specifications that must be followed for tree siting, species selection, and maintenance.</p>
<p><b>Tree retention or removal</b></p>	<p>The <b>Boulevard Tree Planting Guidelines as Required Under Development Agreements</b> specify only trees that have been in the ground for two growing seasons will be considered for final acceptance. Removal and replanting during the maintenance period requires notification to the City.</p> <p>Trees impacted by construction receive protection under the <b>Tree Planting and Maintenance Specification</b> or <b>Tree Planting Details &amp; Specifications Downtown Area and Regional Streets</b>.</p> <p><b>Tree Removal Guidelines</b> apply whenever a request for the removal of a public tree is made to Urban Forestry, under the authority of the <b>Private Access By-law, Streets By-law, Neighbourhood Liveability By-law, and Parks By-law</b>. Public trees approved for removal are replaced by Urban Forestry per the ratios and compensation outlined by the guidelines. Requests to remove trees larger than 30 cm diameter may be declined, subject to further consultation with the City Forester.</p>	<p>The <b>Downtown Zoning By-law</b> has no provisions guiding the retention and removal of trees during development.</p>	<p>The <b>Downtown Zoning By-law</b> has no provisions guiding the retention and removal of trees during development.</p>
<p><b>Tree maintenance</b></p>	<p>Tree provided under a <b>Development Agreement</b> must be maintained by the developer under the required terms until final inspection and acceptance by the City. The <b>Tree Planting and Maintenance Specification</b> applies.</p> <p>Private tree owners may arrange maintenance under the <b>Guidelines for Maintaining City-owned Trees</b>. The City attempts to follow a block program under the <b>Tree Maintenance Priority Guidelines</b>.</p>	<p>All private owners have a responsibility under the <b>Neighbourhood Liveability By-law</b> and <b>Streets By-law</b> to manage their trees for public safety and nuisance hazards.</p>	<p>The <b>Downtown Zoning By-law</b> contains requirements for tree maintenance to preserve sightlines between public streets and adjacent properties, drainage, and encroachment on walkways.</p>

Figure 8 - Summary of bylaws and policies that currently regulate the planting, retention, removal, and maintenance of Winnipeg's trees on public and private land.



## Tree Planting and Maintenance Specification

The *Tree Planting and Maintenance Specification* applies to all planting and maintenance work on City-owned trees conducted internally and put out to tender by the City, including planting work associated with a development agreement. The planting and maintenance specifications incorporate the *City of Winnipeg Standard Construction Specifications* in its entirety, as well as standard construction drawings. Guidance is provided for tree placement and layout, supply and pre-planting care of trees, planting soil, watering requirements, trunk protection and supports, mulching, and planting timing and procedures.

## Guidelines for Maintaining City-Owned Trees

Property owners may arrange to prune, remove, plant, and apply pest or disease treatments to City-owned trees on boulevards and in parks, using a pre-qualified contractor at their own expense. A legal agreement that identifies the roles and responsibilities of the applicant and the contractor is provided. This document must be submitted by the applicant for review by the Urban Forestry branch and the work must be approved before work can commence.

## Tree Maintenance Priority Guidelines

The City attempts to follow a strategic block-pruning program to address pruning needs for boulevard and park trees. Residents may submit individual pruning requests, which are scheduled and completed on a priority basis. Priority 1 is a tree carrying a high risk of injury to people or damage to property and should be done as soon as operationally possible. Priority 2 is any tree that is not an immediate safety concern for risk of injury or damage but may become so in the future. Pruning is performed in the interests of long term tree health and structure, therefore, the City does not entertain requests for pruning where the given reason is related to nuisance or aesthetics.

## Stormwater Management Criteria

In 2001, the City organized a task group to explore alternative designs for land drainage systems. The resulting report proposed design criteria for alternatives to the standard stormwater retention pond design, to be used as baseline requirements for developers proposing new land drainage systems. The criteria contemplate the inclusion of stormwater management facilities in naturalized areas and constructed wetlands. Wetland treatment is subject to review by the City Naturalist and/or City Forester.

## Drainage Criteria Manual for the City of Winnipeg

Published in 1974, the *Drainage Criteria Manual* proposes the assessment criteria for drainage systems in the City of Winnipeg and the evaluation of alternatives. The manual predates the popularization of green infrastructure concepts, but is generally supportive of technologies that promote groundwater infiltration and reduce erosion — outcomes that broadly support urban forest health.



## Federal policies

The federal government is an influence on urban forestry through the control and research functions of its agencies. Additionally, the City of Winnipeg must comply with federal legislation protecting species at risk, fisheries, migratory birds, and certain classes of plants and plant products.

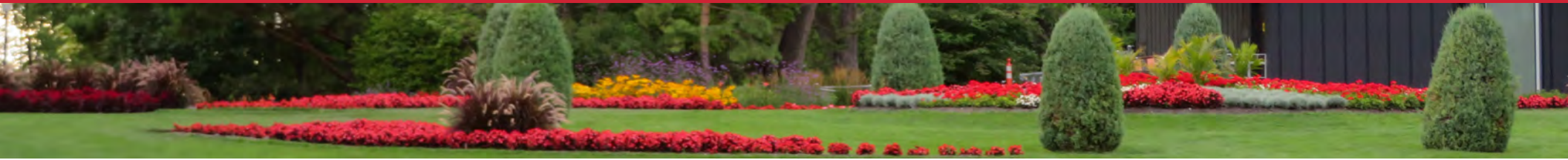
### Canada Food Inspection Agency

Canada Food Inspection Agency (CFIA) is responsible for the enforcement of the federal *Plant Protection Act* and regulations. CFIA adopts regulatory measures to prevent and control the introduction and spread of plant pests in Canada. This includes monitoring and regulating the transport of plants and plant products as the principal pathways of introduction and spread for many plant pests. The transport of regulated materials requires federal permits. CFIA introduced directives in July 1997 to restrict the importation and transport of elm material as a defense against the spread of Dutch elm disease. Additional controls on firewood were introduced in 2001. All of Manitoba is considered a regulated area for controls on the transport of elm plant material and firewood. In August 2003, CFIA introduced phytosanitary control requirements on wood products to prevent the introduction and spread of emerald ash borer. The City of Winnipeg is a regulated area under the directive since the detection of emerald ash borer in the city in 2017, but surrounding communities are not.

In addition to issuing control directions, CFIA conducts surveillance to verify the status of regulated and non-regulated areas. CFIA Plant Health Surveillance Unit plans and executes the national survey program for plant pests, and develops protocols, guides, and tools to assist local governments with pest control. For example, CFIA assisted the City of Winnipeg in surveillance as part of the City's emerald ash borer response in 2017.

### Canadian Forest Service

The Canadian Forest Service (CFS) administers forest health monitoring, national forest inventory, wildfire, climate change, cumulative effects, and extension programs to support forest management in Canada. The CFS provides scientific and technical support in forest pest management, including, since 2002, research into sampling and monitoring, economic impacts, and biological and chemical control mechanisms for emerald ash borer. The City of Winnipeg has provided branch samples to the CFS for research into the emerald ash borer life cycle, which will in turn guide the City's future response efforts.



## Summary of policy gaps

The review of Winnipeg's existing regulatory environment for trees reveals areas where the City can adopt or amend policy to secure improved outcomes for the urban forest. Some trees in Winnipeg are better protected than others. Policies that address good urban forest management are likewise incomplete. This partly reflects the City's ongoing development of a vision for its urban forest — a vision firmly established by the Urban Forest Strategy.

To secure a resilient urban forest, Winnipeg first needs to adopt a city-wide canopy cover target. The absence of a measurable goal for tree cover in the city could previously be explained by the lack of canopy cover data. With new geospatial information on the extent of the City's trees, Winnipeg can begin to set, measure, and monitor related goals for tree loss and replacement by land use or neighbourhood, more effectively schedule maintenance of public trees, and review tree protection with an eye for performance.

With clearly established goals for city-wide and sub-area canopy cover, the City can begin to address gaps in tree protection. With a majority of Winnipeg's tree canopy believed to occur on private land, the absence of a tree bylaw (or equivalent) to help manage and maintain tree canopy is a critical barrier to preserving urban forest values in the face of forest health and climate challenges. On public land, existing tree protection policies can be consolidated within a new City Tree Policy to harmonize tree protection standards across capital projects, provide clarity on best management practices, and improve community relationships.

Alongside enhanced tree protection, the Urban Forest Strategy encourages Winnipeg to embrace the ecological role of the urban forest in providing valuable climate adaptation and mitigation, habitat, and other ecosystem services. As the City updates its asset management plan, it can use new data from monitoring to account for unpriced benefits of the urban forest management program and support increased protection or enhancement of natural areas during the land development process.

Section 5 contains specific actions to fill these and other policy gaps identified by the background review.



## Public insights on trees: engaging on Winnipeg’s urban forest

The success of the Urban Forest Strategy rests on public input and buy-in. The City has undertaken a comprehensive public engagement process to ensure Winnipeggers’ values, priorities, and opinions were considered in the Urban Forest Strategy’s development. Phase 1 was completed in 2020 and Phase 2 is planned to obtain feedback on this draft strategy in 2022.

### Phase 1 public engagement summary

Phase 1 of public engagement took place in late 2020. Phase 1 of public engagement focused on developing a community-supported vision for the urban forest that reflects community perspectives on the city’s identity, culture, and aspirations. It also sought public input on opportunities to preserve, grow, and enhance the urban forest. Residents were invited to provide input through a survey, mapping tool, discussion forum, webinar, self-guided walking tour, and virtual walking tour. In-person walking tours were planned but were cancelled due to COVID-19 and provincial public health orders. Stakeholder organizations were also invited to provide input at a stakeholder workshop and through a stakeholder conversation guide.

#### Public participation:

- Over 4,300 visitors to the project webpage
- 1,753 survey respondents
- 72 attendees at the online presentations
- 96 mapping tool submissions
- 16 emails
- Nine posts on the forum
- 40 attendees at the stakeholder workshop and five submissions of the stakeholder conversation guide

*“I’m worried that we will lose all of our largest mature trees to invasive pests and diseases. I hope that in 20 years, we have been successful in slowing the spread of these pests and that we have planted more shade trees to replace the ones we have lost.” - Walking tour respondent*

#### Survey findings

- 82 percent of respondents wanted to increase the current tree canopy (Figure 9).
- 49 percent of respondents live on a street with regularly spaced, large trees and 53 percent would most prefer that same streetscape over any other alternative (Figure 10).
- 84 percent of respondents have been personally impacted by tree loss and 70 percent of respondents rated the impact on themselves as severe to very severe.
- Toward a vision: Respondents want to see tree canopy that includes diverse, large healthy trees spread across the city with a focus on planting on residential streets.
- The community particularly valued trees for the habitat they provide, air purification, natural experiences, and shading and cooling.

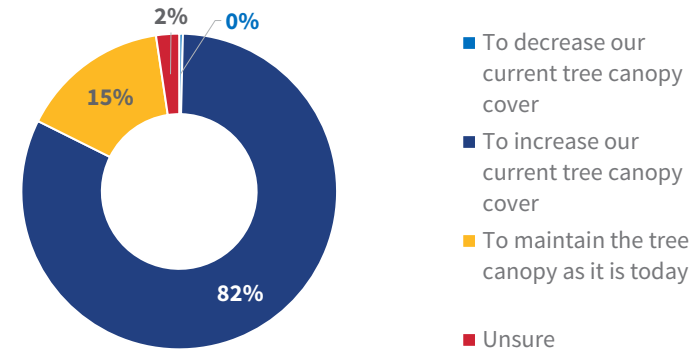


Figure 9 - Survey respondent preferences for Winnipeg’s canopy cover target

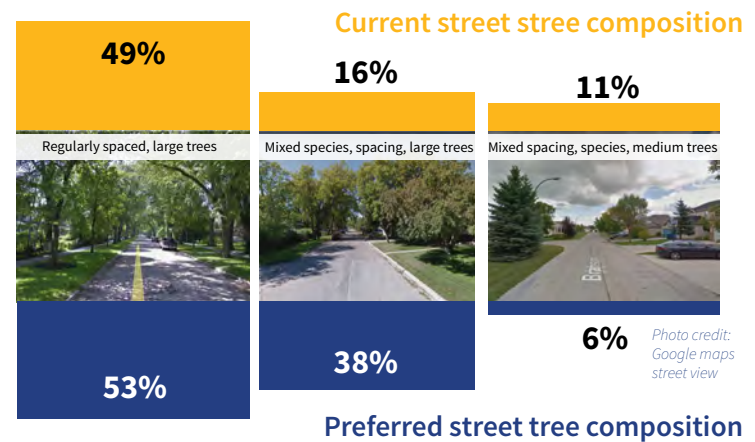


Figure 10 - Top three street tree compositions that respondents noted as currently existing on their street and what is preferred

*“Biodiversity needs to be improved. Although our elm forest is beautiful, the monoculture urban forest has proven to have detrimental impacts. Diversifying our canopies would have a huge amount of benefits in the long run.”*

**- Forum respondent**

## Mapping findings

In the mapping tool, participants were asked to think about trees and geography, then identify both places they value (Figure 11; left) and places where the canopy could be improved (Figure 11; right). Locations were valued primarily because of their beautiful mature trees, their large, forested areas, and/or their variety of ecosystem services. Areas flagged for improvement were noted as needing more timely removal of dead, dying, or diseased trees, as well as increased replacement, planting, and/or pruning

## Stakeholder workshop/conversation guide findings

Stakeholders suggested many improvements such as: increasing replacement planting; finding new and innovative approaches to planting; improving connectivity and the focus on biodiversity; improving tree care; expediting removals; increasing public engagement and education; and, bolstering partnerships with Trees Winnipeg and other active groups and organizations.

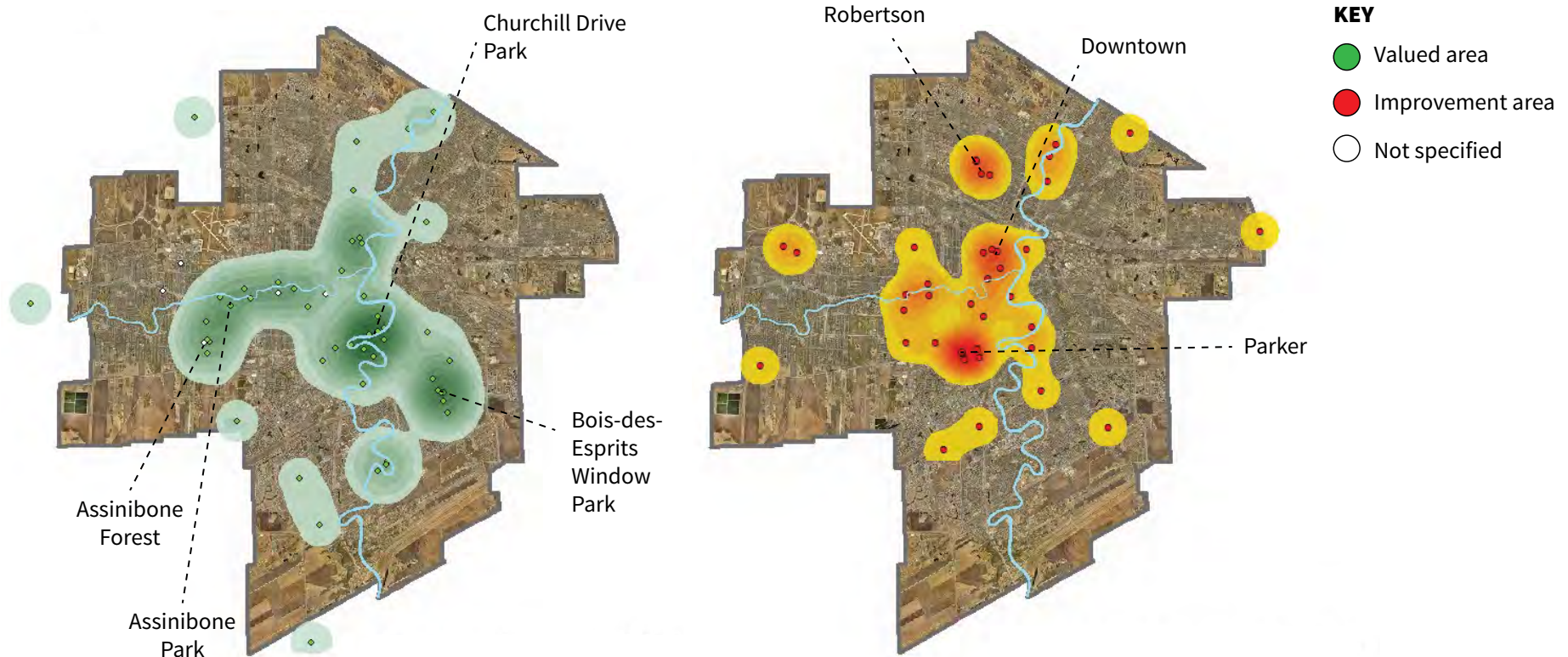


Figure 11 - Heat mapping results for places valued and places needing improvement from responses. The callout areas are where notable hotspots occurred.

# 3. Opportunities and challenges

Section 3 describes the key opportunities and challenges for managing Winnipeg’s urban forest, including healthy people, healthy forests, urbanization, equity, reconciliation, stewardship, and urban forest program sustainability. Priorities for addressing opportunities and challenges are reflected in the policies and actions included in Section 5.



## Healthy people

Climate change is expected to create challenges for both our people and our urban forests. Cities everywhere are facing serious threats related to public health, infrastructure costs, economic viability, and social equity associated with climate change. Climate resilience can be augmented through focused attention on the Winnipeg's urban forest canopy, and activities that help mitigate air pollution and the urban heat island effect while also enhancing human health and well-being outcomes.

The Urban Forest Strategy aligns with Winnipeg's Climate Action Plan, which sets a vision toward a holistic relationship with climate change and emphasizes the value of all things being connected. Trees and forests can help cities mitigate and adapt to climate change by capturing and storing carbon, intercepting rainwater to reduce localized flooding and providing shade and cooling on hot summer days.

### It is a priority to contribute to the health of our community by:

- Establishing and achieving levels of service to meet demonstrated community need
- Prioritizing tree planting and protection where it will provide the greatest benefits for our communities
- Maximizing the quantity and quality of trees planted in streets, parks and with new developments
- Collaborating across City departments to deliver co-benefits for climate adaptation, health and wellbeing through integrated policy and project approaches



Some areas of the city are hotter than others on summer days. The urban heat map (Figure 12) shows the relative hot spots and cool spots on land surfaces across Winnipeg on a hot summer day in July 2017. The coolest areas tend to be permeable areas with high tree canopy, irrigated landscapes like golf courses, and the river valleys. Areas with little tree canopy and abundant impermeable road and building surfaces tend to be hotter. Higher temperatures increase the risk of heat related illness and mortality, particularly for people who are vulnerable due to underlying physical and mental health and social factors.

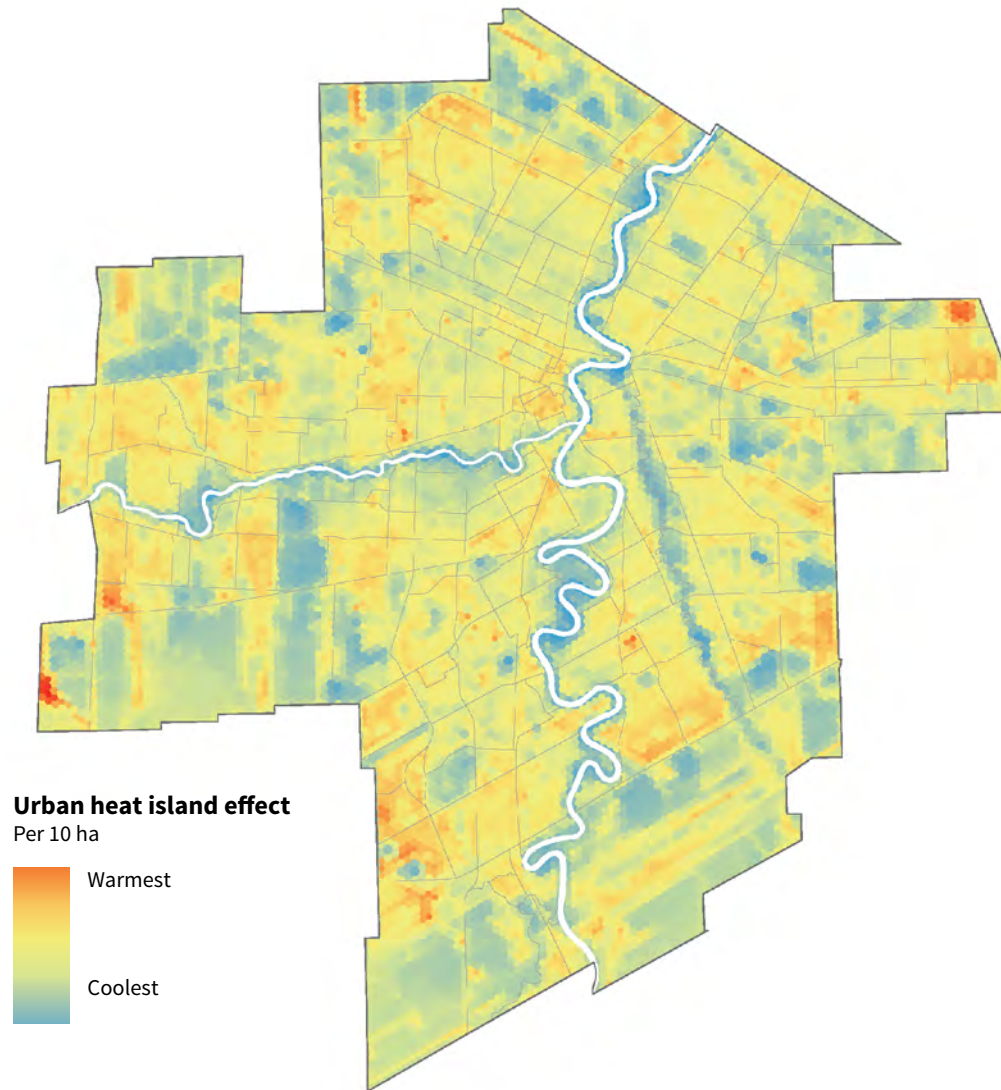
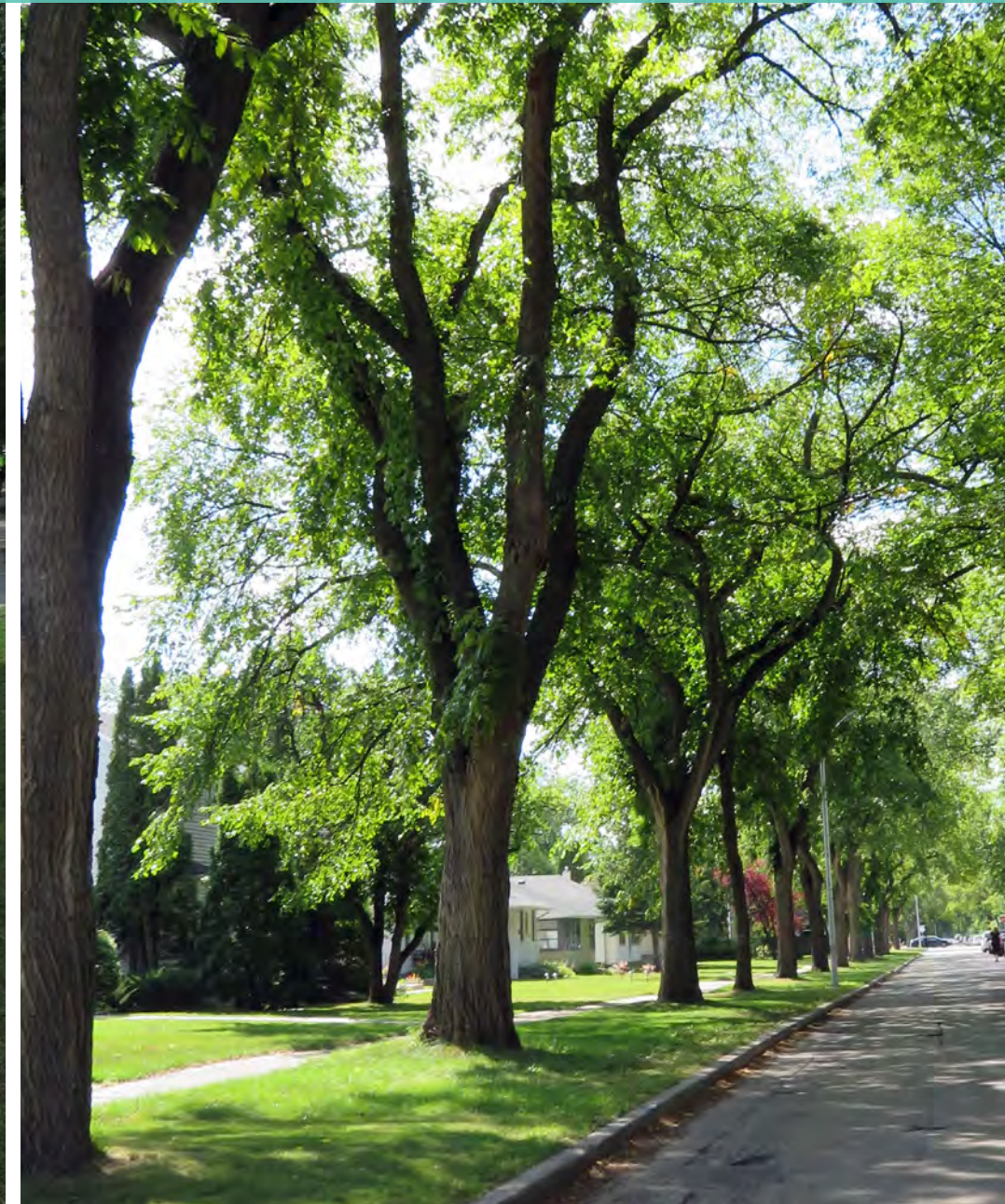
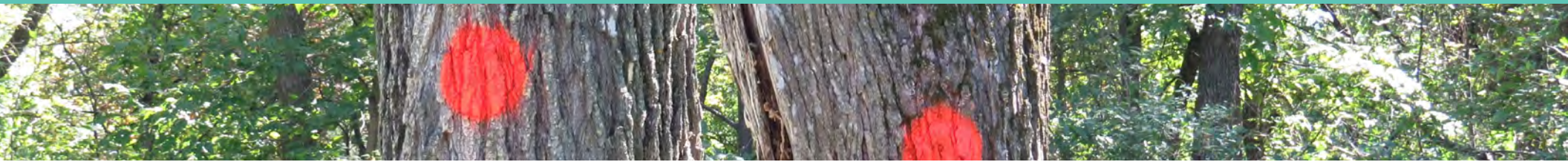


Figure 12 - The urban heat map illustrates the hottest and coolest locations in each neighbourhood based on the average temperature of the surrounding 10 hectares.

*Heat waves in Winnipeg are expected to increase from three to four days to seven days or longer by 2051-2080. Streets with low tree canopy are warmer on hot days than streets with more trees. Many of the older inner-city streets have canopy cover exceeding 40 percent, which significantly reduces the temperature on these streets on hot summer days.*





## Healthy forests

While trees help cities adapt to climate change, trees themselves also feel its effects. Though precipitation levels are expected to increase through winter, spring, and fall, summers are expected to be warmer and drier, which will subject trees to increased drought stress. Extreme events such as heat waves and heavy, wet snowstorms are expected to increase in frequency and may result in more tree damage. Warmer growing seasons have a direct effect on the life cycle of insects and may result in increasing insect populations, which is particularly concerning for emerald ash borer, elm bark beetle and gypsy moth, or newly introduced pests.

Increasing diversity, slowing mortality, and reducing susceptibility to existing insect pest threats will be essential to reducing vulnerability in Winnipeg's urban forest population. Just over half of Winnipeg's public tree population is susceptible to emerald ash borer and Dutch elm disease. Figure 13 shows the distribution of inventoried elm and ash in Winnipeg (public and private land). All areas of the city have vulnerable tree populations with significantly high populations of ash found within the Red and Seine River's natural areas. Elm and ash, compared to all other types of trees in the inventory, provide the vast majority of ecosystem services to the city and are critical to the natural biodiversity in the region.

### It is a priority to improve the overall health of the urban forest by:

- Ensuring that policies guiding tree planting, protection, removal and maintenance decisions are consistent with industry standards and best practices
- Following a best practices program for tree care and tree risk management for public trees
- Increasing the diversity of urban species in the public tree population and proactively replacing aging or dying elm and ash
- Maximizing the health and life expectancy of newly planted urban trees in City streets and parks
- Minimizing the use and impact of cultural practices that harm public trees
- Rapidly removing dead, diseased and dangerous trees
- Monitoring natural area forest cover and prioritizing invasive species removal where overstory canopy losses are expected

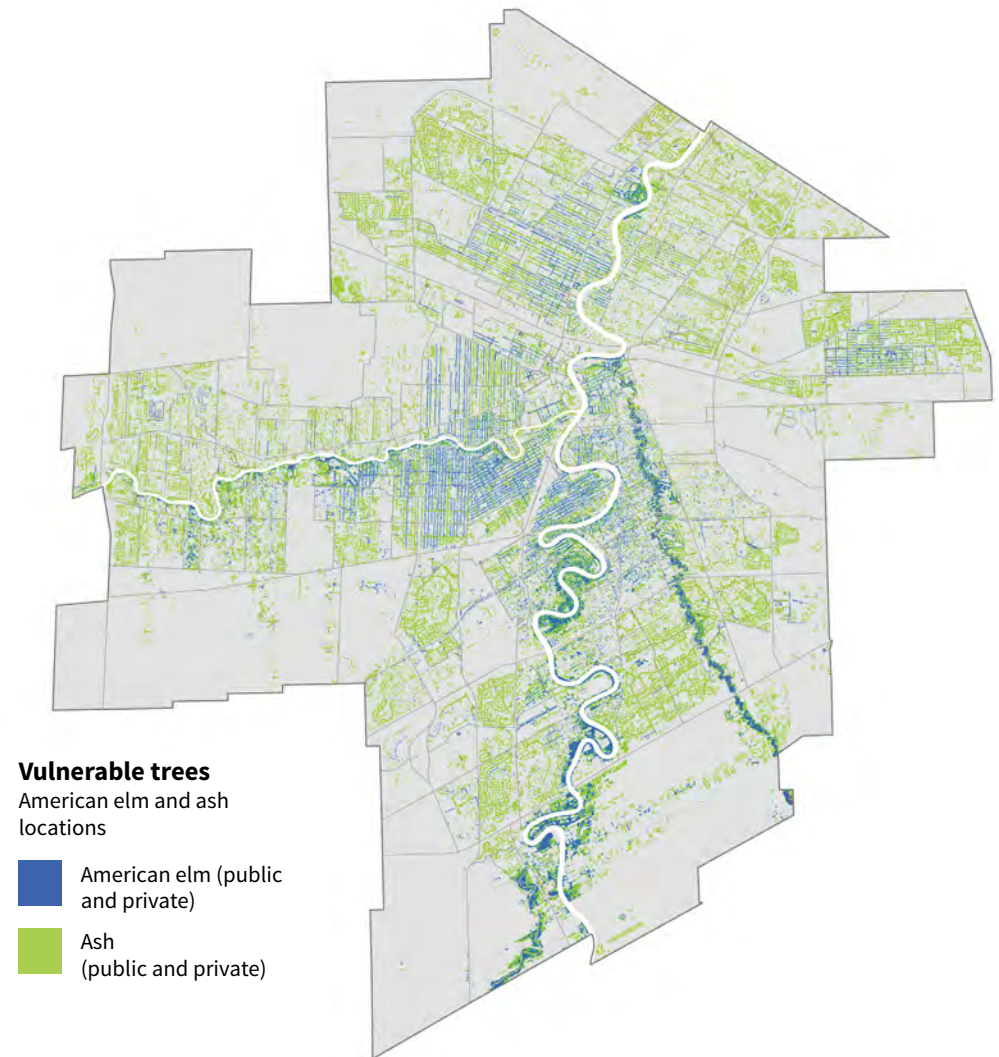


Figure 13 - Vulnerable American elm and ash populations on public and private land mapped throughout Winnipeg with neighbourhood boundaries

*Mature American elm trees have shaped the character and identity of many Winnipeg neighbourhoods. As Dutch elm disease continues to threaten Winnipeg's elm canopy, the loss of these majestic trees is deeply felt by those who live nearby. It is not uncommon to find heartfelt notes, cards, or ribbons left on trees marked for removal, illustrating the impact of the loss on the community.*





## Urbanization

Winnipeg is growing, both through new development at the urban fringe and with densification of existing urban areas. New development can result in both gain (e.g., where trees are added to what was prairie) and loss (e.g., where aspen forest is cleared). Densification of existing urban areas with infill development often means existing trees have to be removed and trees on neighbouring properties may be damaged. Winnipeg addresses some of these challenges in existing policies related to zoning and various guidelines and specifications for development, however, current policies particularly related to private land lack adequate protection and preservation of existing trees and associated enforcement.

Council has directed the public service to consider a tree protection bylaw for private properties. Cities in some parts of Canada use tree bylaws to regulate the protection and replacement of trees on private or public land. Tree bylaws typically function so that trees of a certain type (e.g., size, species, location) are protected and cannot legally be removed unless the owner obtains a tree permit (see Appendix B for a comparison of tree bylaws in Canada). Often, tree bylaws are enacted to regulate tree removals and require tree replacements in order to safeguard community tree benefits.

Tree bylaws and related regulations can have significant implications for resourcing to administer the bylaw process and review planned tree removals and protection for retained trees. The increased cost and resourcing should be focused in areas where the greatest improvement to tree retention and protection can be achieved.

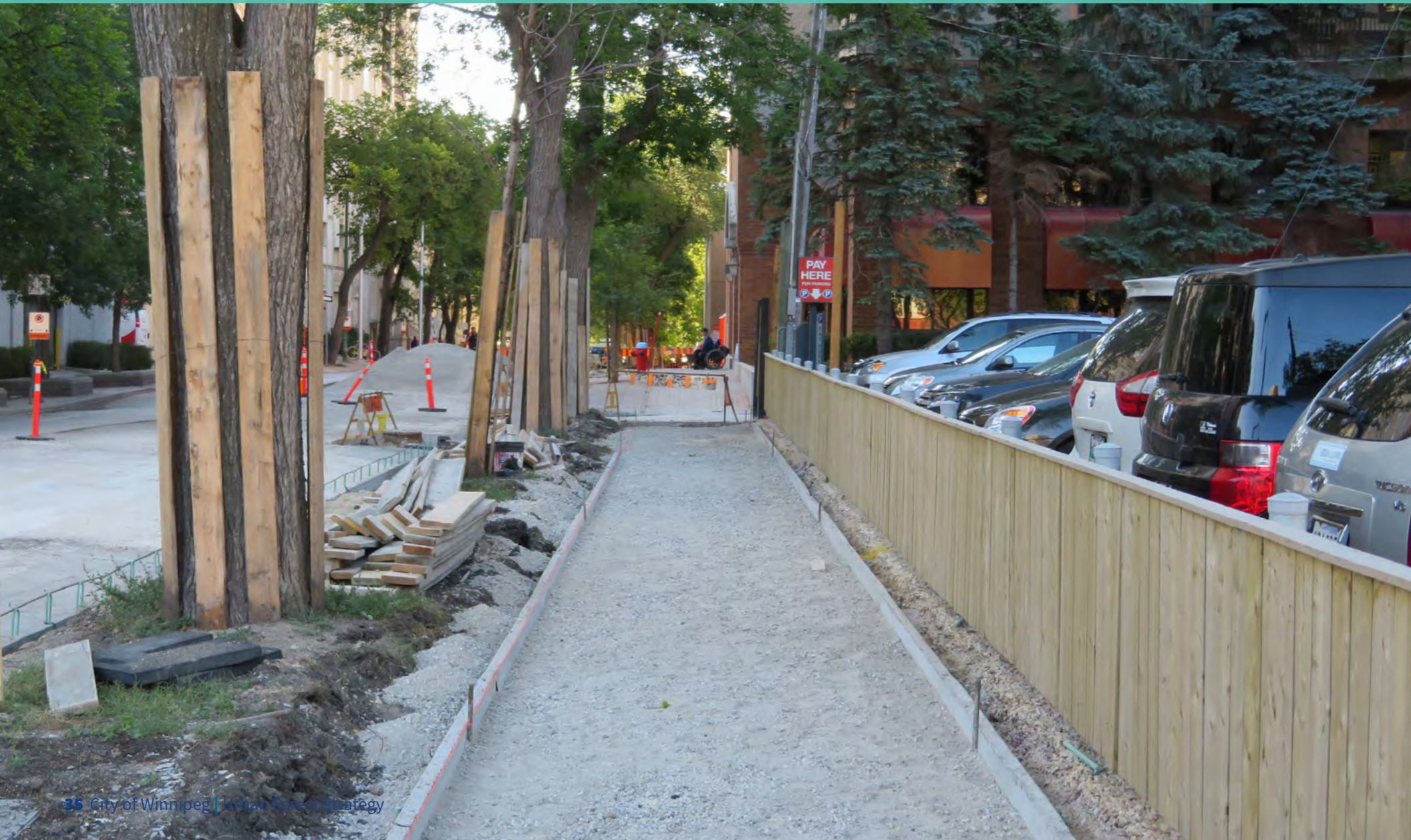
**It is a priority to minimize the impacts of urbanization on the urban forest by:**

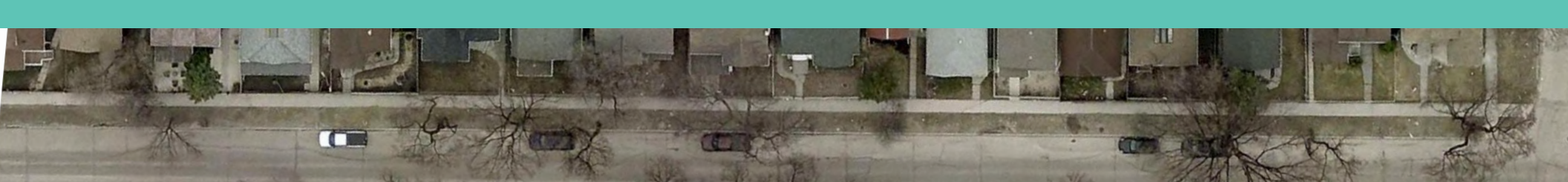
- Increasing protections for trees and soil on private and public land
- Maximizing the quantity and quality of trees planted with development
- Expanding and enhancing naturalized forest and riverbank areas
- Creating a connected and protected green infrastructure network of urban trees, parks and natural area forests





*Urbanization, or the process of an area being made more urban during development, typically increases the extent of paved or built surfaces. Trees and soil are often removed to accommodate new buildings or paved areas. When this work happens around existing trees, they can be damaged by excavation or machinery unless good tree protection measures are in place. Urbanization also reduces the volume of soil and the amount of water available to trees, which often means they are less healthy and have shorter lives than trees growing in permeable areas like parks. In urbanized areas, adequate soil volume needs to be protected or built into projects for trees to live long, healthy lives.*





## Equity

Trees and their associated benefits and services are not distributed equitably across Winnipeg. Poverty can be a significant barrier to health, wellbeing, and social equity. People living in poverty may have fewer means to access private amenities that can reduce vulnerability to heat, such as shady back yards and in-home or in-car air conditioning, or provide other benefits of views and access to nature that people often receive from backyards or travel destinations. For some people, public trees and forests provide a main opportunity to keep their home cooler, provide shade as they walk to school or work, or to experience nature.

In Winnipeg, areas of higher poverty were identified in the 2020 Defining Higher Needs Neighbourhoods report to the Standing Policy Committee on Protection, Community Services and Parks. Areas of higher poverty were identified using 2016 Census data (Figure 14).

These higher poverty areas were compared with the City's public tree inventory, temperature data from a hot July day, and satellite derived canopy data. As shown in Figure 15, areas of higher poverty had significantly:

- Lower tree density per hectare
- Fewer trees per person
- Lower average canopy cover
- Lower tree diversity
- Higher average temperatures

No significant difference in the density of vacant planting sites was found in areas of higher poverty as compared to other areas.

In older neighbourhoods, these results are in part explained by the historic street tree planting pattern, which has created streets of fewer but older, larger elm trees. Other higher poverty neighbourhoods are characterized by higher densities of people and impermeable surfaces or infrastructure that has limited the density of trees.

The benefits of trees and forests should be available to all Winnipeggers and all individuals and groups should have equitable access to urban forestry services and governance.

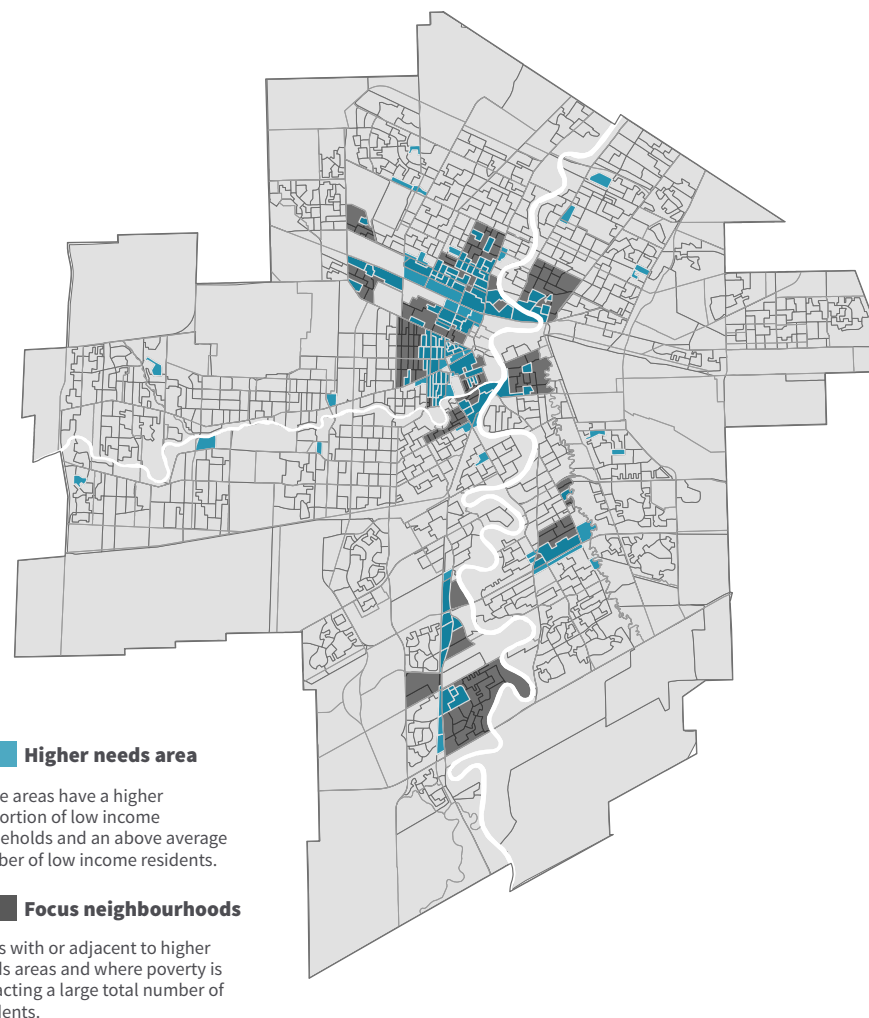


Figure 14 - Areas of higher needs identified 2020 Defining Higher Needs Neighbourhoods report

Data: Target group profile of Market Basket Measure (MBM) population, Census, 2016

Geographic level: Dissemination area (DA) - Statistics Canada standard geographic area composed of one or more neighbouring dissemination blocks and is the smallest standard geographic area for which all census data are disseminated (typically with a total population of 400 to 700 persons)



Exploring the urban forest through an equity lens reveals inequities in the distribution of canopy cover and related health and wellbeing benefits such as shade and cooling on hot days (Figure 15). The lower diversity of existing trees in high poverty areas indicates that tree populations in these areas may also be more vulnerable to canopy loss due to Dutch elm disease and emerald ash borer.

Inequities also exist in terms of access to and influence on decision making about where urban forestry services and resources are prioritized. Winnipeg is growing and diversifying, with an increasing proportion of the population identifying as a visible minority. New Canadians account for almost 25 percent of the city’s population and may have needs and preferences that differ from what has typically been provided in terms of tree planting and management. The urban forestry system needs to be able to evaluate and respond to changing community needs.

**It is a priority to improve equity in urban forest management by:**

- Developing a customer service framework which prioritizes socially equitable service delivery and considers geographic areas of higher poverty
- Collaborating across City departments to deliver poverty reduction co-benefits through integrated policy and project approaches
- Prioritizing tree planting and replacement in areas of higher poverty
- Working with community partners to provide programs to plant trees, foster stewardship and contribute to poverty reduction

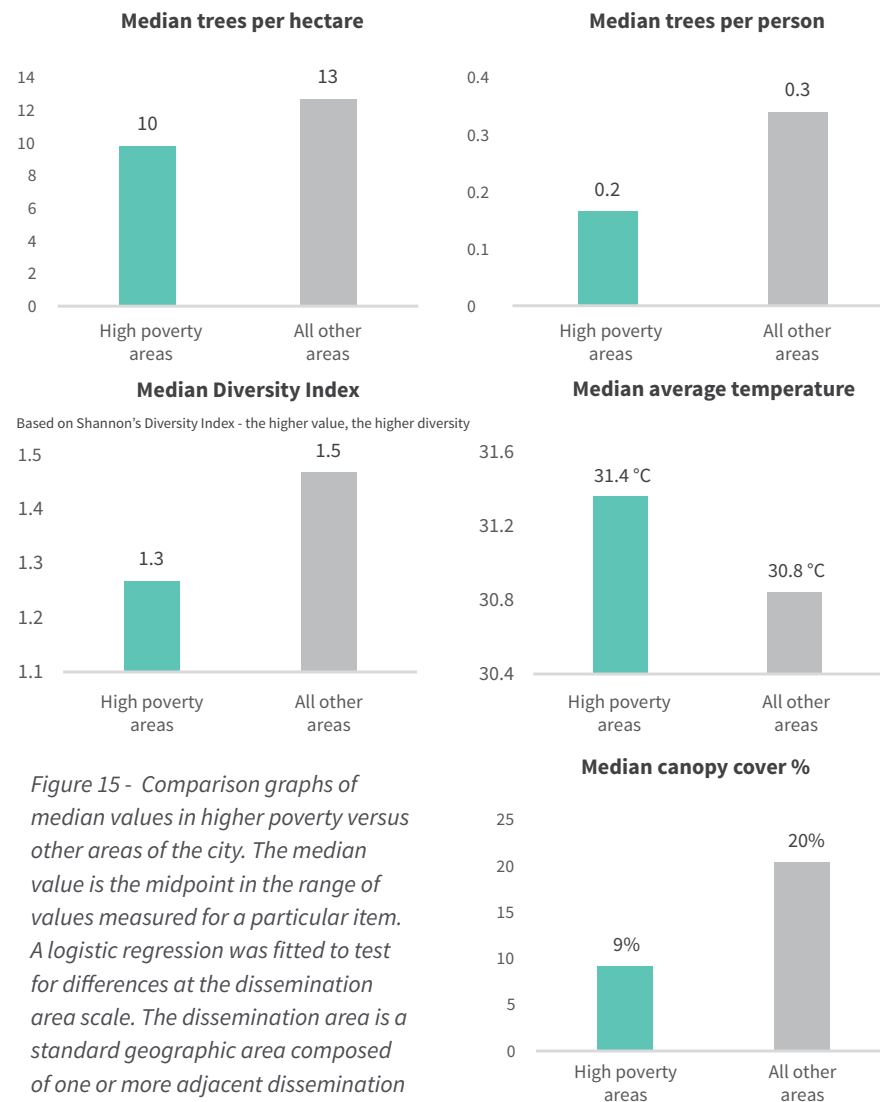


Figure 15 - Comparison graphs of median values in higher poverty versus other areas of the city. The median value is the midpoint in the range of values measured for a particular item. A logistic regression was fitted to test for differences at the dissemination area scale. The dissemination area is a standard geographic area composed of one or more adjacent dissemination blocks used to report census data in Canada.



*The establishment and stewardship of Winnipeg's urban forest has always been a close partnership between municipal and provincial government and private homeowners. Winnipeg residents have been long-time advocates for tree preservation and Dutch elm disease management and have been active participants in workshops, volunteer programs, citizen science projects, and planting programs. Today, non-profit organizations, residents' associations, school groups, and individual homeowners continue to support and grow Winnipeg's canopy through a variety of stewardship activities, including planting and caring for trees on their private properties, which contributes to the diversity and resiliency of Winnipeg's urban forest as a whole.*





## Reconciliation

Winnipeg has the highest Indigenous population among Canadian cities. In 2016, Winnipeg declared the Year of Reconciliation and the Winnipeg Indigenous Accord was subsequently adopted by Council as a tool for communities to establish mutually respectful partnerships with First Nations, Métis, and Inuit governments, organizations, and individuals towards advancing reconciliation work across Winnipeg.

The City of Winnipeg has targeted support for Indigenous-focused and led projects and initiatives since 2000. The Indigenous Relations Division (IRD) was created in 2013 to coordinate such programs and initiatives. IRD has been tasked with leading the design and implementation of the five Truth and Reconciliation Calls to Action relating to municipalities, the development of the Missing and Murdered Indigenous Women and Girls, and Two-Spirited Peoples (MMIWG2S+) Calls for Justice, Winnipeg's Indigenous Accord, and other initiatives.

The City of Winnipeg is committed to a Journey of Reconciliation. More work must be done to build and maintain respectful relationships with Indigenous peoples, organizations, communities, and governments including in the realm of urban forest management in Winnipeg.

### **It is a priority to foster reconciliation through urban forest management by:**

- Establishing mutually-respectful partnerships with First Nations, Métis, and Inuit governments, organizations, and individuals
- Working together with local Indigenous communities to incorporate Indigenous perspectives into plant species selection and climate adaptation approaches for Winnipeg's urban forest and natural areas
- Shifting planting and management actions on sites of Indigenous significance as determined by the Indigenous community
- Collaborating to adopt a cultural landscape plan through the Winnipeg Parks Strategy

## Stewardship

Management of the more than three million trees in Winnipeg's urban forest is a responsibility shared by many stakeholders. Successful implementation of Winnipeg's Strategy will require strong partnerships and active participation from a broad range of individuals and organizations.

More than 91 percent of participants in the project's Phase 1 public engagement survey had participated in a stewardship activity in the last five years, with the most common activities including pruning or planting a tree on private property. Property owners sometimes also hire qualified contractors to perform work on City-owned trees (with City approval) located on boulevards and in parks.

Numerous community organizations in Winnipeg are active in planting, watering, tree health care, trail maintenance, research, education, and advocacy for the urban forest. Community organizations include Neighbourhood Associations and Tree Committees, Bishop Grandin Greenway, Coalition to Save The Lemay Forest, Friends of Fisher Park, Friends of the Harte Trail, Manitoba Eco-Network, Manitoba Urban Forest Council, OURS Winnipeg, Save Our Seine, Sustainable South Osborne Community Co-op, Transcona Trails, Trees Winnipeg, Wildwood Heritage and Conservation Committee, Sustainable South Osborne Community Co-op. These organizations are critical to successfully implement the Strategy and achieving Mayor Brian Bowman's Million Tree Challenge initiative to plant one million trees by the time Winnipeg's population reaches a million residents (predicted to be by 2040).

Within and external to the City, numerous departments and agencies influence urban forest management, and their collaboration is needed to implement the Strategy.

### **It is a priority to strengthen urban forest stewardship by:**

- Empowering residents to participate in urban forest management
- Providing incentives to encourage private land tree planting
- Raising the profile of urban forestry city-wide
- Working with existing partners and broadening partnerships to implement the Urban Forest Strategy
- Strengthening communication and information sharing between departments and other agencies external to the City

*Greenspaces such as the Kapabamayak Achaak Healing Forest (the park was named by Anishnaabe Elder Peetanacoot Nenakawekapo, which means “Wandering Spirit”) in the northeast corner of St. John’s Park are examples of what future opportunities for reconciliation may look like<sup>28</sup>. The idea from Winnipeg education professor Lee Anne Block was in response to the Calls to Action, specifically education on reconciliation and the history of colonialism<sup>29</sup>. The park’s goal is to ‘help people reflect, heal and learn from the past’ and the trees planted honour residential school survivors and missing and murdered Indigenous women and girls<sup>30</sup>.*





## Urban forest program sustainability

Winnipeg’s urban forestry program provides a wide variety of services to the public and to other City departments for the management of City-owned street and park trees. There is a growing gap between the maintenance and renewal costs of City-owned trees and the City’s urban forestry operating and capital budgets. A significant challenge in providing urban forestry services in Winnipeg today involves responding to the unprecedented forest health impacts faced by the urban forest while continuing to meet the needs and expectations of the public and operate within limited resources. A clear, strategic approach and well-defined levels of service will help to clarify expectations and prioritize resources to address current service gaps.

### Valuing tree assets

Cities are increasingly incorporating green infrastructure assets like trees, bioswales, and forests into their asset management strategies and Winnipeg is no exception. Asset management helps guide cities in designing, installing, maintaining, and replacing assets over time and in understanding how much budget needs to be allocated to maintain or renew different assets.

Assets are usually assessed in terms of their condition, life expectancy, and replacement value. Grey infrastructure assets, like pipes or sidewalks, are at their peak value when they are first installed and then decline with wear and tear. Unlike grey assets, trees are living and increase in value for most of their lifecycle. In fact, they need to be in the ground for at least 40 years to reach their peak value and, if healthy, can remain at that peak for decades.

The 2018 City Asset Management Plan included a valuation for public inventoried trees at \$226 million based on a simple replacement cost of \$740 per tree as a 1:1 tree replacement. This replacement valuation did not account for the fact trees grow and their value increases with size, age, and health. Since it is not feasible to replace a large tree with a large tree, replacement approaches following best practices often plant an equivalent diameter of trunk compared to the tree removed. Valuing trees based on their size and condition would provide a better indication of the true cost of replacing Winnipeg’s tree assets, and the cost avoided by investing in maintenance to maximize their safe useful life expectancy. Municipalities such as London and Ajax (ON) use diameter based replacement ratios to calculate replacement values.

Winnipeg currently requires diameter based replacement for trees removed due to construction and development under the City’s Tree Removal Policy and Guidelines. Applying the compensation valuation methods from the guidelines results in:

- **City-owned tree removals:** Trees 10 centimetres in diameter or less valued at \$740 per tree and trees greater than 10 centimetres in diameter valued at the Council of Tree and Landscape Appraisal formula (calculated using i-Tree Eco). **2021 replacement value of the public tree inventory would translate into \$683 million using this methodology**, or 2% of the replacement value of all City infrastructure (Figure 16).

An alternative valuation method is applied for tree removals associated with Manitoba Hydro construction projects to reflect that the majority of the projects occur in natural areas and typically result in higher volume of smaller diameter trees.

- **Manitoba Hydro removals:** One replacement tree for each 10 centimetres in diameter at \$740 per tree. **2021 replacement value of the public tree inventory would translate to \$740 million**

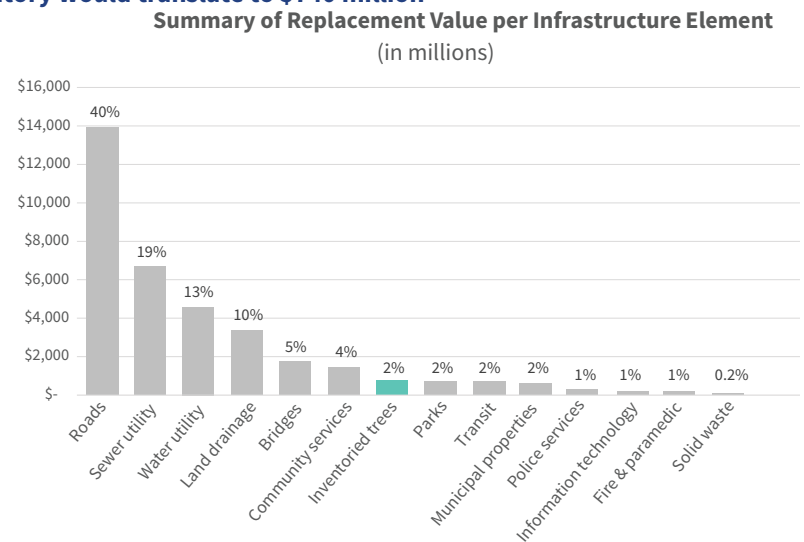


Figure 16 - Summary of the replacement values reported in the 2018 City Asset Management Plan and inventoried trees if the Tree Removal Guidelines compensation approaches were used

*The benefits and amenity provided by large, mature trees are much greater than that of young trees. It takes decades to replace the value lost when a large tree is removed. It only costs \$740 to plant a*

*new tree but it takes another 40 years for that tree to mature into the asset that we are planning for.*





## Maximizing tree condition and life expectancy

Tree asset management aims to maximize the benefits and minimize the risk from trees for least costs. Given that the benefits of trees grow with time, maximizing their health and life expectancy is essential. Tree assets cost the most at the beginning and end of their life cycles (planting and removal), so extending their time in healthy maturity ensures the urban forest maximizes the return on investment in tree planting and maintenance.

Take the example of a linden tree planted in a Winnipeg street. The City pays for planting, watering, and annual maintenance of the linden throughout its life until it is removed. The tree produces benefits as it grows, and we can use i-Tree Eco to estimate values for amenity, carbon storage, and sequestration, avoided runoff, energy savings, and pollution removal throughout its life.

If the linden lives a long life, it will produce benefits that provide a positive return on the City's investment (Figure 17). However, if it dies as a young tree, it will fail to produce those benefits and the City will lose money on its investment over time. Figure 18 shows the estimated financial impact of that linden tree dying by the time it is 10 years old, and being removed and replaced repeatedly. At the end of the 100 year period, it is estimated that the City would have incurred a net loss of more than \$18 thousand for one representative tree. On top of that, there is a lost opportunity cost from the benefits that could have been provided by a long-lived tree during the same period.

Maintaining healthy trees will maximize their life expectancy and ensure that the City receives a positive return on its investment in the urban forest.

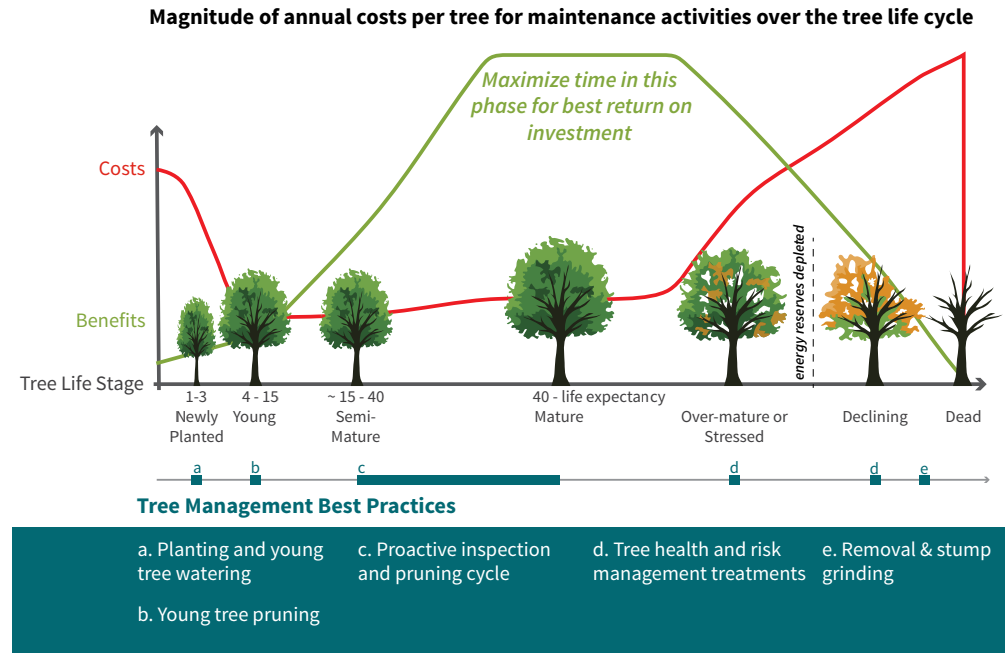


Figure 17 - Tree life cycle costs and benefits



Figure 18 - Cumulative financial loss estimated for a linden tree if removed and replaced every ten years

*City of Winnipeg arborists undertake all aspects of public tree care including planting, pruning, tree removals, and assessments, but must also be readily available to respond to storm damage and emergency calls. In October 2019, Winnipeg experienced one of the most destructive winter storms in recent memory. Approximately 30,000 trees were damaged by this storm event, generating a total of over 6,700 service requests from the public over the course of 45 days. City of Winnipeg Urban Forestry crews were joined by arborists from neighbouring municipalities and private tree care companies to assist with this unprecedented storm response, attending to fallen trees, broken limbs, and various other public safety risks throughout the city.*





## Risks to the sustainability of Winnipeg’s urban forest program

To be sustainable, Winnipeg’s urban forest program needs to deliver adequate service levels for the least possible cost. Several issues risk the sustainability of the urban forest program. These issues generally impact the condition and safe useful life expectancy of tree assets and, if not addressed, could ultimately lead to a widespread loss of benefits and a high cost to reactively manage risks. These issues and the risks if not resolved are summarized in Table 2



Table 2. Urban forestry program priority issues with a high impact on budgets and resourcing

Current issue	Risks if not resolved
Pruning cycle has lengthened to 31 years	<ul style="list-style-type: none"> <li>• Structural problems will not be detected until issues are advanced, limiting tree asset service life and resulting in premature tree removal and/or more costly risk mitigation, and increased risk to public safety</li> <li>• Mature trees with structural problems will typically remain in the landscape until a service call is received, increasing risks to public safety and liability to the City</li> <li>• When storms occur, damage is likely to be more extensive due to the prevalence of structural problems in the tree population</li> <li>• Costs of responding to demand calls, mitigating risks that could have been prevented, and responding to storm damage are likely to be higher</li> </ul>
High numbers of service calls for demand pruning and storm response	<ul style="list-style-type: none"> <li>• Program resources redirected from other tasks to tree removals</li> <li>• Increasing number of trees in the landscape with structural issues as the pruning cycle continues to lengthen, and growing number of service calls with longer wait periods for service as existing resources are limited to respond to calls in a timely manner</li> </ul>
Average annual tree mortality rate has increased from 1.3% to 1.9%	<ul style="list-style-type: none"> <li>• Increasing tree mortality annually means that the average life expectancy for public trees is decreasing</li> <li>• Decreasing life expectancy means more frequent replanting, increased tree planting costs and reduced benefits that will impact the long term value and sustainability of the program</li> </ul>
Emerald ash borer and cottony ash psyllid are establishing in Winnipeg threatening 33% of public tree assets	<ul style="list-style-type: none"> <li>• If emerald ash borer becomes widespread, most urban forestry resources will need to be redirected to rapid removal at an estimated cost of \$105 million over 10 years</li> <li>• The annual tree mortality rate for all City-owned tree assets is expected to increase to 4% or more at the peak of ash mortality (more than 10% mortality per year for ash)</li> </ul>

Current issue	Risks if not resolved
High volume of Dutch elm disease tree removals due to high infection rates	<ul style="list-style-type: none"> <li>Increasing infection spread rates from diseased trees left in the landscape beyond June of the following year, resulting in growing backlog of trees to remove, higher loss of trees and benefits, and higher cost of services for removal and replacements</li> <li>Program resources redirected from other tasks to tree removals</li> <li>The annual elm removal rate peaked at just under 4% due to disease in 2018 before the removal backlog was brought under control</li> </ul>
Trees removed from the public landscape are replaced less than half of the time	<ul style="list-style-type: none"> <li>Net loss of trees and tree canopy in areas that used to have established canopy</li> <li>Net loss of ecosystem services particularly in areas with high elm populations</li> </ul>
An estimated 40,600 planting sites are vacant	<ul style="list-style-type: none"> <li>The urban forestry program will not be maximizing limited public permeable space and the benefits produced from trees, including those critical for climate mitigation and adaptation</li> </ul>
Areas with higher poverty have lower urban forestry levels of service	<ul style="list-style-type: none"> <li>Areas of higher poverty are underserved in terms of trees and tree canopy, increasing vulnerability to heat and reducing access to ecosystem services in these areas</li> </ul>
Approximately 2,000 new trees are added to the City's inventory each year from development with no additional budget to maintain	<ul style="list-style-type: none"> <li>The City will not be maximizing the benefits produced from these trees due to lack of resources to maintain them to maximize their life cycle</li> <li>Loss of investment</li> <li>Unsustainable operational impact</li> </ul>

Addressing the issues described in Table 2 would improve the sustainability of the urban forest program by maximizing the benefits provided while minimizing risk for least cost. Resolving these issues will require increases in budgets from current levels. However, the cost of taking no action is anticipated to be higher in the medium-term based on more expensive risk mitigation, higher risks to public safety and liability to the City, more frequent tree removals, higher service call rates, and the net loss of ecosystem services values, which have indirect costs for human and environmental health impacts.

**It is a priority to improve urban forest sustainability by:**

- Establishing and achieving levels of service to meet demonstrated community need
- Including natural assets and their value in the corporate asset management plan
- Maintaining and regularly updating an inventory of urban forest assets
- Maximizing the health and life expectancy of newly planted urban trees in City streets and parks
- Rapidly removing dead, diseased, and dangerous trees
- Following a best practices program for tree care and tree risk management for public trees

## 4. Urban forest baseline and service targets

Section 4 describes the current state of the urban forest as baselines against which future progress can be assessed. These targets are intended to drive progress towards achieving Winnipeg's vision for an urban forest that is abundant, healthy, diverse, and resilient.



## City-wide canopy cover

Winnipeg's canopy cover was estimated at 17 percent in 2018 using i-Tree Canopy with a leaf-off orthophoto (Figure 19). To map canopy cover extent in 2020, we used Landsat-derived canopy imagery from the University of Maryland's global forest change analysis<sup>31</sup>. Due to low resolution from the Landsat imagery, this data was not used to estimate canopy percentages, however, the imagery is useful to show low to high canopy cover (Figure 20).

Canopy cover is highest along river corridors, including the Red and Seine Rivers, in the Assiniboine Forest, and around the River Heights neighbourhoods. In terms of land uses, the highest canopy cover is found in parks and the lowest is found in commercial land uses.

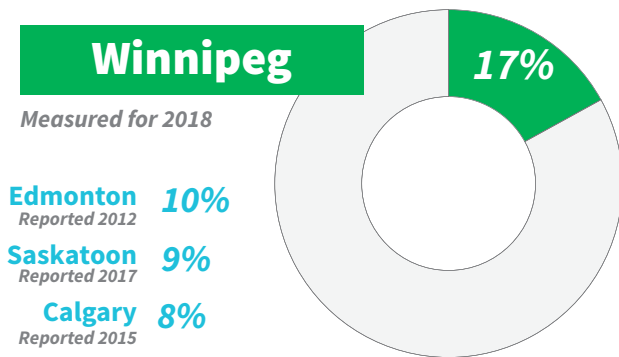


Figure 19 - In 2018, Winnipeg's canopy cover was 17 percent.



### Baseline

Winnipeg's 2018 canopy cover estimated at 17%

### Service target

24% canopy cover by 2065

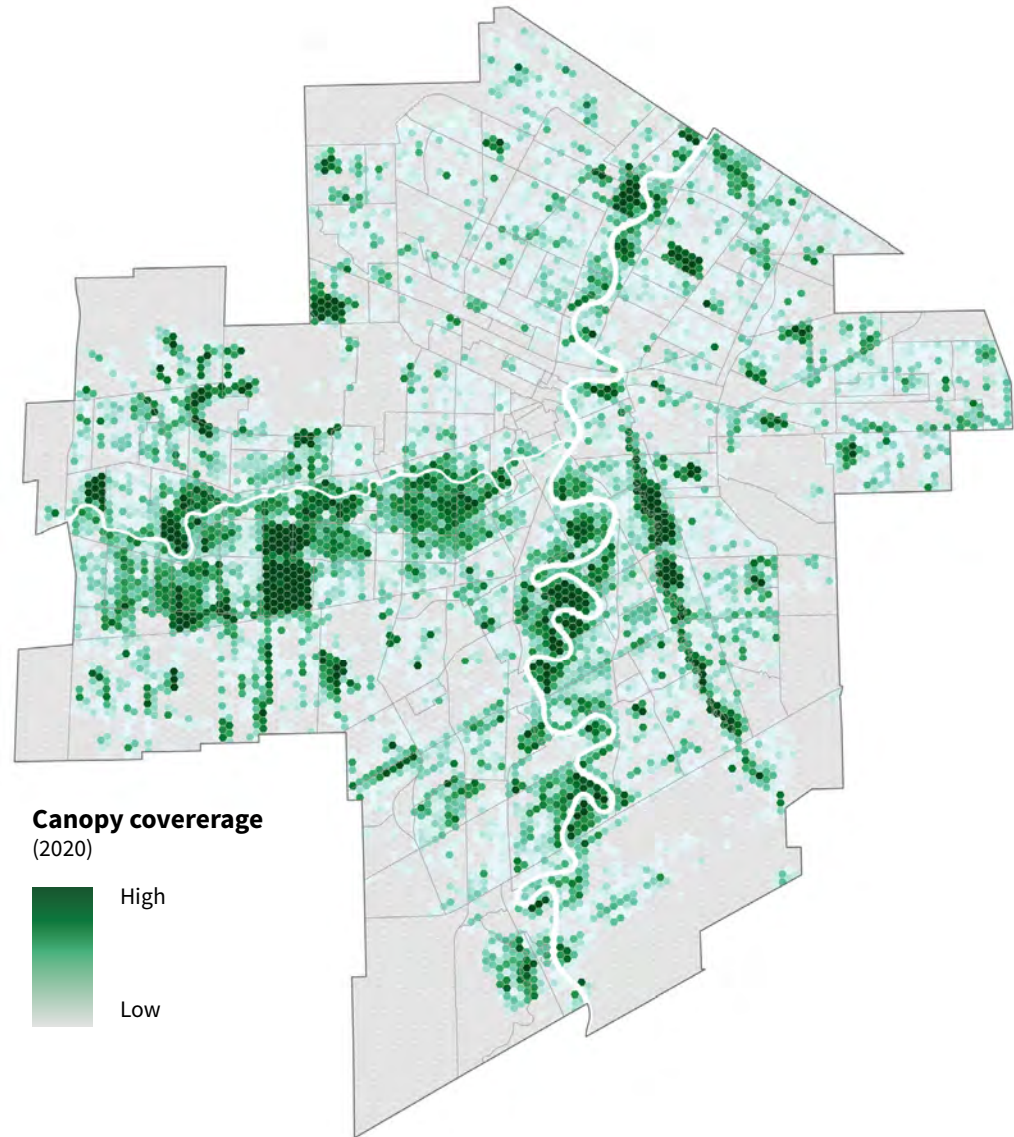


Figure 20 - Low to high canopy cover for 2020 using Global Forest Cover Change (Hansen et al. 2013) data mapped in 10-hectare grids and shown with neighbourhood boundaries

## Setting a city-wide canopy cover target

Potential planting opportunities were estimated to determine a canopy cover target for Winnipeg. Based on opportunities, it is anticipated that a best-case scenario **canopy cover target of between 17 and 24 percent by 2065** will be possible. However, the upper range of the target will only be feasible if emerald ash borer is slow to establish and elm loss due to Dutch elm disease is capped at two percent per year. Twenty-four percent canopy cover is an ambitious target because it assumes an overall mortality rate of 1.5 percent, that all opportunities are planted and all trees removed are replaced.

Figure 21 presents a range of future canopy cover scenarios:

### 1. Best-case:

- a. **Canopy projected to increase to 24 percent (without EAB)** if planting is increased, every tree removed is replaced and mortality rates remain similar to today.

- b. **Canopy projected to remain at 17 percent (with EAB)** if planting is increased but all ash are lost to emerald ash borer. This scenario assumes one fifth of the tree canopy would be lost based on the proportional leaf area of ash estimated in i-Tree Eco study presented in the State of the Urban Forest Report in Appendix A.

### 2. Status quo:

- a. **Canopy projected to decline to 13 percent (without EAB)** if similar mortality and planting rates are maintained compared to today, and elm mortality is high (four percent).
- b. **Canopy projected to decline to nine percent (with EAB)** if similar planting rates are maintained compared to today but elm mortality is high (four percent) and all ash are lost to emerald ash borer.

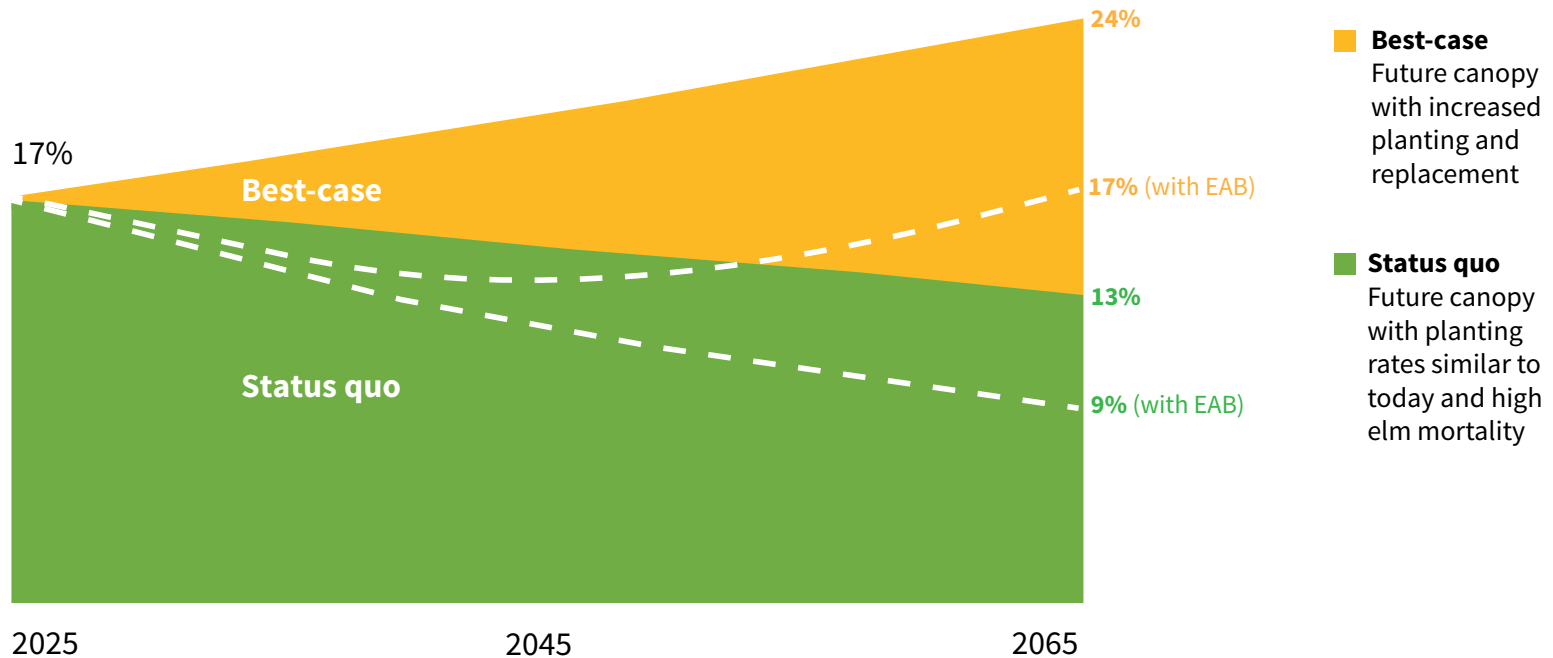


Figure 21 - Potential canopy cover outcomes for different planting and loss scenarios with and without emerald ash borer (EAB)

## Achieving a best-case canopy cover target

Table 3 outlines the targets and the estimated rates of planting required to achieve a 24 percent canopy cover target city-wide by 2065 (or maintain 17% if emerald ash borer establishes). The greatest potential to increase canopy cover through tree planting is found on private residential lands, future development lands, in vacant sites, on new roads, and in parks through restoration of natural forest areas.

Table 3. How the best-case canopy cover target can be achieved over Winnipeg's land uses

Land use	Land Area (ha)	2065 Canopy Cover Target	Approximate # of New Trees Required to 2065	Approximate Annual Planting Rate (net new)	How could this be achieved?*
Residential	15,079	24%	146,000	3,300	ReLeaf would need to result in Winnipeggers planting approximately 3,000 trees per year and redevelopment would need to at least replace all trees removed
Future development	8,046	20%	240,000	5,300	Assumes developed land will plant or retain approximately 30 trees per hectare in addition to street trees, while also retaining or restoring at least 5% of the area as natural forest in parkland
Agriculture	2,112	9%	-	-	No action proposed
Right-of-way	8,228	19%	140,000	3,200	40,000 trees would be planted in vacant spots and developments would be adding 2,000 new street trees per year
Manufacturing	5,795	12%	33,000	750	*New recommendation – require industrial locations to incorporate landscape buffers and tree planting (see example next page)
Parks	5,215	60%	139,000	3,200	At least 3,000 new trees per year, much of it riverbank
Commercial	1,661	15%	48,000	1,100	Require surface parking to incorporate landscape buffers and 1 tree per 6 stalls
Educational and institutional	325	30%	8,000	200	ReLeaf and partner programs to plant 200 trees per year on educational and institutional properties
CentreVenture	228	15%	4,000	100	100 trees to be planted per year with road upgrades and new development
<b>Total City</b>	<b>46,690</b>	<b>24%</b>	<b>758,000</b>	<b>17,150</b>	

\* Achieving future canopy cover assumes that the population of new trees planted will average ~45 m<sup>2</sup> canopy area per tree in the year 2065, and that existing canopy will either be retained or replaced in addition to new tree planting.





### Baseline

12% of potential planting sites vacant

### Service target

No more than 5% of potential planting sites vacant

## City-wide tree planting

Increasing canopy cover in Winnipeg by one percent of total city area requires 464 hectares of new tree canopy, or approximately 45,000 large trees or 100,000 small to medium trees. Today, tree planting tends to be composed of 60 percent large trees and 40 percent small trees and it is assumed that this ratio will continue.

Table 3 outlines the estimated new tree plantings required to reach 24 percent canopy cover by 2065. It is estimated that **approximately 760,000 new trees, or about 17,000 new trees per year, will need to be planted over the next 44 years** (in addition to tree replacements). These trees would be planted on both public and private land through a combination of incentive programs, public land planting programs and regulatory tools.

## Vacant locations for tree planting

The City has inventoried more than 42,000 vacant tree planting locations on public land (Figure 22). Historically, only 60 percent of these sites have ended up being suitable for planting because adjacent infrastructure and landscape features change over time. As a result, we estimate that approximately 26,000 of these locations are likely to be suitable for planting. Another 14,500 trees have been removed and not replaced, bringing the total estimate of vacant planting locations on public land to 40,500 (a combination of new sites and missing trees). These vacant locations represent a vacancy rate of 12 percent in a possible population of 340,500 inventoried trees. The City's planting program is not presently keeping up with replanting and the vacancy rate is growing. It is recommended that a target be set to reduce the vacancy rate to no more than five percent by 2065.

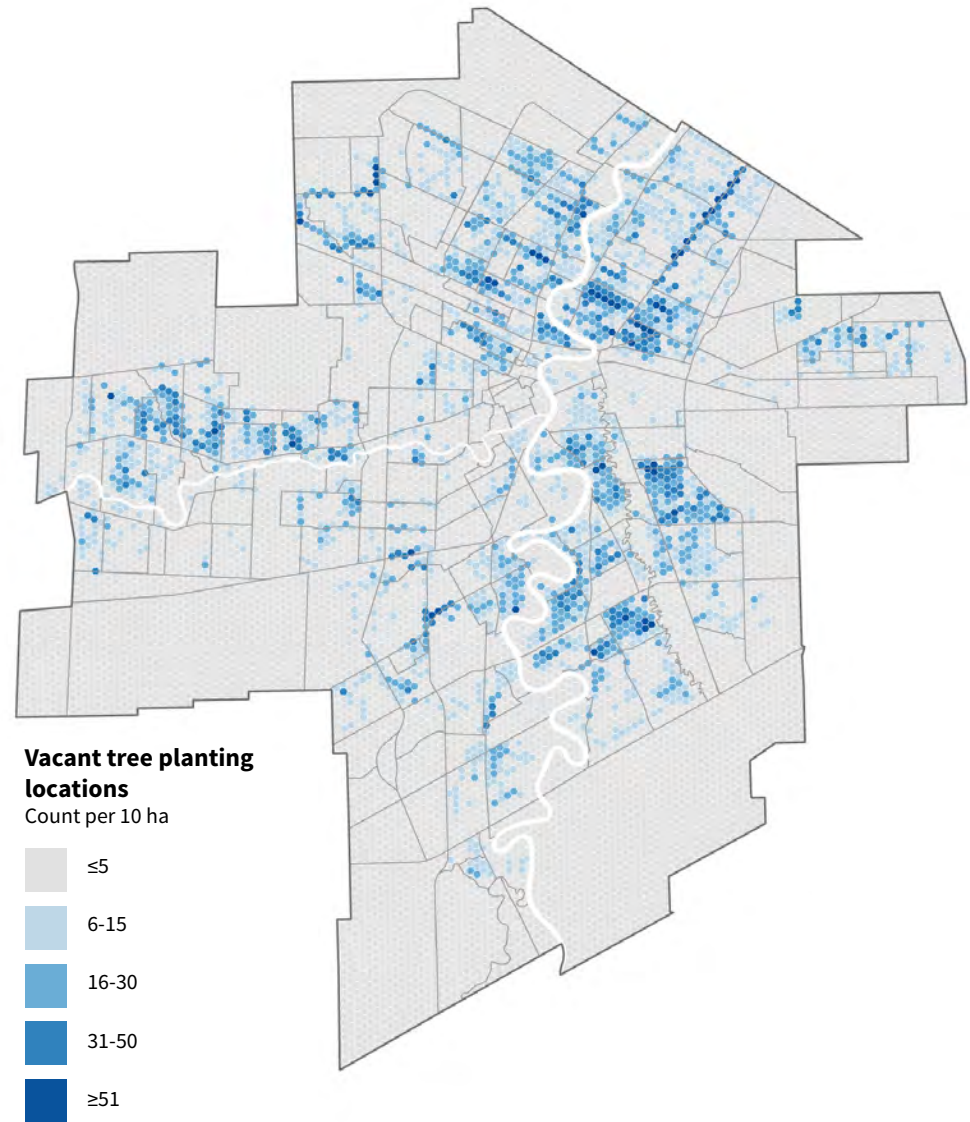


Figure 22 - Count of vacant tree planting locations identified in 2020 by ten hectare area with neighbourhood boundaries

## Public tree replacement

From 2016 to 2020, the City replaced an average of 2,000 trees on streets and parks annually but removed an average of 5,100 trees (Figure 23). In 2019 and 2020, fewer than one in three trees removed were replaced. It is recommended that the City set a target to replace every tree removed in order to prevent the erosion of Winnipeg’s tree canopy, and to meet the City’s target to increase canopy cover. It is anticipated that this will require replacing between 4,000 and 6,000 trees on public land per year based on historic tree removal numbers.

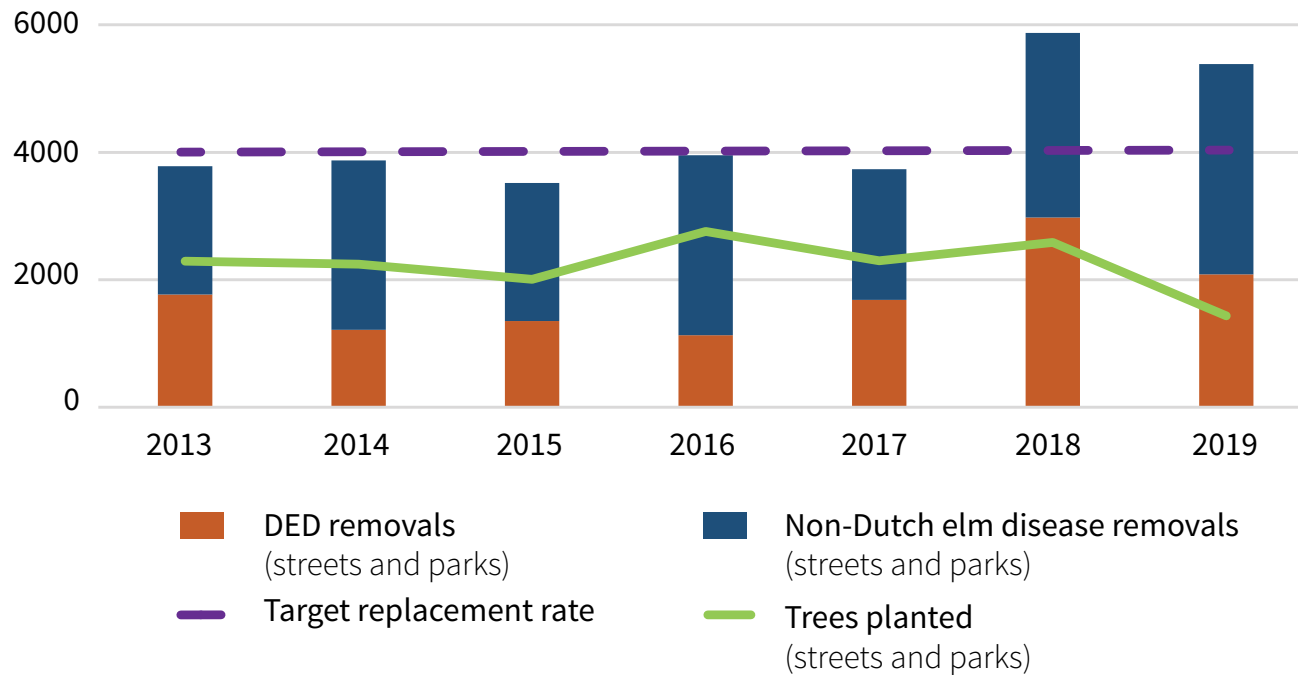


Figure 23 - Annual rates of removal and replacement for public trees in City streets and parks

## Public tree diversity

The public tree inventory is dominated by ash, at 33 percent, and elm at 25 percent of the overall tree inventory (Figure 24). **A diversity target of no more than 10 percent of any single species and 20 percent of any genus in the City’s tree inventory is recommended.** Diversification should focus on species that are performing well based on current inventory data and that are recommended for use in Table 4. In addition, new species and types of trees that are hardy and have tolerance to salt should be prioritized for trials.

Winnipeg’s tree inventory has low tree species diversity because of climate limitations - the City plants trees that have a plant hardiness of Zone 3 and can grow successfully in prairie climates. Presently, seven genera (e.g., maple, ash, oak etc.) make up 91 percent of the City’s public tree inventory, with elm and ash making up more than 50 percent (Figure 24). Some Winnipeg neighbourhoods are planted with a higher diversity of trees than others. To measure species diversity, the Shannon-Weiner Diversity index calculation was applied to a 10 hectare grid city-wide. The index calculates an ‘H’ value based on the abundance and richness of species in each grid. Figure 25 illustrates the H values across Winnipeg for all inventoried trees in streets and parks; the higher the value, the higher the diversity. In general, the highest diversity of trees are in areas adjacent to Winnipeg’s rivers. Some hot spots have as many as 21 different types of tree genus but most areas have much less.

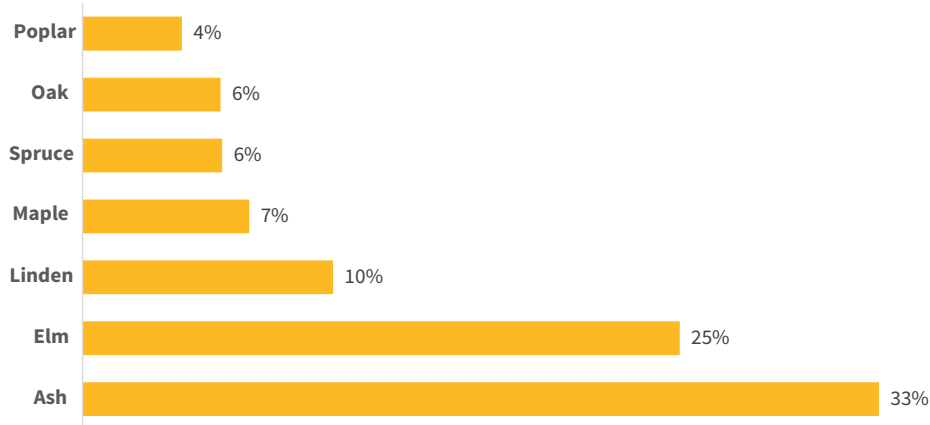


Figure 24 - The dominant genera in Winnipeg’s public tree inventory (2020)



### Baseline

Ash and elm make up 58% of the City’s public tree inventory

### Service target

No more than 10% of any species and 20% of any genus in the public inventory

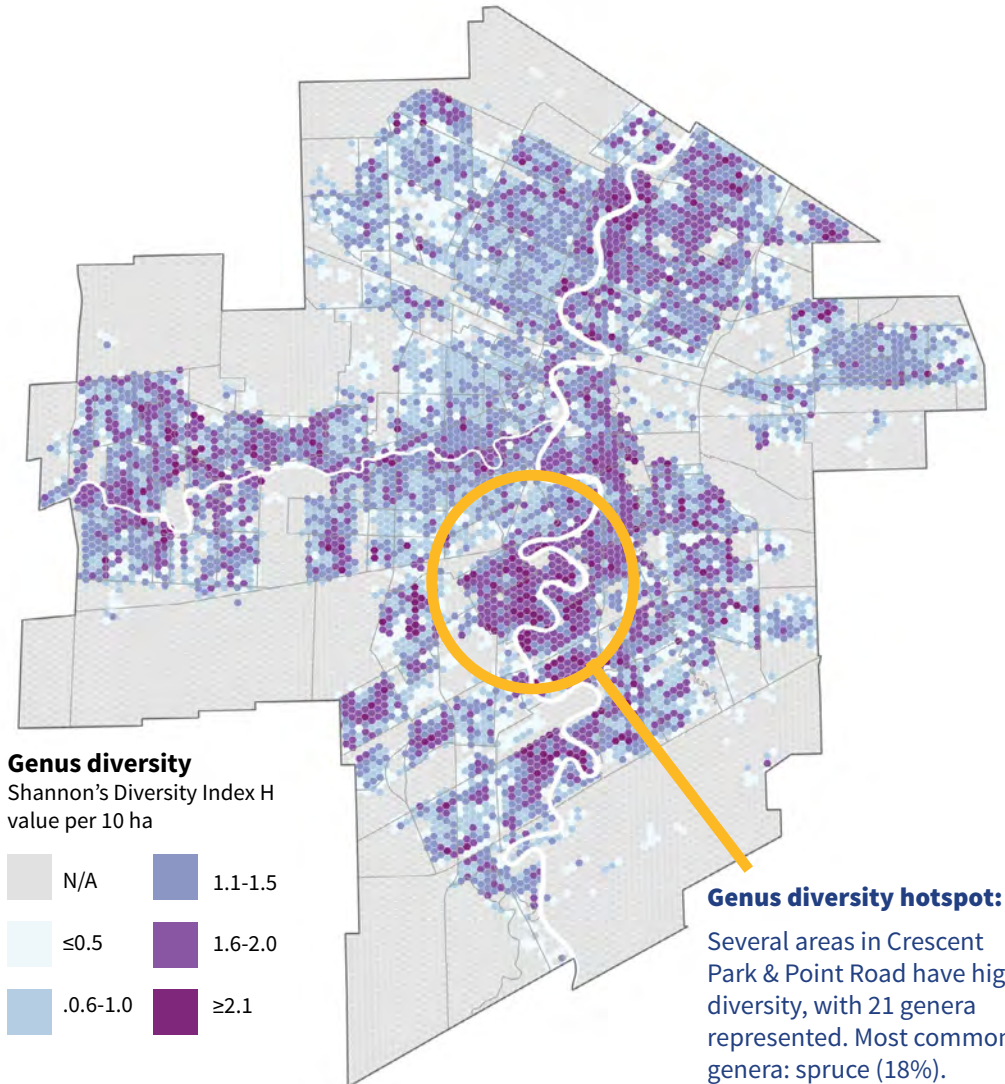


Figure 25 - Shannon’s diversity index mapped by 10-hectare area by genus with neighbourhood boundaries. The higher the H value, the higher the diversity of public trees.

Table 5. The most abundant species in Winnipeg's tree inventory, their annual growth and mortality, and a recommendation regarding their ongoing use (based on removals between 2013 and 2020 inventory updates) \*Site suitability criteria influence usage

Species (n>50)	Average annual diameter growth (cm dbh)	Annual removal rate (percent of species population)	2020 population	2020 species %	Use recommendation
Amur maple ( <i>Acer ginnala</i> )	0.8	1%	2126	0.7%	Use often
Manitoba maple ( <i>Acer negundo</i> )	1.1	1%	14687	4.9%	Use often
Silver maple ( <i>Acer saccharinum</i> )	1.4	1%	3368	1.1%	Use often
Sugar maple ( <i>Acer saccharum</i> )	No data (n<10)	0%	159	0.1%	Try more
Ohio buckeye ( <i>Aesculus glabra</i> )	No data (n<10)	0%	811	0.3%	Try more
Paper birch ( <i>Betula papyrifera</i> )	0.8	2%	1404	0.5%	Use sometimes
Hackberry ( <i>Celtis occidentalis</i> )	1.1	1%	1401	0.5%	Use often
Hawthorn ( <i>Crataegus spp.</i> )	No data (n<10)	1%	230	0.1%	Try more
Russian olive ( <i>Elaeagnus angustifolia</i> )	1.2	3%	928	0.3%	Less preferred
Manchurian ash ( <i>Fraxinus mandshurica</i> )	0.9	1%	4030	1.3%	No (EAB)
Black ash ( <i>Fraxinus nigra</i> )	0.8	2%	8774	2.9%	No (EAB)
Green ash ( <i>Fraxinus pennsylvanica</i> )	1.0	1%	85489	28.6%	No (EAB)
Tamarack ( <i>Larix laricina</i> )	1.0	4%	227	0.1%	Less preferred
Crabapple ( <i>Malus spp.</i> )	0.9	1%	4464	1.5%	Use often*
White spruce ( <i>Picea glauca</i> )	0.8	1%	7419	2.5%	Use often*
Blue spruce ( <i>Picea pungens</i> )	0.9	1%	9823	3.3%	Use often*
Scots pine ( <i>Pinus sylverstris</i> )	0.8	1%	1092	0.4%	Use often*
White poplar ( <i>Populus alba</i> )	1.5	2%	209	0.1%	Less preferred
Poplar ( <i>Populus spp.</i> )	1.5	2%	7623	2.5%	Less preferred
Trembling aspen ( <i>Populus tremuloides</i> )	0.9	1%	4249	1.4%	Use often*
Amur cherry ( <i>Prunus maackii</i> )	1.4	3%	856	0.3%	Less preferred
Schubert chokecherry ( <i>Prunus virginiana var Shubert</i> )	0.8	23%	3852	1.3%	No (black knot)
Chokecherry ( <i>Prunus virginiana var Virginiana</i> )	No data (n<10)	1%	284	0.1%	No (black knot)
Bur oak ( <i>Quercus macrocarpa</i> )	0.6	0%	17148	5.7%	Use often
White willow ( <i>Salix alba</i> )	1.6	2%	2575	0.9%	Less preferred
Laurel willow ( <i>Salix pentandra</i> )	1.4	5%	554	0.2%	Less preferred
Mountain ash ( <i>Sorbus spp.</i> )	0.8	4%	471	0.2%	Less preferred
Japanese tree lilac ( <i>Syringa reticulata</i> )	0.6	1%	2353	0.8%	Use often
Cedar ( <i>Thuja occidentalis</i> )	1.1	1%	1060	0.4%	Use often*
Linden ( <i>Tilia spp.</i> )	1.2	1%	26018	8.7%	Use often
American elm ( <i>Ulmus americana</i> )	0.8	3%	52405	17.5%	Less preferred
Japanese elm ( <i>Ulmus davidiana var japonica</i> )	1.6	0%	1788	0.6%	Use often
Siberian elm ( <i>Ulmus pumila</i> )	0.9	2%	18912	6.3%	Less preferred

## Public tree diversity

The public tree inventory is dominated by ash, at 33 percent, and elm at 25 percent of the overall tree inventory (Figure 24). **A diversity target of no more than 10 percent of any single species and 20 percent of any genus in the City's tree inventory is recommended.** Diversification should focus on species that are performing well based on current inventory data and that are recommended for use in Table 4. In addition, new species and types of trees that are hardy and have tolerance to salt should be prioritized for trials.

Winnipeg's tree inventory has low tree species diversity because of climate limitations - the City plants trees that have a plant hardiness of Zone 3 and can grow successfully in prairie climates. Presently, seven genera (e.g., maple, ash, oak etc.) make up 91 percent of the City's public tree inventory, with elm and ash making up more than 50 percent (Figure 24). Some Winnipeg neighbourhoods are planted with a higher diversity of trees than others. To measure species diversity, the Shannon-Weiner Diversity index calculation was applied to a 10 hectare grid city-wide. The index calculates an 'H' value based on the abundance and richness of species in each grid. Figure 25 illustrates the H values across Winnipeg for all inventoried trees in streets and parks; the higher the value, the higher the diversity. In general, the highest diversity of trees are in areas adjacent to Winnipeg's rivers. Some hot spots have as many as 21 different types of tree genus but most areas have much less.

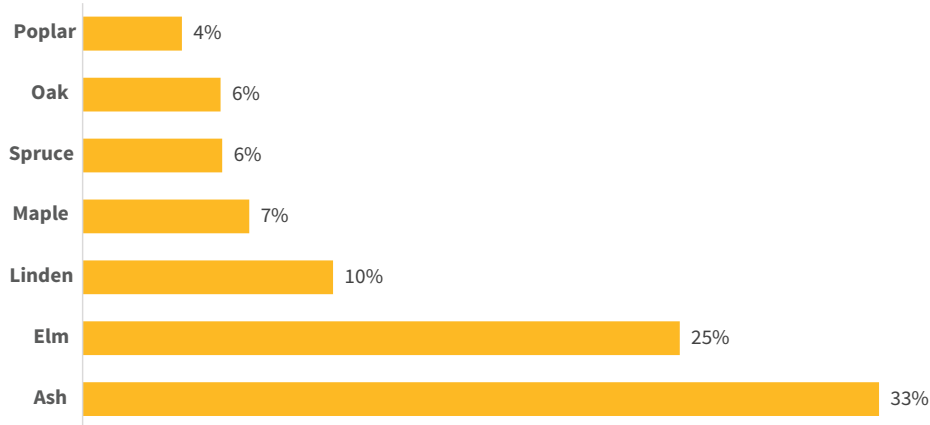


Figure 24 - The dominant genera in Winnipeg's public tree inventory (2020)



### Baseline

Ash and elm make up 58% of the City's public tree inventory

### Service target

No more than 10% of any species and 20% of any genus in the public inventory

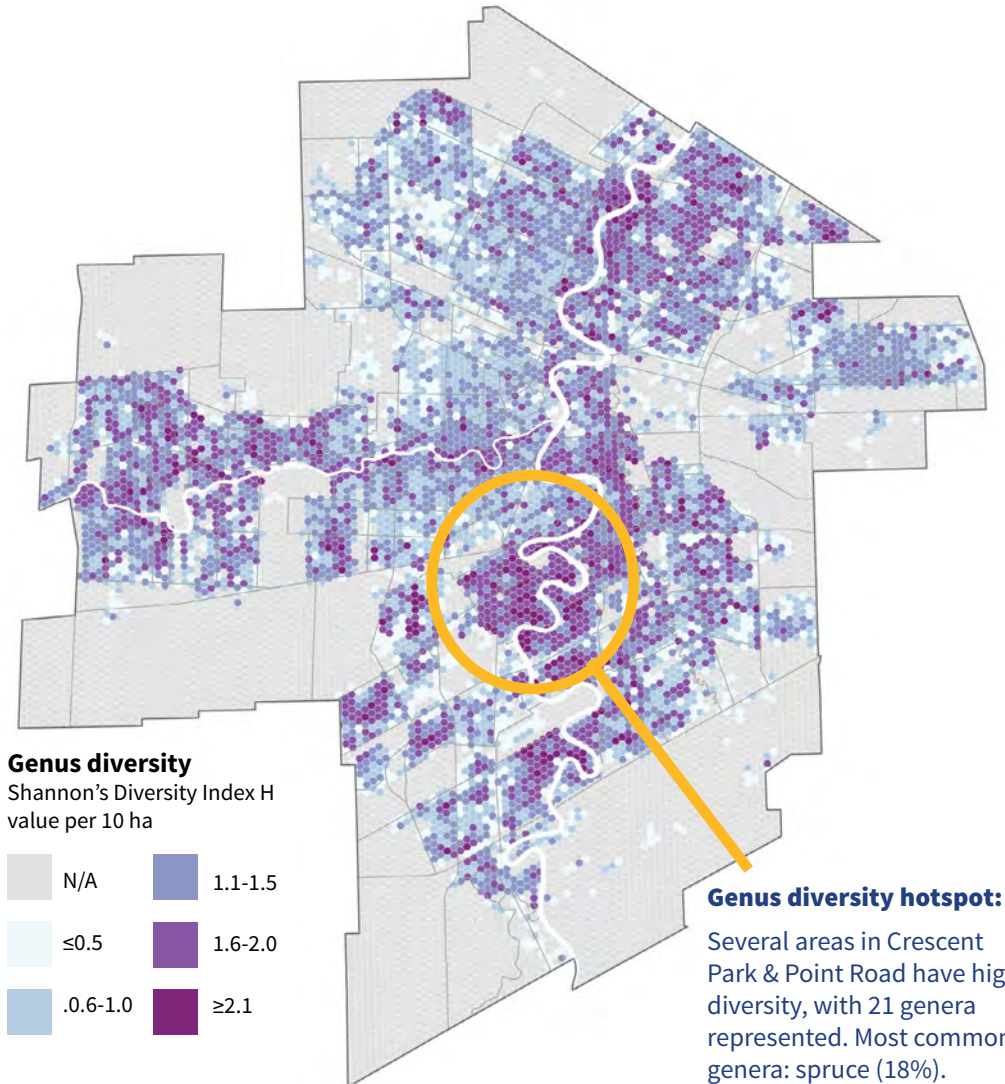


Figure 25 - Shannon's diversity index mapped by 10-hectare area by genus with neighbourhood boundaries. The higher the H value, the higher the diversity of public trees.



### Baseline

Average American elm loss per year from 2016-2020 was 3.3%

### Service target

No more than 2% annual loss of city-wide American elm

## City-wide elm loss

As of 2020 the city-wide inventory of elms captures 215,000 American elm trees on public and private land. The population has been declining gradually since Dutch elm disease was detected in the 1970s. Since 2016, the inventoried elm population has dropped from 237,000 to 215,000 American elms on public and private land (Figure 28).

Over the five years, the average rate of American elm population loss was 3.3 percent. However, in 2019 and 2020, the loss rate averaged almost four percent mainly due to continuing impacts of drought. In 2019, over 9,000 American elms were marked for removal, the highest number since the early 1990s. The historic average annual number of trees marked for removal due to Dutch elm disease was approximately 6,000. **A target of no more than two percent of city-wide American elms lost to disease annually is recommended.**

Figure 29 shows the distribution of American elms threatened by Dutch elm disease in Winnipeg's elm inventory (public and private land). The older areas of the city centre, riverbanks and pockets of the north and east are particularly vulnerable to canopy loss over time due to the concentration of elms.

### City-wide American elm population and percent loss per year

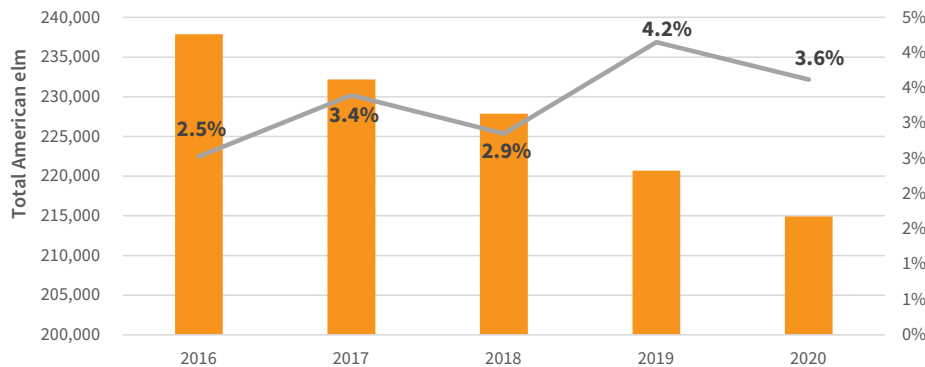


Figure 28 - American elm population decline and percent annual loss from 2016 to 2020 (public and private).

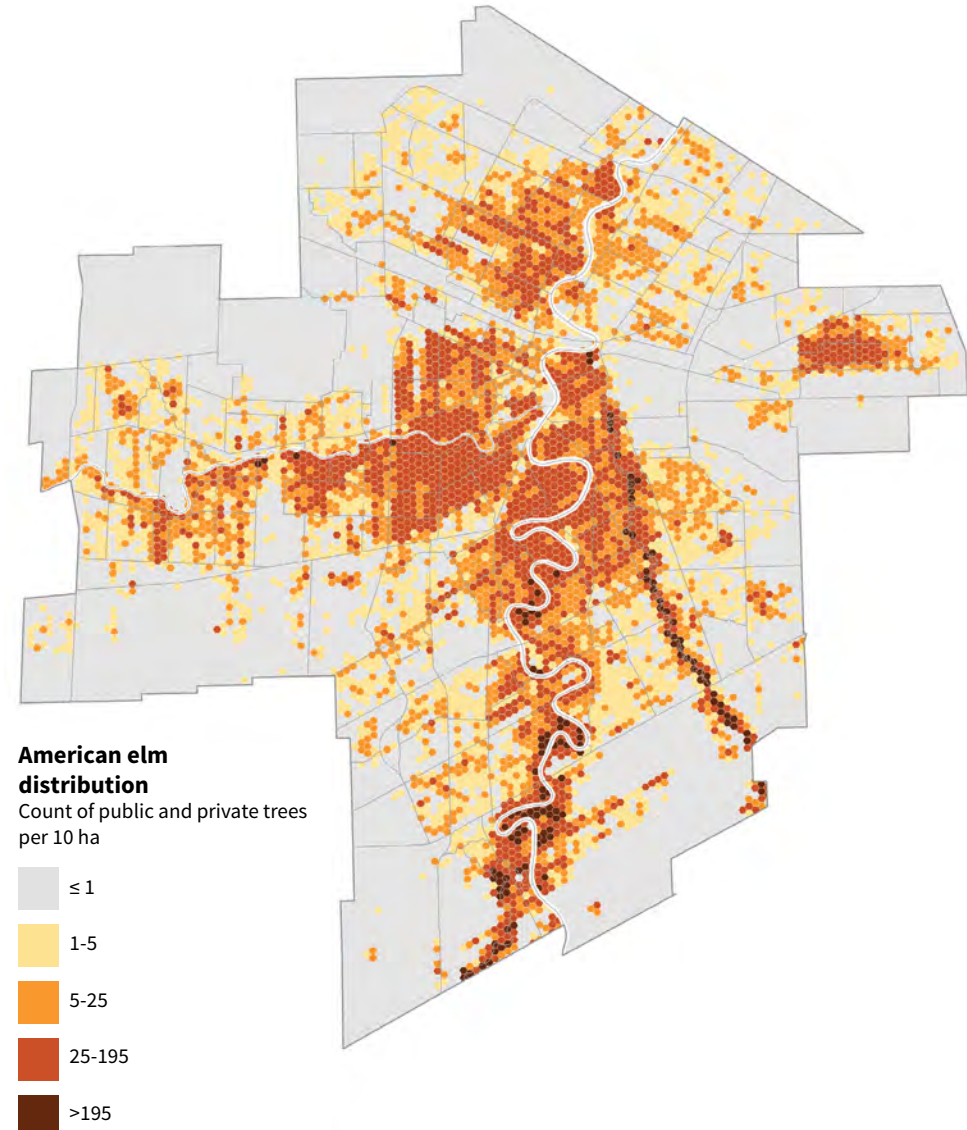


Figure 29 - Count of American elm trees inventoried on public and private land per ten hectare area throughout Winnipeg

Four scenarios were explored (Figure 30) to project future trends for American elm loss city-wide due to Dutch elm disease or hazard:

1. **Scenario 1 “no Dutch elm disease management”** assumes the City stops managing Dutch elm disease resulting in an 18 percent estimated annual loss rate by year five.
1. **Scenario 2 “high mortality”** assumes the high loss rates experienced in 2019 and 2020 continue at a rate of four percent.
2. **Scenario 2 “gradual improvement”** assumes that the loss rate will be reduced gradually to no more than two percent by 2040.
3. **Scenario 4 “best-case”** assumes that management practices will be implemented in 2022 to limit the loss rate at two percent immediately.

If management were to stop now as in Scenario 1 with an 18 percent annual loss rate, nearly all American elm will be lost by 2065 (52 remaining). If the four percent annual loss rate continues per Scenario 2, more than 180,000 trees would be lost by 2065 (85 percent loss in 43 years) compared with approximately 140,000 trees (66 percent loss in 43 years) in Scenario 3. The best-case Scenario 4 would see a loss of approximately 130,000 trees (60 percent loss in 43 years). Scenarios 1 through 4 are estimates and may vary over time.

American elms store approximately 34 percent of the carbon in the city’s urban forest. Delaying the loss of these elms will also delay the loss of a significant quantity of ecosystem services (Table 4). Stabilizing the elm loss rate at two percent, whether now or over the term of this plan’s implementation, will significantly extend the average life expectancy of mature elms in Winnipeg.

Table 4. Summary of values provided by American elm in the public tree inventory compared with city-wide American elm. City-wide values are from the 2019 i-Tree Eco analysis from the State of the Urban Forest Discussion Paper.

Value	Public tree inventory	City-wide (public & private)
Count of American elm	52,384	303,583
Carbon storage (tonnes)	37,995	172,932
Carbon sequestration (tonnes p. year)	433	2,816
Compensatory value (\$ CAD)	\$247 million	\$1.1 billion
Avoided runoff (m3 per year)	60,578	377,496

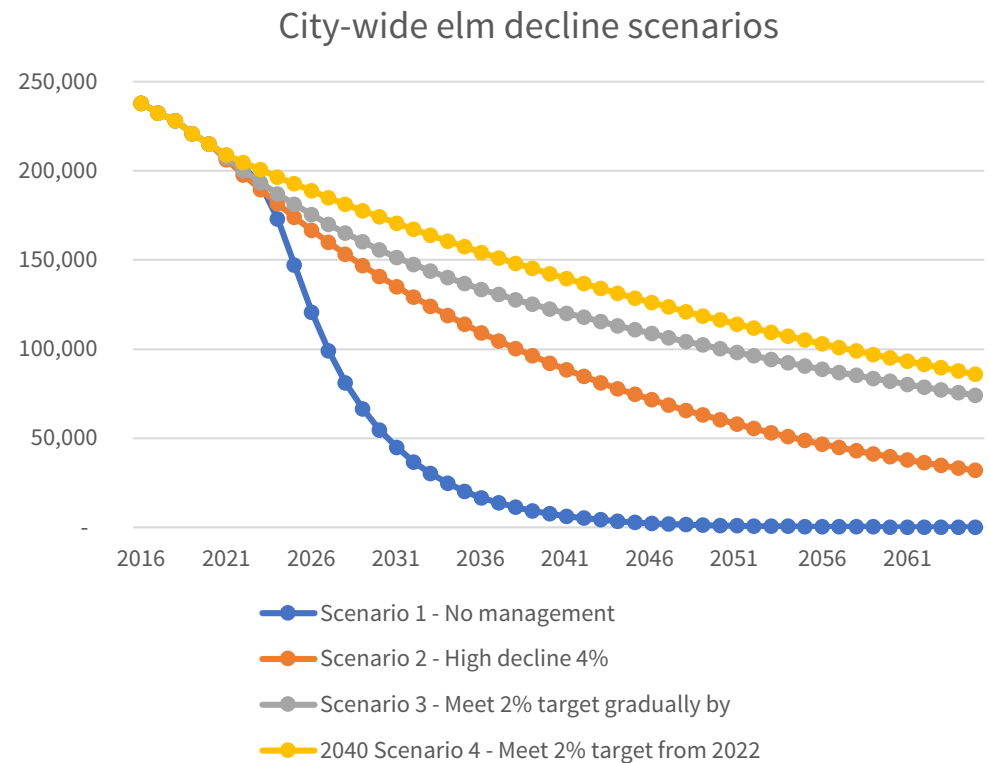


Figure 30 - Public American elm decline scenarios over the next 43 years



### Baseline

City trees are currently on a 31-year pruning cycle

### Service target

Prune street trees on a seven-year cycle and park trees on a 12-year cycle

## Public tree pruning cycles

The City tracks the percentage of public trees pruned annually and the pruning cycle (how frequently every tree is, on average, inspected and pruned if needed). Figure 31 shows the actual percent of trees pruned and the corresponding length of the cycle for 2013 to 2019. The percentage of trees pruned per year has been declining and the pruning cycle has lengthened as more resources have been allocated to Dutch elm disease management, priority tree removals, and emergency response. Pruning cycle is used as a standard performance indicator for effective urban forest management in the industry.

To improve overall tree health and condition and reduce vulnerability to storm damage, **a target to prune street trees on a seven-year cycle is recommended.** For **park trees, a 12-year cycle** is recommended because park trees have fewer conflicts with infrastructure, generally grow in better conditions, and the City has limited resources to prune trees annually. These targets correspond to pruning at least 14 percent of the street tree population annually (seven-year cycle) and at least eight percent of the park tree population annually (12-year cycle).

**Target:** Seven-year cycle for street trees, 12-year cycle for park trees

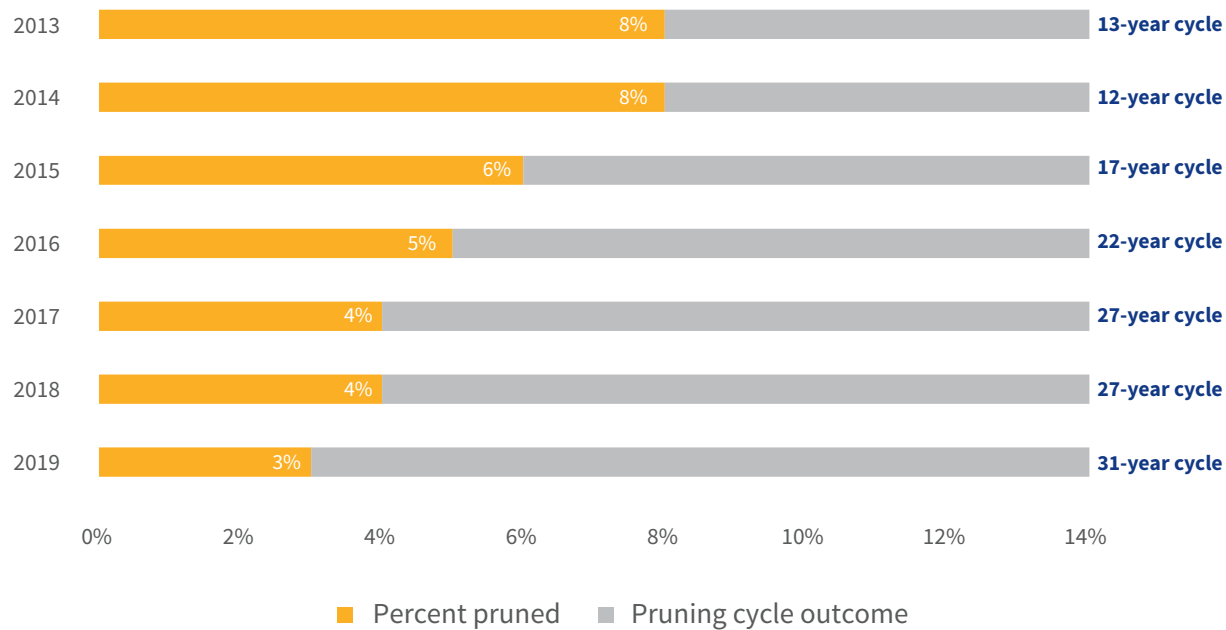


Figure 31 - Actual percent of trees pruned per year and corresponding length of the pruning cycle for 2013 - 2019





### Baseline

Customer satisfaction with levels of service averages less than 50%

### Service target

At least 50% customer satisfaction rate across all services

## Customer satisfaction with levels of service

Based on survey results, satisfaction with current urban forestry levels of service averages less than 50 percent (Figure 32). Respondents were generally neutral or satisfied with emerald ash borer and Dutch elm disease management, tree removal, and pruning. Respondents were dissatisfied with public education, preserving and protecting trees with development, and tree planting. To improve customer satisfaction, **a target to have all levels of service achieving 50 percent or greater satisfaction (neutral, satisfied, or very satisfied responses) is recommended.**

### Legend

- Very satisfied
- Somewhat satisfied
- Neutral
- Dissatisfied
- Very dissatisfied

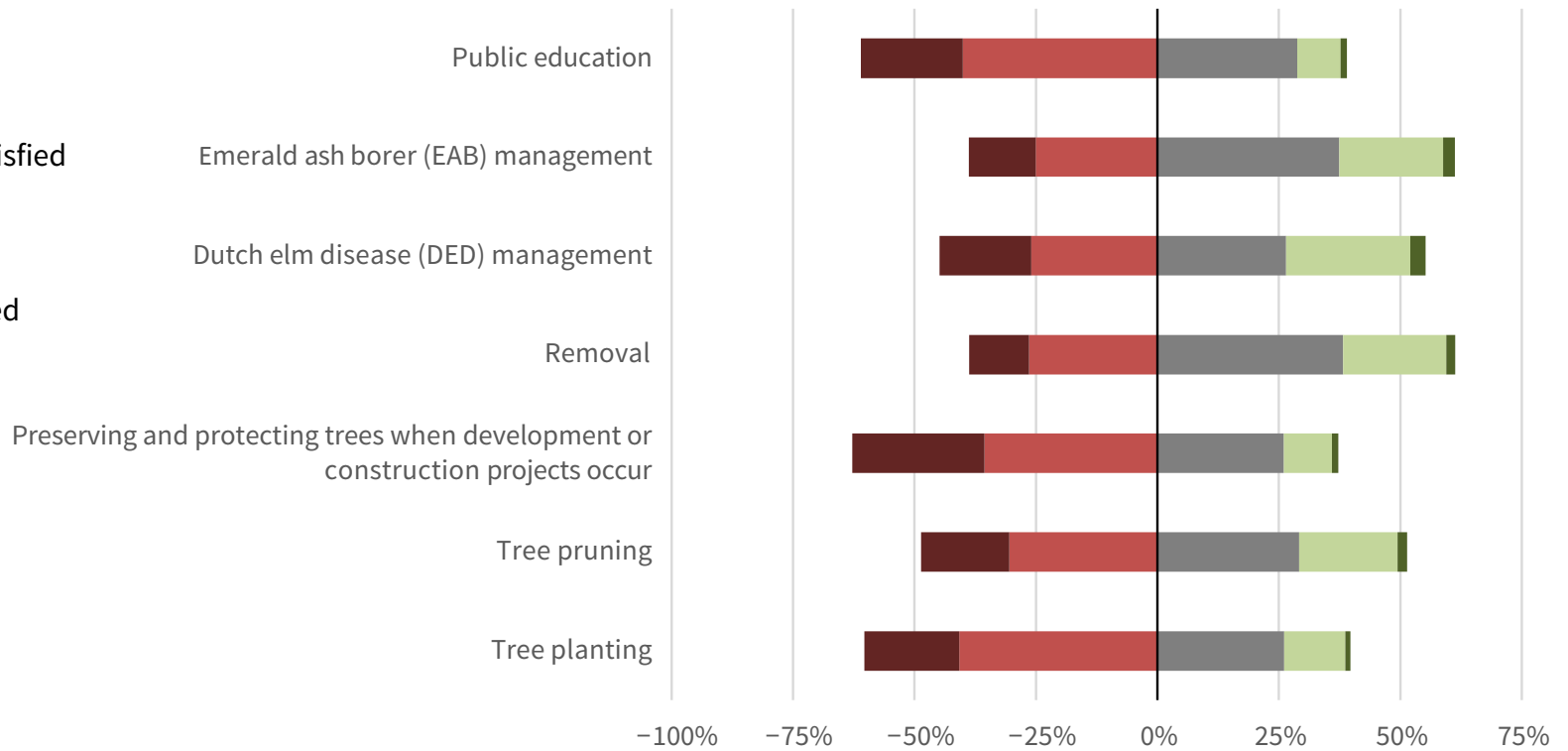


Figure 32 - Satisfaction with urban forestry levels of service reported by survey respondents in 2020 (excludes unsure responses)

## Summary of baselines and targets

Table 6 summarizes the baselines and targets defined for Winnipeg’s urban forest. These baselines and targets have been established so that progress on implementing the Strategy can be assessed and monitored over time. Section 5 outlines the actions needed to achieve these targets, and describes the associated financial and resource implications.

Table 6. Summary of baselines and targets

Baseline	Target	Measurement frequency and method
<b>Canopy cover city-wide</b> 17% canopy cover in 2018	24% canopy cover by 2065 (or maintain at 17% if EAB establishes)	5 years - LiDAR
<b>Tree planting city-wide</b> 12% of potential planting sites vacant in 2020	No more than 5% of potential planting sites vacant by 2065	5 years - inventory of vacant sites
<b>Public tree replacement</b> Less than 1 tree replaced for every 3 trees in 2020	1:1 tree replacement annually	Annual - tree removal and planting records
<b>Public tree diversity</b> Ash and elm make up 58% of the tree inventory in 2020	No more than 10% of any species and 20% of any genus in the public inventory by 2065	5 years - tree inventory
<b>Public tree losses</b> 1.4% of public trees lost in 2020	No more than 1.5% annual loss of public trees	Annual - tree removal records
<b>City-wide elm loss</b> American elm loss averaged 3.3% from 2016 to 2020	No more than 2% annual loss of city-wide American elm	Annual - DED surveillance and American elm removal records
<b>Public tree pruning cycles</b> 31-year pruning cycle in 2019	Prune street trees on a seven-year cycle and park trees on a 12-year cycle	Annual - pruning records
<b>Customer satisfaction with levels of service</b> Less than 50% satisfaction on average in 2020	At least 50% customer satisfaction rate across all services	5 years - resident survey

# 5. Urban forest strategic framework

There are five management goals with associated policies and actions to guide the Strategy, outlined in section five. The five goals are:

## PLAN



Accountably to achieve an equitable distribution of connected tree and forest assets that will improve the health of people and communities

## PLANT



Strategically to grow a robust and sustainable urban forest that will maximize benefits for human health and ecological function

## MANAGE



Adaptively to improve tree health and public safety, respond to challenges and opportunities, and achieve planned levels of service

## PROTECT



Prudently to sustain Winnipeg's urban forest canopy where it will maximize benefits for human health and ecological function

## PARTNER



Purposefully to foster reconciliation and stewardship that will build capacity to achieve goals and respond to challenges



# PLAN ACCOUNTABLY



## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$: within existing resources/costed in other City strategy
- \$\$: <\$100,000
- \$\$\$: \$100,000 to \$500,000
- \$\$\$\$: >\$500,000

Action plan	Initiation timeline	Financial impacts
<b>Policy 1. Establish and achieve levels of service to meet demonstrated community need</b>		
<b>Action 1A.</b> Adopt service targets for public trees in streets and parks, including city-wide and land use canopy cover and planting density, with corresponding targets for new and replacement planting rates, maintenance cycles, and protection.	Short	\$
<b>Action 1B.</b> Commit to an annual reporting strategy to communicate progress to Standing Policy Committee on closing gaps in service targets and Urban Forest Strategy implementation.	Short	\$
<b>Action 1C.</b> Develop a customer service framework that prioritizes socially equitable service delivery with consideration of the Complete Communities 2.0 Reinvestment Areas and the Poverty Reduction Strategy.	Medium	\$
<b>Policy 2. Create a City tree policy to guide tree planting, preservation, protection, removal, and maintenance decisions to align with industry standards, best practices, and other City policies</b>		
<b>Action 2A.</b> Review and consolidate existing policy and guideline documents related to trees into a single City tree policy.	Medium	\$\$
<b>Action 2B.</b> Consider revising the City of Winnipeg Charter to enable the City to regulate tree preservation and protection on private property under a new tree bylaw.	Medium	\$
<b>Policy 3. Include trees as natural assets and their value in the corporate asset management plan</b>		
<b>Action 3A.</b> Assign urban forest asset classes to the corporate asset management plan as street trees, park trees, natural forest areas, and tree planting sites.	Short	\$
<b>Action 3B.</b> Determine methods for assigning values to urban forest asset classes.	Short	\$
<b>Action 3C.</b> Estimate the full cost of managing each urban forest asset class over its lifecycle and adjust operational budgets annually as new assets are added to the system, e.g., lifecycle costs including watering, pruning, inspections, and removal.	Short	\$
<b>Action 3D.</b> Improve consistency in the terminology used in City documents and when communicating with the public, e.g., define boulevard and median consistently.	Short	\$

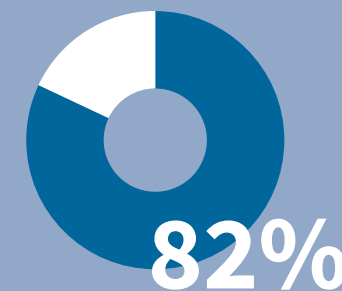
## Goal

Plan accountably to achieve an equitable distribution of connected tree and forest assets that will improve the health of people and communities



## Key target

24% canopy cover city-wide by 2065



Survey respondents wanted to see canopy cover target to increase canopy



# PLAN ACCOUNTABLY

## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$:** within existing resources/costed in other City strategy
- \$\$:** <\$100,000
- \$\$\$:** \$100,000 to \$500,000
- \$\$\$\$:** >\$500,000

Action plan	Initiation timeline	Financial impacts
<b>Policy 4. Collaborate across City departments to deliver co-benefits through integrated policy and project approaches</b>		
<b>Action 4A.</b> Explore opportunities to consistently integrate trees and soil volume into projects to meet stormwater management objectives.	Medium	\$\$
<b>Action 4B.</b> Explore opportunities to improve upon and incentivize tree planting and/or protection or inclusion of green infrastructure on private property or in new development, e.g., stormwater utility tax credits, development incentives, grant programs, or rebates.	Short	\$
<b>Action 4C.</b> Explore opportunities for service review or special program development in urban forestry to contribute to poverty reduction per the Poverty Reduction Strategy and city well-being as indicated by Winnipeg's PEG Community Indicator system.	Short	\$
<b>Action 4D.</b> Formalize the involvement of the Urban Forestry Branch in the City's transportation project steering committee to: <ul style="list-style-type: none"> <li>i. Ensure that trees are an integral part of streetscapes,</li> <li>ii. Explore opportunities to use streetscape design and renewal projects to improve planting site quality, and</li> <li>iii. Ensure that planting locations and sites are designed to mitigate potential conflicts or leverage opportunities for mutual benefit.</li> </ul>	Short	\$
<b>Action 4E.</b> Continue to collaborate with the Water and Waste Department on utilizing urban tree waste in the City's soil fabrication, composting, and bio-soil initiatives.	Short	\$
<b>Action 4F.</b> Support reductions in greenhouse gas emissions related to urban forest management operations in accordance with the applicable targets identified in Winnipeg's Climate Action Plan.	Medium	\$\$
<b>Policy 5. Manage the urban forest adaptively</b>		
<b>Action 5A.</b> Measure progress regularly by: <ul style="list-style-type: none"> <li>i. Capturing tree canopy using LiDAR every five years</li> <li>ii. Maintaining the tree inventory and the inventory of vacant sites</li> <li>iii. Continuing to track tree removals and tree planting</li> <li>iv. Continuing DED surveillance and elm removal recording</li> <li>v. Continuing to track annual pruning</li> <li>vi. Surveying resident satisfaction with customer service levels annually</li> </ul>	Medium	\$\$\$
<b>Action 5B.</b> Review Urban Forest Strategy Action Plan every four years and update recommendations as needed to improve progress towards service targets.	Medium	\$\$



# PLANT STRATEGICALLY



## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$:** within existing resources/costed in other City strategy
- \$\$:** <\$100,000
- \$\$\$:** \$100,000 to \$500,000
- \$\$\$\$:** >\$500,000

Action plan	Initiation timeline		Financial impacts
<b>Policy 6.</b> Increase new and replacement tree planting in streets and parks to achieve canopy cover targets and promote carbon sinks			
<b>Action 6A.</b> Replace each tree removed from boulevards and parks at 1:1 annually.	Medium		\$\$\$\$
<b>Action 6B.</b> Plant 760,000 new trees, in addition to replacement trees, on public and private land by 2065 (this is expected to align with community volunteer tree planting programs).	Medium	Long	\$\$\$\$
<b>Action 6C.</b> Explore opportunities to expand on the current commemorative tree donation program to create a tree donation program for public trees, including a commemorative tree designation.	Short		\$
<b>Policy 7.</b> Prioritize urban tree planting where it is most needed			
<b>Action 7A.</b> Develop a 10-year park and boulevard planting strategy to: <ul style="list-style-type: none"> <li>i. Phase planting in priority areas such as areas of higher poverty, business improvement zones, urban heat hot spots, locations with low City-owned tree density, and in consideration of Complete Communities 2.0 Policy 6.1,</li> <li>ii. Create a cool streets network through neighbourhoods, to schools and institutions, between transit hubs, and in alignment with existing and future active transportation routes, and</li> <li>iii. Guide planting of treed buffers between subdivisions and regional road networks and highways.</li> </ul>	Medium		\$\$
<b>Action 7B.</b> Develop a downtown area and regional streets planting strategy to increase tree canopy and formalize planting selections in these areas.	Short		\$\$
<b>Action 7C.</b> Create park tree planting specifications, density targets, and guidelines by park classification for inclusion in a new City tree policy and in Development Agreement Parameters.	Medium		\$\$
<b>Action 7D.</b> Consider enabling urban agriculture projects for orchards on City parks or properties in equitable locations and with maintenance partnership agreement in place.	Medium		\$

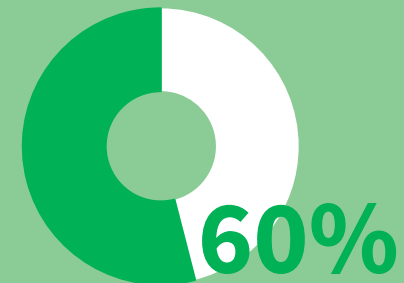
## Goal

Plant strategically to grow a robust and sustainable urban forest that will maximize benefits for human health and ecological function



## Key targets

- No more than 5% of potential planting sites vacant by 2065
- 1:1 tree replacement annually
- No more than 10% of any species and 20% of any genus in the public inventory by 2065



Survey respondents dissatisfied with planting



## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$:** within existing resources/costed in other City strategy
- \$\$:** <\$100,000
- \$\$\$:** \$100,000 to \$500,000
- \$\$\$\$:** >\$500,000

Action plan	Initiation timeline		Financial impacts
<b>Policy 8. Increase the diversity of urban species in the City’s public tree population and proactively replace aging or dying elm and ash</b>			
<b>Action 8A.</b> Establish tree diversity standards at no more than 10% of any one species and 20% of any genus in the street and park tree inventory.	Short		\$
<b>Action 8B.</b> Develop successional planting plans for neighbourhoods with high proportions of ash and elm trees.	Short		\$
<b>Action 8C.</b> Develop a nursery management plan to grow difficult to source tree species at the civic nursery.	Short		\$\$
<b>Action 8D.</b> Explore opportunities to create growing contracts with nurseries to improve the procurement of desired species and stock quality in order to meet the reforestation demands within the city.	Short		\$
<b>Action 8E.</b> When eligible, apply for Federal funding for tree planting and nursery development through the Disaster Mitigation and Adaptation fund, the 2 Billion Trees Program or other funds that become available.	Short		\$
<b>Action 8F.</b> Establish trials for planting species with various traits favoured for future climate suitability, disease resistance and salt tolerance, prioritizing large canopy areas as an adaptation measure to sustain the character of mature trees in Winnipeg, and to maximize opportunities to sequester carbon.	Medium	Long	\$\$\$
<b>Action 8G.</b> Update the Acceptable Tree Species for Boulevard Planting as needed to add new species expected to perform well under changing climate and remove species that are not performing well.	Short		\$
<b>Policy 9. Maximize the health and life expectancy of newly planted public trees on City streets and in parks</b>			
<b>Action 9A.</b> Update and consolidate the Tree Planting and Maintenance Specification document and the Tree Planting Details and Specifications Downtown Area and Regional Streets document to create a City tree planting standard, with particular consideration for the following: <ul style="list-style-type: none"> <li><b>i.</b> Consolidating the two documents, with standards specific to downtown and regional streets,</li> <li><b>ii.</b> Establish new minimum soil volume requirements:               <ol style="list-style-type: none"> <li><b>1.</b> <i>Small trees; 8 cubic metres of soil, 6 cubic metres if shared</i></li> <li><b>2.</b> <i>Medium trees; 20 cubic metres of soil, 15 cubic metres if shared</i></li> <li><b>3.</b> <i>Large trees; 35 cubic metres of soil, 30 cubic metres if shared, and</i></li> </ol> </li> <li><b>iii.</b> Enable the City Forester to approve reduced soil volumes in short-term landscapes where trees may be managed on a short-lived rotation (less than 25 years).</li> </ul>	Medium		\$\$



## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

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- \$\$:** <\$100,000
- \$\$\$:** \$100,000 to \$500,000
- \$\$\$\$:** >\$500,000

Action plan	Initiation timeline	Financial impacts
<b>Policy 10. Maximize the quantity and quality of trees planted with development</b>		
<p><b>Action 10A. Consider updating the Zoning By-law (200/2006) and related policy to:</b></p> <ul style="list-style-type: none"> <li><b>i.</b> Explore alignment with Infill Design Guidelines document which contains spatial requirements for private infill planting,</li> <li><b>ii.</b> Simplify information included in the Zoning By-law and instead refer to a technical document that contains detail for tree requirements,</li> <li><b>iii.</b> Require trees on private land to be spaced at least 6 m away from any existing or proposed City-owned tree,</li> <li><b>iv.</b> In addition to requiring one tree for every 10 metres of frontage, establish a planting or retention target of 30 trees per hectare to contribute to achieving 24% city-wide canopy cover at maturity and explore cash-in-lieu where tree density cannot be accommodated,</li> <li><b>v.</b> Require surface parking to incorporate landscape buffers and one tree per six stalls,</li> <li><b>vi.</b> When trees are retained, reduce the credits by half for each size class,</li> <li><b>vii.</b> Require, when possible, consolidated permeable areas in preferred locations (e.g., frontage or rear yard) to support tree planting on private land,</li> <li><b>viii.</b> Specify soil quality, depth, and volume requirements on newly developed boulevards and private property to support healthy trees,</li> <li><b>ix.</b> When trees are present onsite or on neighbouring property, require tree surveys and arborist reports to accurately locate trees and recommend retention, protection, and removals of any trees impacted by development prior to building permit approval,</li> <li><b>x.</b> Consider enforcement program to ensure trees for new developments are planted in accordance with zoning requirements and plan approvals, and</li> <li><b>xi.</b> Require bonding for tree protection, planting and landscaping.</li> </ul>	Medium	\$\$
<p><b>Action 10B. Consider updating the Downtown Zoning By-law (100/2004) and related policy to:</b></p> <ul style="list-style-type: none"> <li><b>i.</b> Simplify information included in the Downtown Zoning By-law and instead refer to a technical document that contains detail for tree requirements,</li> <li><b>ii.</b> Require trees on private land to be spaced at least 6 m away from any existing or proposed City-owned tree,</li> <li><b>iii.</b> Establish a planting or retention target of 18 trees per hectare that are sufficient to achieve 15% canopy cover at maturity in the CentreVenture area and explore cash-in-lieu where tree density cannot be accommodated,</li> <li><b>iv.</b> Require minimum soil volumes per tree:               <ol style="list-style-type: none"> <li><b>1.</b> <i>Small trees 8 cubic metres of soil, 6 cubic metres if shared</i></li> <li><b>2.</b> <i>Medium trees 20 cubic metres of soil, 15 cubic metres if shared</i></li> <li><b>3.</b> <i>Large trees 35 cubic metres of soil, 30 cubic metres if shared,</i></li> </ol> </li> </ul>	Medium	\$\$





# PLANT STRATEGICALLY

## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$:** within existing resources/costed in other City strategy
- \$\$:** <\$100,000
- \$\$\$:** \$100,000 to \$500,000
- \$\$\$\$:** >\$500,000

Action plan	Initiation timeline	Financial impacts
<ul style="list-style-type: none"> <li><b>v.</b> When trees are present onsite or on neighbouring property, require tree surveys and arborist reports to accurately locate trees and recommend retention, protection, and removals of any trees impacted by development,</li> <li><b>vi.</b> Require bonding for tree protection, planting, and landscaping, and</li> <li><b>vii.</b> Consider enforcement program to ensure trees for new development are planted in accordance with the Downtown Zoning By-law and plan approvals.</li> </ul>	Medium	\$\$
<p><b>Action 10C.</b> Consider updating the Development Agreement Parameters to:</p> <ul style="list-style-type: none"> <li><b>i.</b> Ensure that tree planting, soil volume and quality requirements including soil specifications for boulevards and parks, are consistent with existing and updated City policies and standards related to trees and new City tree policy,</li> <li><b>ii.</b> Require minimum boulevard planting strip widths to support street trees and in consideration of services within the right-of-way,</li> <li><b>iii.</b> Include park tree planting requirements based on achieving tree planting densities specified by parks classification.</li> <li><b>iv.</b> Require a minimum planting in new neighbourhoods at 30 trees per hectare to contribute to achieving 24% city-wide canopy cover at maturity, including street and park trees, and</li> <li><b>v.</b> Encourage sustainable neighbourhood design principles such as rainwater harvesting and grey water recycling/reuse systems that could be used to water vegetation health in streets and parks.</li> </ul>	Medium	\$\$
<b>Policy 11. Provide incentives to encourage private land tree planting</b>		
<b>Action 11A.</b> Continue to collaborate with community partners who subsidize tree planting on private land and provide education extension services to increase resident uptake, including exploring options to increase engagement with high poverty areas.	Short	\$\$
<b>Action 11B.</b> Develop a recommended species list to provide information to residents about species growing requirements, pest and disease risk, climate hardiness, and salt tolerance.	Short	\$\$
<b>Policy 12. Expand and enhance naturalized forest and riverbank areas</b>		
<b>Action 12A.</b> Develop a natural areas management plan that includes a restoration planting strategy to guide the planting of native trees and enhancement of forest structure in urban parks, boulevards, and riverbanks.	Short	\$\$
<b>Action 12B.</b> Continue to propagate plants in the native plant nursery to maintain local biodiversity in natural area plantings.	Short	\$
<b>Action 12C.</b> Explore opportunities to work with the Province of Manitoba and other stakeholders to source climate adapted seeds and seedlings for natural areas.	Medium	\$
<b>Action 12D.</b> Where eligible, apply for Federal funding for native tree propagation and restoration through the Disaster Mitigation and Adaptation fund, 2 Billion Trees Program or other funds that become available.	Short	\$
<b>Action 12E.</b> Restore degraded riverbanks or other restoration areas in accordance with the natural areas management plan.	Medium	Long
		\$\$\$



# MANAGE ADAPTIVELY



## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$: within existing resources/costed in other City strategy
- \$\$: <\$100,000
- \$\$\$: \$100,000 to \$500,000
- \$\$\$\$: >\$500,000

Action plan	Initiation timeline	Financial impacts
<b>Policy 13. Maintain and regularly update an inventory of urban forest assets</b>		
<b>Action 13A.</b> Work with the Corporate Support Services to identify appropriate software to update the tree inventory to a cloud-based system hosted on City GIS.	Medium	\$\$
<b>Action 13B.</b> Explore options to enable the creation and management of work orders using the City's tree inventory system.	Medium	\$
<b>Action 13C.</b> Update and maintain an inventory of vacant planting locations.	Medium   Long	\$\$
<b>Action 13D.</b> Map urban tree canopy to establish a baseline canopy extent.	Medium	\$\$
<b>Action 13E.</b> Explore options to monitor tree health using remote sensing or other emerging technologies.	Medium	\$\$
<b>Action 13F.</b> Document a process for managing and updating the tree inventory as crews complete the pruning cycle.	Medium	\$
<b>Action 13G.</b> Add tree tags to Commemorative Trees.	Medium	\$\$
<b>Policy 14. Follow a best practices program for tree care and tree risk management for City-owned trees</b>		
<b>Action 14A.</b> Inspect City-owned trees on a regular cycle based on their location or condition. <ul style="list-style-type: none"> <li>i. Update the current block pruning program to target a seven-year cycle for street trees and 12-year cycle for park trees and prioritize areas with a higher proportion of trees in poor condition.</li> <li>ii. When an area comes up for inspection with the pruning cycle, conduct windshield surveys to both identify 'Priority 1' trees requiring immediate attention, as well as to define the scope of pruning work for the cycle.</li> <li>iii. Include a 'Monitor Risk' action in the tree inventory to flag trees requiring annual risk assessment.</li> </ul>	Medium	\$\$\$\$
<b>Action 14B.</b> Continue enhanced maintenance of street and park trees in Downtown / CentreVenture area.	Short	\$
<b>Action 14C.</b> Continue current on-demand practices for responding to service requests for pruning or risk assessment.	Short	\$

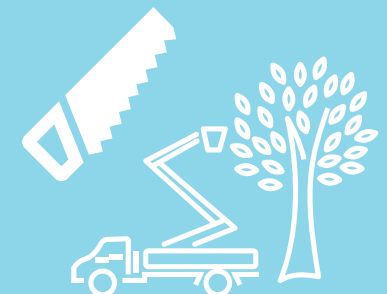
## Goal

Manage adaptively to improve tree health and public safety, respond to challenges and opportunities, and achieve planned levels of service



## Key targets

- Prune street trees on a 7-year cycle and park trees on a 12-year cycle
- No more than 1.5% annual loss of public trees
- No more than 2% annual loss of city-wide American elm



31 year pruning cycle in 2019



# MANAGE ADAPTIVELY

## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$:** within existing resources/costed in other City strategy
- \$\$:** <\$100,000
- \$\$\$:** \$100,000 to \$500,000
- \$\$\$\$:** >\$500,000

Action plan	Initiation timeline	Financial impacts
<b>Action 14D.</b> Document risk assessment and response in records tied to the tree inventory.	Medium	\$
<b>Action 14E.</b> Consider establishing qualified tree risk assessor staff positions dedicated to responding to service requests for on-demand risk inspection and proactive risk assessment.	Medium	\$\$\$
<b>Action 14F.</b> Document a formal storm response plan.	Short	\$\$
<b>Action 14G.</b> Consider extending the watering and maintenance program for newly planted trees from two years to five years after planting.	Short	\$\$
<b>Policy 15. Rapidly remove dead, diseased, and dangerous trees</b>		
<b>Action 15A.</b> Implement a prioritized rapid removal program for Dutch elm disease by removing priority brood trees by August 30th annually.	Short	\$\$\$
<b>Action 15B.</b> Complete all tree removals for Dutch elm disease infected trees by April each year.	Short	\$\$\$
	Medium	
	Long	
<b>Action 15C.</b> Create and implement an invasive forest pest response plan for ash trees, including: <ul style="list-style-type: none"> <li>i. an emerald ash borer response plan for parks and natural areas to define procedures for trail/park closures,</li> <li>ii. tree removals and debris management thresholds to mitigate public safety risk, and</li> <li>iii. wildfire risk once emerald ash borer has been detected in an area.</li> </ul>	Short	\$\$\$
<b>Action 15D.</b> Update the Neighbourhood Livability By-law to enable the City to require owners to remove dead trees, dying trees, or trees infested with emerald ash borer including penalties for violations.	Short	\$
<b>Action 15E.</b> Explore opportunities for community partnerships or subsidies to identify disparities in equitable access.	Medium	\$\$
<b>Action 15F.</b> Explore the feasibility of wood utilization options such as directing waste wood to the Water and Waste department to manage the volumes of woodwaste anticipated in the next 10 years.	Short	\$



# MANAGE ADAPTIVELY

## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$:** within existing resources/costed in other City strategy
- \$\$:** <\$100,000
- \$\$\$:** \$100,000 to \$500,000
- \$\$\$\$:** >\$500,000

Action plan	Initiation timeline		Financial impacts
<b>Policy 16. Minimize the use and impact of common practices that harm City-owned trees</b>			
<b>Action 16A.</b> Continue to explore alternatives to road salts, such as beet juice and calcium chloride.	Medium		\$
<b>Action 16B.</b> Consider mitigating salt impacts in planting areas; in particular, give consideration to: <ul style="list-style-type: none"> <li>i. Flushing planting areas and trees with water in the spring prior to bud break, and</li> <li>ii. Installing larger soil volumes and drainage to enable flushing of soil and greater dilution of salt concentrations.</li> </ul>	Medium	Long	\$\$\$
<b>Policy 17. Strengthen communication and information sharing between departments and other agencies external to the City</b>			
<b>Action 17A.</b> Ensure tree inventory data is available internally across departments.	Short		\$
<b>Action 17B.</b> Add tree issues categories to the 311 dropdown menu for view/find and apply/register/report on the City website.	Short		\$
<b>Action 17C.</b> Create an online map interface on the City's GIS platform to publicly communicate planned tree removals and plantings.	Medium		\$\$
<b>Action 17D.</b> Establish a working group with Manitoba Hydro to streamline processes for pruning or removing trees within 10 feet of utility wires and within Hydro easements, and to establish standards for pruning elms in the City at risk of Dutch elm disease.	Medium		\$
<b>Policy 18. Monitor natural area forest cover and prioritize invasive species removal where overstory canopy losses are expected</b>			
<b>Action 18A.</b> Inventory the extent of buckthorn and other invasive species with the potential to invade and replace forests following ash or elm removal.	Medium		\$\$\$
<b>Action 18B.</b> Obtain data on understory regeneration and seed bank composition in ash and elm dominated natural areas to identify areas needing replanting.	Medium		\$\$
<b>Action 18C.</b> Develop a natural areas management plan that identifies high risk canopy areas as well as appropriate treatment options, and also includes recommendations for restoration post-disturbance, if applicable.	Medium		\$\$\$



# PROTECT PRUDENTLY

## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$: within existing resources/costed in other City strategy
- \$\$: <\$100,000
- \$\$\$: \$100,000 to \$500,000
- \$\$\$\$: >\$500,000

## Goal

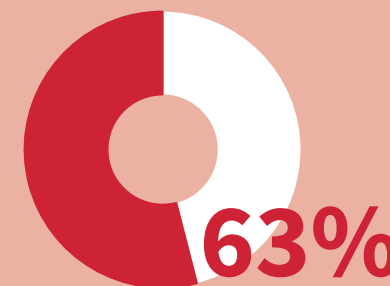


Protect prudently to sustain Winnipeg's urban forest canopy where it will maximize the benefits for human health and ecological function



## Key targets

- No more than 1.5% annual loss of public trees
- No more than 2% annual loss of city-wide American elm



Survey respondents dissatisfied with tree protection during development/construction

Action plan	Initiation timeline	Financial impacts
<b>Policy 19. Increase protections for trees and soil on private land</b>		
<b>Action 19A.</b> Consider creating a tree bylaw that: <ul style="list-style-type: none"> <li>i. Regulates removal, protection, and replacement of trees that are retained or planted as a condition of a building permit or a legal agreement related to development, servicing, zoning, or subdivision,</li> <li>ii. Regulates removal, protection, and replacement of trees in existing natural areas (quality grade C or above) identified in the Natural Areas Inventory and regulated areas of the Waterway By-law (5888/92), and</li> <li>iii. Enables enforcement and fines for damage to trees protected under the bylaw.</li> </ul>	Medium	\$\$
<b>Action 19B.</b> Update the Tree Removal Guidelines to: <ul style="list-style-type: none"> <li>i. Consolidate the Tree Removal Guidelines with other policies in a new City Tree Policy, and</li> <li>ii. Establish City-owned replacement tree planting securities to \$2,000 per tree (up to a maximum total per project) to deter forfeiture of planting obligations on development sites.</li> </ul>	Medium	\$
<b>Action 19C.</b> Monitor tree canopy loss on private property over time using urban tree canopy mapping to detect changes at the lot scale and consider whether future updates to the tree bylaw should broaden tree protection to all private land.	Medium	\$\$
<b>Action 19D.</b> Consider creating a Development Arborist position in the Planning, Property & Development to administer the regulatory components for trees in the zoning bylaws and receive referrals on all tree issues related to development.	Medium	\$\$\$
<b>Action 19E.</b> Explore opportunities to advance tree protection earlier in the development process and formalize a referral stage with Land Development or a new Development Arborist position.	Medium	\$
<b>Action 19F.</b> Consider creating technical documents that detail tree requirements in support of the Zoning By-law (200/2006) and Downtown Zoning By-law (100/2004) to include requirements for arborist reporting and protection standards and bonds to be held for retained trees during development.	Medium	\$\$
<b>Action 19G.</b> Consider enabling density bonuses and up-zoning to provide incentives for the retention of existing natural areas (quality grade C or above) identified in the Natural Areas Inventory or restoration of areas that would contribute towards developing a city-wide green infrastructure network.	Medium	\$
<b>Action 19H.</b> Explore options to regulate or provide incentives to retain native soils for use on development sites, or to protect native soil areas on lands that will become parks or tree planting areas.	Medium	\$



## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$: within existing resources/costed in other City strategy
- \$\$: <\$100,000
- \$\$\$: \$100,000 to \$500,000
- \$\$\$\$: >\$500,000

Action plan	Initiation timeline	Financial impacts
<b>Policy 20. Increase protections for the City-owned trees</b>		
<b>Action 20A.</b> Review the Park By-law, Streets By-law, Neighbourhood Livability By-law and Municipal By-law Enforcement Act Enabling By-law to: <ul style="list-style-type: none"> <li>i. Prohibit damage to and unauthorized removal of all trees on City property under the authority of the City Forester,</li> <li>ii. Add fine provisions and amounts for damage to or removal of City-owned trees.</li> </ul>	Short	\$\$
<b>Action 20B.</b> Explore opportunities to advance tree protection earlier in the design process for municipal projects and to formalize processes for referring projects to Urban Forestry for review and recommendations.	Short	\$
<b>Action 20C.</b> Update tree protection specifications for inclusion in City construction specifications to include tree preservation and protection measures, requiring project arborists for supervising works around trees, and hold backs.	Short	\$
<b>Action 20D.</b> Move Tree Protection during Construction from the Tree Planting Details & Specifications Downtown Area and Regional Streets into a new City Tree Policy module and require security bonds per tree to be held for the duration of construction projects (amounts based on a minimum per tree and/or tree valuation, whichever is greater).	Medium	\$
<b>Action 20E.</b> Consider expanding on Tree Protection during Construction in the City Tree Policy to include a section for the protection of ecologically significant lands on City property.	Medium	\$
<b>Action 20F.</b> Consider identifying historical City-owned tree resources, such as the Broadway elms, to nominate for inclusion in the List of Historical Buildings and Resources and protection under the Historical Resources By-law (55/2014).	Medium	\$\$
<b>Policy 21. Create a connected and protected green infrastructure network of public trees, parks, and natural area forests</b>		
<b>Action 21A.</b> Building on the Ecologically Significant Natural Lands Strategy, identify a city-wide green infrastructure network of significant habitats and corridors and prioritize for protection and restoration through the development planning process.	Medium	\$\$
<b>Action 21B.</b> Update the Ecologically Significant Natural Lands Strategy (ESNL) and provide policy direction identifying how and when natural areas are to be preserved to: <ul style="list-style-type: none"> <li>i. Explore the possibility of identifying forest patches in ecologically significant natural lands for protection and integration into the design of new communities at the secondary planning stage, prior to dedication of parkland, and</li> <li>ii. Enable the evaluation and designation of ESNL on all City lands prior to disposition or destruction of natural features.</li> </ul>	Medium	\$\$
<b>Action 21C.</b> Focus protection and preservation of continuous forest patches with a canopy greater than 0.5 ha in area, in accordance with the Winnipeg Parks Strategy.	Medium	\$
<b>Action 21D.</b> Proactively acquire parks in rural and agricultural areas to preserve natural areas, in accordance with Winnipeg's Parks Strategy and Complete Communities. <ul style="list-style-type: none"> <li>i. As these spaces are acquired, ensure that Indigenous peoples have access to this space for land-based education programs, including cultural teachings, food, and ceremonies.</li> </ul>	Long	\$\$\$\$
<b>Action 21E.</b> Explore opportunities to incentivize private landowners to protect and restore ecologically significant lands.	Medium	\$
<b>Action 21F.</b> Create a conservation fund with the objective of acquiring natural areas and forested land.	Long	\$\$\$\$



# PARTNER PURPOSEFULLY

## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$: within existing resources/costed in other City strategy
- \$\$: <\$100,000
- \$\$\$: \$100,000 to \$500,000
- \$\$\$\$: >\$500,000

Action plan	Initiation timeline	Financial impacts
<b>Policy 22.</b> Establish mutually-respectful partnerships with First Nations, Métis, and Inuit governments, organizations, and individuals		
<b>Action 22A.</b> Identify partnerships with Indigenous communities and learn how to engage with Indigenous peoples.	Short	\$\$
<b>Action 22B.</b> Work together with local Indigenous communities to incorporate Indigenous perspectives into plant species selection and climate adaptation approaches for Winnipeg’s urban forest and natural areas.	Short	\$\$
<b>Policy 23.</b> Empower residents to participate in urban forest management.		
<b>Action 23A.</b> Explore the potential to create a Citizen Forester program in collaboration with a community partner to train volunteers to: <ul style="list-style-type: none"> <li>i. Prune newly planted trees in years three and five,</li> <li>ii. Participate in watering trees,</li> <li>iii. Participate as citizen scientists and collect data to inform urban forest management, and</li> <li>iv. Become community tree stewards who can be called on to train new volunteers and provide presentations and education to community members interested in participating in stewardship programs.</li> </ul>	Medium	\$\$
<b>Action 23B.</b> Enable smaller caliper trees to be planted on City property by residents or community groups when approved by the City Forester.	Short	\$
<b>Action 23C.</b> Explore grant, rebate, or tax incentive program opportunities to support people to maintain large trees on their own properties.	Long	\$\$
<b>Action 23D.</b> Provide canopy cover and other urban forest data on a public map viewer dashboard and make data available on the Open Data system.	Medium	\$
<b>Action 23E.</b> Explore the development of an Adopt-a-Tree-Block program where residents of a street could come together to monitor and enhance young tree care and watering in streets or parks, and to share information about planting and tree care on their own properties.	Short	\$\$

## Goal

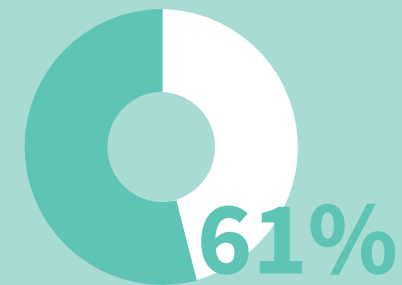


Partner constructively to foster reconciliation and stewardship that will build capacity to achieve goals and respond to challenges



## Key targets

At least 50% customer satisfaction rate across all services



Survey respondents dissatisfied with public education



# PARTNER PURPOSEFULLY

## LEGEND

### Initiation timeline

- Short:** 1 to 4 years
- Medium:** 5 to 10 years
- Long:** 11 to 20 years

### Financial impact

- \$:** within existing resources/costed in other City strategy
- \$\$:** <\$100,000
- \$\$\$:** \$100,000 to \$500,000
- \$\$\$\$:** >\$500,000

Action plan	Initiation timeline	Financial impacts
<b>Policy 24. Raise the profile of urban forestry city-wide</b>		
<b>Action 24A.</b> Promote the Tree Donation Program to encourage more participation from businesses and individuals to contribute to reforestation and/or new plantings.	Short	\$
<b>Action 24B.</b> Develop and implement a communications and stewardship plan that explores opportunities to share key messages about implementing the Urban Forest Strategy, engage community members in stewardship, and provide educational opportunities in collaboration with partners.	Short	\$\$
<b>Action 24C.</b> Develop a community volunteer tree planting program with required associated resources.	Medium	\$\$\$
<b>Action 24D.</b> Pursue ‘Tree City’ status through the Tree Cities of the World program to recognize Winnipeg’s commitment to caring for its trees and forests.	Medium	\$
<b>Action 24E.</b> Explore opportunities to collaborate with partners in the arts and business improvement zones to develop an urban arboretum/art projects that uses trees and signage to tell stories of the urban forest and ensure Indigenous voices and histories are heard.	Medium	\$\$
<b>Action 24F.</b> Explore opportunities to partner with Manitoba Hydro to share information with the public about tree removals, pruning, and replanting taking place due to their maintenance activities.	Medium	\$
<b>Policy 25. Work with partners to implement the Urban Forest Strategy</b>		
<b>Action 25A.</b> Continue to work with the Western Nursery Growers group on planting trials in various prairie regions to test hardiness and suitability of different tree species and new cultivars.	Short/Medium/Long	\$\$
<b>Action 25B.</b> Continue to collaborate with community organizations that can support the City’s implementation of the Urban Forest Strategy and coordinate stewardship activities and grants to support community tree planting.	Short/Medium/Long	\$\$
<b>Action 25C.</b> Continue to work with local universities to study the urban forest, Dutch elm disease, emerald ash borer, and the effectiveness of management practices to support adaptive management.	Short/Medium/Long	\$
<b>Action 25D.</b> Continue to support and promote Trees Winnipeg’s ReLeaf program and related initiatives.	Short/Medium/Long	\$\$
<b>Action 25E.</b> Continue to maintain regular contact and collaborate with the Province of Manitoba and the Canadian Food Inspection Agency on the management of current and emerging pest and disease threats.	Short/Medium/Long	\$
<b>Action 25F.</b> Continue to participate in regional networks such as the Prairies Region Canadian Urban Forest Network, the Manitoba Urban Forest Council, the Manitoba Nursery and Landscape Association, and the International Society of Arboriculture Prairie Chapter.	Short/Medium/Long	\$
<b>Action 25G.</b> Explore opportunities to partner with government and the development and construction sectors to implement stewardship programs that would support the preservation and restoration of native woodland areas.	Medium	\$\$
<b>Action 25H.</b> Explore opportunities to partner with school and institutional land managers to adopt canopy cover targets and implement the Urban Forest Strategy on their own lands.	Long	\$





## 6. Measuring progress

This Strategy has been developed at a time when Winnipeg’s urban forest faces unprecedented threats from invasive pests and disease and climate change. The actions recommended in this strategy are focused on increasing the Winnipeg’s capacity to respond to these threats and increasing the resilience of the tree population to sustain Winnipeg’s urban forest legacy.

There is significant uncertainty surrounding the extent and rate of change in tree canopy that climate hazards, Dutch elm disease and emerald ash borer will cause. The Strategy integrates an adaptive management approach by recommending that progress towards meeting service targets be monitored at regular intervals, and that the actions proposed in this plan be reviewed every four years.

While responsibility for implementing this plan lies primarily with the City, realizing the vision for an abundant, healthy, diverse, and resilient urban forest that contributes to the health and wellbeing of all people and communities will require the support and participation of all partners and residents.

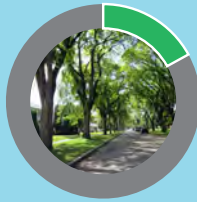
Table 7. Monitoring plan

Target	Measurement Frequency and method
24% canopy cover by 2065 (or maintain at 17% if EAB establishes)	5 years - LiDAR
No more than 5% of potential planting sites vacant by 2065	5 years - inventory of vacant sites
1:1 tree replacement (one tree replaced for every tree removed)	Annual - tree removal and planting records
No more than 10% of any species and 20% of any genus in the public inventory by 2065	5 years - tree inventory
No more than 1.5% annual loss of public trees	Annual - tree removal records
No more than 2% annual loss of city-wide American elm	Annual - DED surveillance and American elm removal records
Prune street trees on a seven-year cycle and park trees on a 12-year cycle	Annual - pruning records
As least 50% customer satisfaction rate across all services	5 years - resident survey

# WINNIPEG'S URBAN FOREST



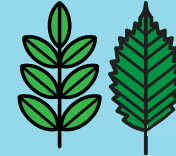
**3 MILLION**  
Trees city-wide



**17%**  
Canopy cover  
(2018)



**\$3 BILLION**  
Compensatory  
value



**58%**  
of public tree  
inventory is  
ash & elm

## CHALLENGES



### Climate Change

Warmer summers means more hot days and less moisture for trees. The frequency of extreme events like heat waves and heavy, wet snowfalls is expected to increase.



### Urbanization

Winnipeg is growing, with new development at the urban fringe and densification in existing areas changing the landscape for trees.



### Pests & Disease

Dutch elm disease and emerald ash borer could impact more than 50% of Winnipeg's tree population. Warmer temperatures will improve pest survival and growth.

**Winnipeg risks losing almost 50% of its tree population in the next 40 years to pests and disease**

## OUR PLAN

### Vision for the urban forest

An abundant, healthy, diverse, and resilient and contributes to the health and wellbeing of all people and communities.



**1. PLAN**  
accountably



**2. PLANT**  
strategically



**3. MANAGE**  
adaptively

### Goals



**4. PROTECT**  
prudently



**5. PARTNER**  
purposefully

### City-wide Targets

1. 24% canopy cover by 2065
2. No more than 2% annual loss of city-wide American elm

### Public Tree Targets

3. No more than 5% of potential planting sites vacant
4. One tree replaced for every tree removed

5. No more than 10% species and 20% genus in public inventory
6. No more than 1.5% annual loss of public trees
7. Prune street trees on a seven-year cycle and park trees on a 12-year cycle
8. At least 50% customer satisfaction rate across all services



## Endnotes

- 1 Konijnendijk van den Bosch, C., Ricard, R., Kenny, A., Randrup, T. B. (2006). *Defining urban forestry-A comparative perspective of North Americana and Europe*. Urban Forestry & Urban Greening. 4:3-4
- 2 City of Winnipeg. (2021) *State of the Urban Forest*. 39p. <https://engage.winnipeg.ca/10550/widgets/67282/documents/56609>
- 3 Golder Associates. (2015). *Winnipeg's 2011 Community Greenhouse Gas Inventory and Forecast*. <https://www.winnipegvitalsigns.org/wp-content/uploads/Golder-and-Assoc-GHG-Report.pdf>
- 4 Manitoba Government. (n.d.). *Species and Ecosystem at Risk*. <https://gov.mb.ca/fish-wildlife/wildlife/ecosystems/index.html>
- 5 Casati, B., Yagouti, A., Chaumont, D. (2013). *Regional climate projections of extreme heat events in nine pilot Canadian communities for public health planning*. Journal of Applied Meteorology and Climatology, 52(12), 2669-2698.
- 6 Prairie Climate Centre. (2019). *Heat Waves and Health – A special report on climate change in Canada*. <https://climateatlas.ca/heat-health-report.pdf>
- 7 Ziter, C., Pedersen, E., Kucharik, C., Turner, M. (2019). *Scale-dependent interactions between tree canopy cover and impervious surfaces reduce daytime urban heat during summer*. Proceedings of the National Academy of Sciences, 2019; 201817561 DOI: 10.1073/pnas.1817561116
- 8 Hansen, M., Jones, R., Tocchini, K., (2017). *Shinrin-Yoku (Forest Bathing) and Nature Therapy: A State-of-the-Art Review*. doi: 10.3390/ijerph14080851
- 9 Williams, F. (2016). *This is your brain on nature*. <https://www.nationalgeographic.com/magazine/2016/01/call-to-wild/>
- 10 City of Winnipeg. (2021). *Winnipeggers love parks: Pandemic push leads to spike in visits*. <https://winnipeg.ca/ourstories/2021/210318-2.stm>
- 11 Heerwagen, J.H., & Orians, G.H. (2002). *The ecological world of children*. In: Kahn, P.H.J., and S.R. Kellert (eds.), *Children and Nature: Psychological, Sociocultural, and Evolutionary Investigations*. MIT Press, Cambridge MA, pp. 29-64.
- 12 Moore, R. (1986). *The Power of Nature Orientations of Girls and Boys Toward Biotic and Abiotic Play Settings on a Reconstructed Schoolyard*. Children's Environments Quarterly 6, 1:3-6.
- 13 Kaiser Family Foundation (KFF). (2020). *Generation M2: Media in the Lives of 8- to 18-Year-Olds*. <https://www.kff.org/other/report/generation-m2-media-in-the-lives-of-8-to-18-year-olds/>
- 14 Ho, H.C., Knudby, A., Chi, G., Aminipouri, M., Yuk-Fo Lai, D. (2018). *Spatiotemporal analysis of regional socio-economic vulnerability change associated with heat risks in Canada*. Applied Geography. Vol. 95. <https://doi.org/10.1016/j.apgeog.2018.04.015>
- 15 Prairie Climate Centre. (2019). *Heat Waves and Health – A special report on climate change in Canada*. <https://climateatlas.ca/heat-health-report.pdf>
- 16 Dick, L. (1996). *Parks Canada. Manitoba History: The Greening of the West: Horticulture on the Canadian Prairies, 1870-1930*. [http://www.mhs.mb.ca/docs/mb\\_history/31/prairiehorticulture.shtml](http://www.mhs.mb.ca/docs/mb_history/31/prairiehorticulture.shtml)
- 17 Food and Agriculture Organization of the United Nations. (2016). *Benefits of urban trees*. <http://www.fao.org/resources/infographics/infographics-details/en/c/411348/>
- 18 Wolf, K.L. (2005). *Business District Streetscapes, Trees and Consumer Response*. Journal of Forestry 103, 8:396-400.
- 19 University of Washington. (2018). *Green Cities: Good Health*. <http://depts.washington.edu/hhwb/>
- 20 Prairie Climate Centre. (2019). *Heat Waves and Health – A special report on climate change in Canada*. <https://climateatlas.ca/heat-health-report.pdf>
- 21 Mitchell, R., & Popham, F. (2008). *Effect of Exposure to Natural Environment on Health Inequalities: An Observational Population Study*. The Lancet 372: 1655-1660.
- 22 Omid, K., Gozdyra, P., Mistic, B., Moola, F., Palmer, L., Paus, T., Berman, M. (2015). *Neighbourhood greenspace and health in a large urban center*. <https://www.nature.com/articles/srep11610>

- 23 Thomas, L. (2014). *Exploring Connections Between Trees and Human Health*. United States Department of Agriculture and United States Forest Service. <https://www.fs.fed.us/pnw/science/scifi158.pdf>
- 24 City of Winnipeg. (2021). *Population of Winnipeg*. <https://winnipeg.ca/cao/pdfs/population.pdf>
- 25 Goldsborough, G. (2006). *Manitoba History: Greening the Treeless Plain*. Manitoba Historical Society Newsletter Number 53,.
- 26 Macdonald, C. (1995). *A City at Leisure: an Illustrated History of Parks and Recreation Services in Winnipeg 1893-1993*. <https://www.winnipegarchitecture.ca/wp-content/uploads/2014/09/A-City-at-Leisure.pdf>
- 27 Rosen, M. (2015). *A Brief Historical Perspective of Urban Forests in Canada*. <http://treecanada.ca/wp-content/uploads/2017/10/Article-2-EN-2015-Historical-Perspective-Urban-Forests.pdf>
- 28 Croal, P., Geol, P., Stirby's, P. (2021). *National Healing Forest project launched across Canada*. Tree Canada. <https://treecanada.ca/blog/national-healing-forest-project-launched-across-canada/>
- 29 Hildebrandt, S. (2020). *Healing Forest receives new name - Phase Two of the forest design plan continue this summer*. Winnipeg Free Press. <https://www.winnipegfreepress.com/our-communities/times/Healing-Forest-receives-new-name-571834561.html>
- 30 Dacy, E. (2018). *Healing forest to be grown in Winnipeg park*. CBC News. <https://www.cbc.ca/news/canada/manitoba/healing-forest-grown-winnipeg-park-1.4530753>
- 31 Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S.A., Tyukavina, A., Thau, D., Stehman, S.V., Goetz, S.J., Loveland, T.R., Kommareddy, A., Egorov, A., Chini, L., Justice, C.O., Townshend, J.R.G. (2013). *High-Resolution Global Maps of 21st-Century Forest Cover Change*. Science 342 (15 November): 850–53. Data available on-line from: <http://earthenginepartners.appspot.com/science-2013-global-forest>.

# 7. Appendix

## State of the Urban Forest Report



Winnipeg Comprehensive Urban Forest Strategy

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**State of the Urban Forest**

# Acknowledgments

Diamond Head Consulting Ltd. (DHC) prepared this report for the City of Winnipeg. DHC acknowledges the participation and support of City of Winnipeg departments and staff in preparing this document.



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## 1. Introduction

This Report on the State of Winnipeg's Urban Forest provides an overview on the composition of Winnipeg's urban forest, its value, how it is managed, introduces performance metrics and indicators for sustainable urban forest management, and compares Winnipeg's urban forest management programs and services with other Canadian cities.

**The purpose of this document** is to provide a baseline and background to inform and help guide the development of the Comprehensive Urban Forest Strategy.

The report is organized into the sections listed below:

1. **Introduction** - a brief overview of why we need urban forests and how they benefit cities
2. **Winnipeg's urban forest resource** — a description of what and where the urban forest is, why it is important and how it benefits the community
3. **Winnipeg's urban forestry program** — a synopsis of the current urban forest services and programs that the City provides in relation to indicators for achieving sustainable urban forest management
4. **Peer city comparison** — a comparative analysis of Winnipeg urban forest management and service metrics compared to information available from other jurisdictions in Canada
5. **Enabling policies**— a description of the current policy context that frames Winnipeg's urban forest management
6. **Key challenges and opportunities** — an overview of some of the major areas that the Comprehensive Urban Forest Strategy will address



*A Comprehensive Urban Forest Strategy will provide the 20-year strategic direction for Winnipeg's urban forest.*

***Urban forestry is the 'art, science and technology of managing trees and forest resources in and around urban community ecosystems for the physiological, sociological, economic, and aesthetic benefits trees provide society'***  
***(Helms, 1998)***

## Why cities need urban forests

When healthy and well-managed, the urban forest produces 'ecosystem services' often defined in four distinct but inter-connected categories:

1. **Cultural services:** how people value the urban forest in our way of life such as for beautification, sense of place, health, spirituality, recreation, and tourism
2. **Regulating services:** the regulation of ecosystem processes like pollination, air and water quality, storm water flow, shade, and cooling. With climate change, the role of trees to mitigate extreme heat and precipitation becomes increasingly important
3. **Supporting services:** habitat, biodiversity, and enabling natural processes to occur that maintain the conditions to support life – supporting services are essential to the production of all other ecosystem services
4. **Provisioning services:** direct products of trees and forests, such as fruits, nuts, or medicines

Ecosystem services, some of which are illustrated in Figure 1, are the product of healthy, functioning ecosystems and organisms that benefit human health and well-being. Nearly 40 years of research provides evidence for the benefits of incorporating nature into cities for human health and well-being<sup>1</sup>. Many cities are looking to the urban forest to help adapt to climate hazards, such as by creating shade to cool spaces during heat waves and capturing rainwater to reduce localized flooding during extreme rainfall. Urban forests are increasingly recognized as an essential part of city infrastructure - a natural asset that delivers ecosystem services throughout communities.

That trees and nature are important to Winnipeg has been evident since Winnipeg's beginnings when residents began planting trees. Perhaps the most famous example is the Wolseley elm, planted around 1860, that became a flashpoint for the community's values. The city developed around the Wolseley elm, and - rather than remove it as the street was built - retained it in the centre of Wolseley Avenue. In 1957, the City ordered it cut down as a traffic hazard, but others in the community considered it a safety feature for slowing traffic and an important community symbol worthy of protection. Several women made national news when they formed a human chain around the tree and prevented City crews from cutting it. While the tree was ultimately removed, it was such an enduring symbol that a new Wolseley Elm was planted in 1995 as a dedication to the original tree and the 'Elm Guard'. Today, the City of Winnipeg has an enviable legacy of mature trees and canopy cover, cared for by skilled staff and green industry professionals, active community partners, and passionate residents.

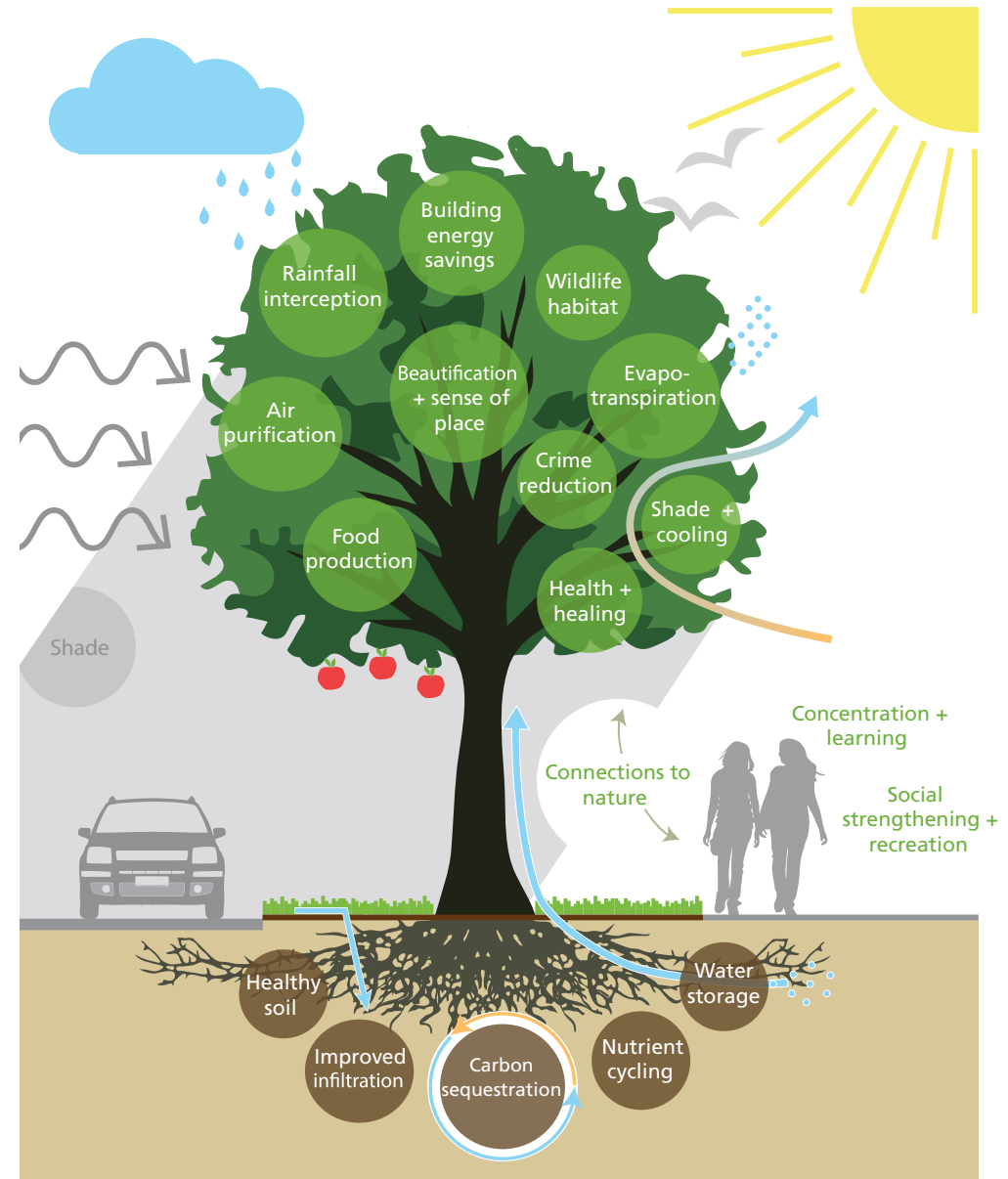


Figure 1: Ecosystem services provided by the urban forest.

<sup>1</sup> Numerous urban forest research studies are summarized on the Green Cities: Good Health website <http://depts.washington.edu/hhwb/>.

## How cities maximize the benefits from trees

Trees are City assets just like roads, sewers, and streetlights. But, unlike these hard assets that depreciate in value with time, trees appreciate in value as they grow and age. Trees also deliver more services as they grow. Large, long-lived and healthy trees provide the greatest benefits because they have the largest canopy and most biomass (Figure 2). Planting and managing few large trees, rather than many small trees, is more efficient and beneficial. This is challenging in urban areas due to limited space, so the best approach is to plant the largest possible tree for the site. Ideally, as a tree matures, it is not in damaging conflict with other infrastructure (e.g. overhead wires). In addition to choosing the right tree for the right place, it is essential to design in adequate space to support healthy tree growth when there are opportunities to install new trees.

Asset management is an approach many cities use to plan for and manage existing and new assets to maximize the benefits, reduce risks, and provide a satisfactory level of service for a sustainable cost. Asset management approaches can be used to create and maintain conditions that give urban trees the best possible chance of reaching maturity and delivering value and services to the community over their full life cycle (Figure 3). Understanding the state of the asset is essential information for creating an asset management plan. The next section describes what we know about Winnipeg's urban forest resource, including the city's entire tree canopy and the public tree inventory.



A street of healthy, mature elms in Winnipeg.

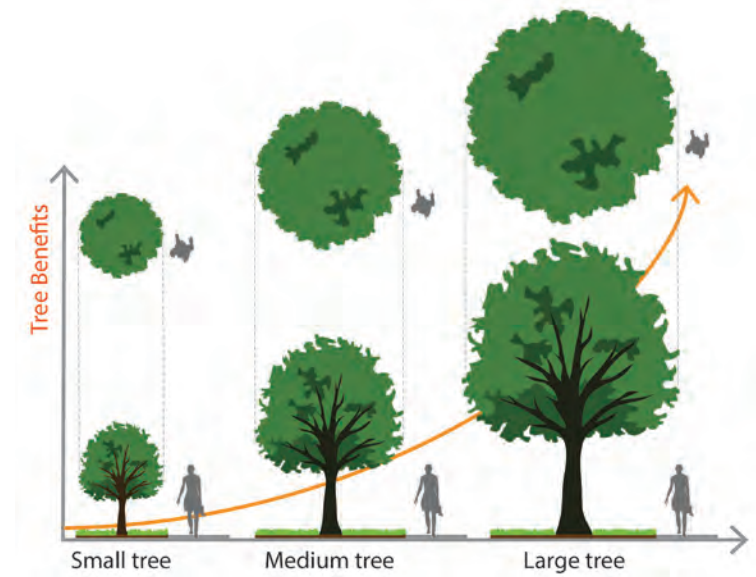


Figure 2: Large, long-lived tree species provide many times the benefits of small tree species over a much longer timeframe when planted in the right place.

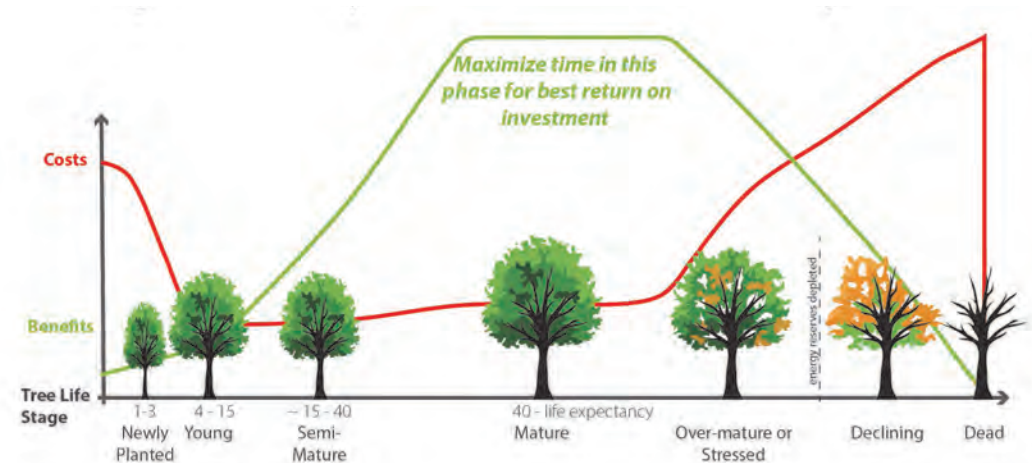


Figure 3: Tree assets should be managed to maximize their healthy, mature life expectancy. Trees cost the most at the start and end of their lives and produce the greatest benefits in the middle. Planning for quality planting sites, tree selection, and maintenance over the whole tree life cycle maximizes life expectancy, minimizes risk and avoids frequent removal and replanting costs.

## 2. Winnipeg's urban forest resource

**Winnipeg's urban forest is the sum total of all trees and associated vegetation, soil, natural processes, and cultural elements on public and private land in and around towns, cities, and other communities(Figure 4).**

The urban forest plays a vital role in forming the city's character and identity. Urban tree planting in Winnipeg started before the City's incorporation in 1873 and now large elm and ash trees provide a beautiful and defining natural character to Winnipeg's streets, parks, and neighbourhoods. The City began planting trees in urban parks and boulevards from the late 1800s to develop Winnipeg as a "garden city".

It is hard to imagine Winnipeg without its green canopy of trees stretching to the horizon. Sadly, urban forest loss is a real prospect due to unprecedented combined challenges from Dutch elm disease, emerald ash borer, extreme weather events, and climate change ravaging Winnipeg's tree canopy. In developing a Comprehensive Urban Forest Strategy, the City will be considering the actions required to increase the long-term resilience and sustainability of Winnipeg's urban forest. This section will summarize the state of the urban forest resource in terms of metrics that could inform setting targets and monitoring change over the term of the Strategy.



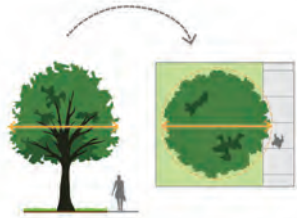
*Winnipeg's extensive urban tree canopy blankets the city's older neighbourhoods.*



*Figure 4: Winnipeg's urban forest includes all trees and associated vegetation, soil, natural processes, and cultural elements.*

## Winnipeg's tree canopy

### Canopy Cover



Canopy cover is a measure cities commonly use to describe the amount or size of their urban forest. Canopy cover measures the area occupied by tree crowns (upper leafy surface) when viewed from above. It is often expressed as a percent compared to the total area of the city. The USDA's i-Tree Canopy program was used to estimate citywide canopy cover.

**Citywide canopy 2018:** 17 percent (declined from 18 percent in 2005 - see Figure 5)

The change measured is not statistically significant. Winnipeg's canopy has been relatively stable over the 13-year period measured, which is likely due to:

- The City's Dutch elm disease management program managing the loss of elm canopy
- New development into prairie grasslands resulting in new tree planting
- Stability in the large undeveloped land uses at the edges of the city meaning that canopy changes have comparatively small impact on citywide canopy cover values
- Continued stable maturation of trees in previously developed neighbourhoods with shade tree plantings on boulevards, parkland, and private properties

Despite this apparent stability, elm removals are continually increasing and the removal rate has now surpassed the planting rate. Ash is also under threat due to insect pests. As tree loss accelerates, this decline is expected to become significant. The current distribution of tree canopy within the city boundary is shown in Figure 6.

### CANOPY COVER CHANGE (2005-2018)

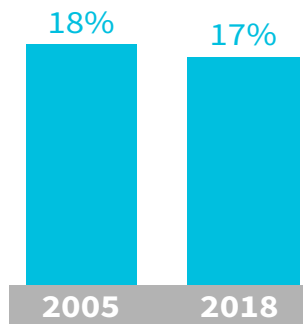


Figure 5: Citywide canopy cover decline from 2005 to 2018.

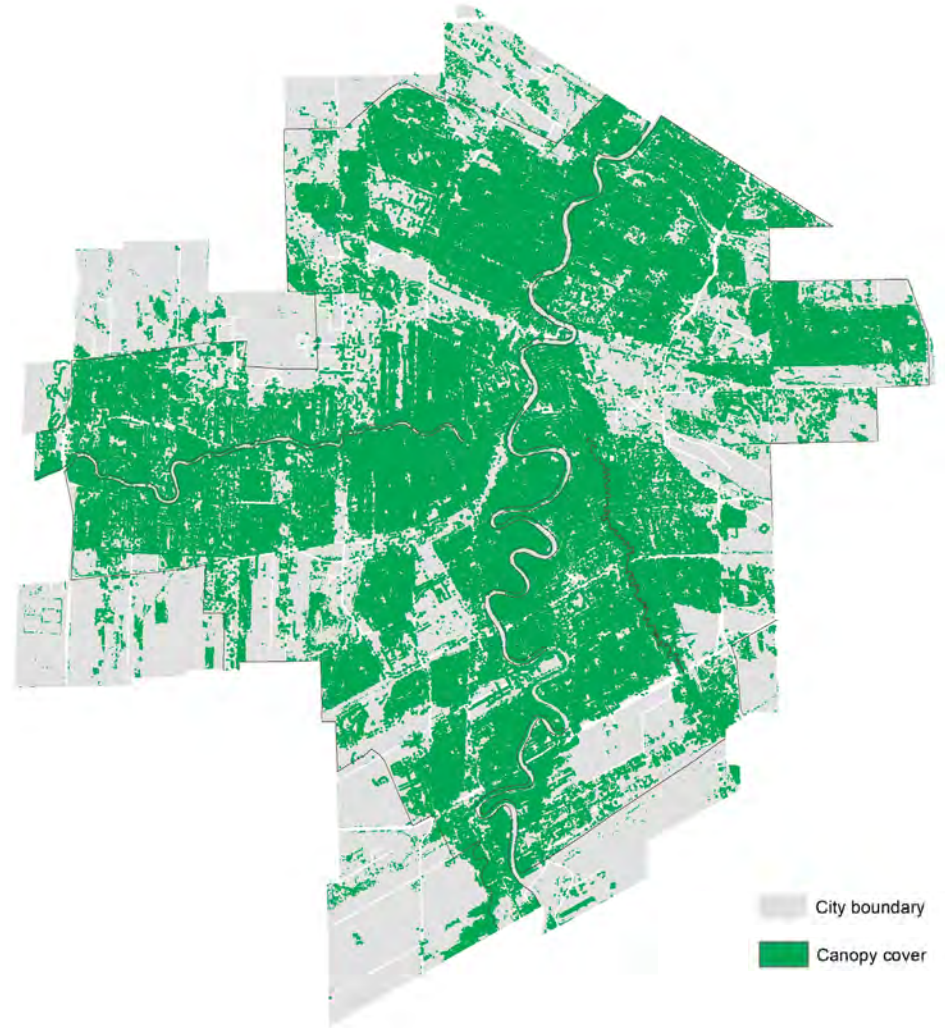
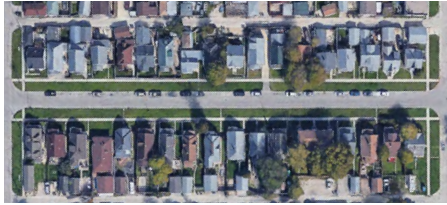


Figure 6: Approximate distribution of trees and canopy across Winnipeg using the City's inventory data and satellite data of tree canopy from the University of Maryland (Hansen et al. 2013).

### What does canopy cover look like at street-level?

At street-level, canopy cover varies widely across Winnipeg. The examples in Figure 7 show three different city streets with a range of canopy covers as well as the Google Street View illustration of the canopy cover experienced at the ground level.

~10% canopy cover



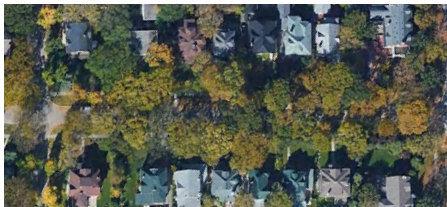
Google Street View

~40% canopy cover



Google Street View

~80% canopy cover



Google Street View

Figure 7: Canopy cover distribution varies across the city.

### How does Winnipeg's canopy cover compare to other Prairie cities?

At 17 percent, Winnipeg's tree canopy cover is substantially higher than other Canadian Prairie cities (Figure 8).

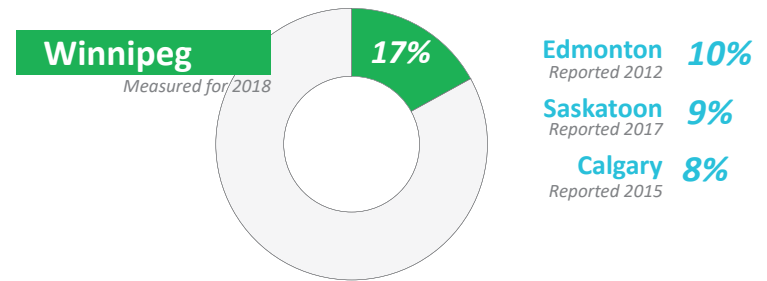


Figure 8: In 2018, Winnipeg's canopy cover was 17 percent.



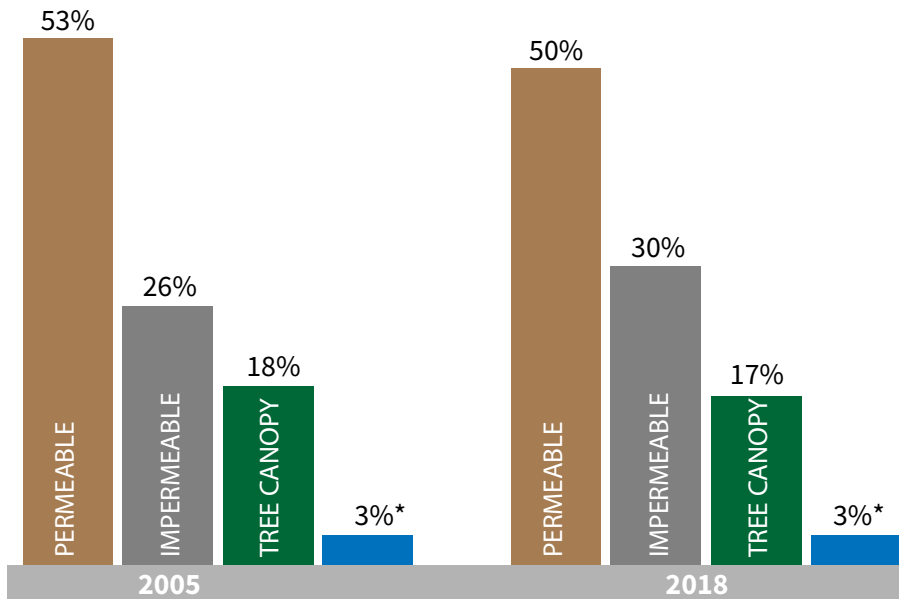
Many of Winnipeg's older neighbourhoods have streetscapes with high canopy cover.

### What are the trends for other types of land cover?

Trends in land cover show how land use is changing over time in Winnipeg. i-Tree Canopy was used to estimate the cover of tree canopy, impermeable land, permeable land, and water (excluding the rivers). The results in Figure 9 show a significant increase in impermeable area and corresponding declines in permeable area and, to a lesser extent, tree cover. In other words, grassland and open green space have been replaced with paved roads and buildings.

Based on observations in i-Tree Canopy, the land cover change in Winnipeg was most often related to urban development into rural prairie lands (Figure 10a). Usually, the land impacted had grass cover but sometimes new developments impacted natural stands of trees. Some tree cover loss was also observed in already developed areas, likely due to Dutch elm disease (Figure 10b). Tree cover gain was observed in a few instances where back yard or street trees were planted. However, tree cover loss was observed six times more often than tree cover gain.

The extent and distribution of permeable and impermeable land cover types can indicate the potential to grow the urban forest. When impermeable surfaces — such as buildings, roads, and surface parking areas — dominate a land area there is less physical space to plant trees and less soil to support tree growth. Impermeable surfaces are often highest and canopy cover lowest in dense urban areas such as downtown and commercial zones.



\*Water (excluding rivers)

Figure 9: Land cover change in Winnipeg (2005-2018).



Figure 10a: Examples of change from grassland to impermeable land uses.



Figure 10b: Examples of tree cover loss due to development and Dutch elm disease.

## Characteristics and benefits of Winnipeg's urban forest

In 2019, the City of Winnipeg partnered with the University of Winnipeg and Trees Winnipeg to collect data to measure the structure and benefits of **trees on public and private land** in developed areas (Figure 11). The data was entered into the USDA's i-Tree Eco program<sup>2</sup>. The results provide information about the characteristics and value of the estimated three million trees in the urban forest. Key findings from the 2019 i-Tree Eco analysis are included in Table 1 with a summary of monetary values in Table 2.

Table 1: Summary table of whole urban forest key findings from i-Tree Eco analysis.



**3,075,000 trees estimated in the city**, approximately 60 percent of which are young and only 15 percent are mature or old



The **five most common species** are trembling aspen (*Populus tremuloides* - 21%), green ash (*Fraxinus pennsylvanica* - 14%), bur oak (*Quercus macrocarpa* - 11%), American elm (*Ulmus americana* - 10%), and Manitoba maple (*Acer negundo* - 6%)



In terms of **total leaf area**, which drives many urban forest benefit calculations (e.g., pollution removal, rainwater interception, oxygen production, shading, etc.), American elms supply 31% of the leaf area, followed by green ash (17%). Winnipeg's built up area contains 375.5 square kilometers of leaf surface area.



**Tree density** is 85 trees per hectare, which is about half the density of trees in Toronto and about the same as Boston, MA.



Most **runoff** is intercepted by American elm, then green ash.

Most **carbon** is stored and sequestered by American elm, then bur oak, and green ash. **Carbon storage value** of \$39.2 million (\$77 per tonne of Carbon). Carbon storage value is expected to increase as the social cost of carbon receives wider recognition. Increases in Canada's federal carbon price schedule will bring this value to \$93 million by 2022.



Trees **reduce energy-related costs** from residential buildings by an estimated \$5,800,000 annually, primarily due to reduced heating costs, and avoid 7,890 metric tons of carbon emissions from fossil-fuel based power plants.



**Compensatory value** (e.g., estimated cost of compensation to replace each tree with a similar tree) of \$3.31 billion.

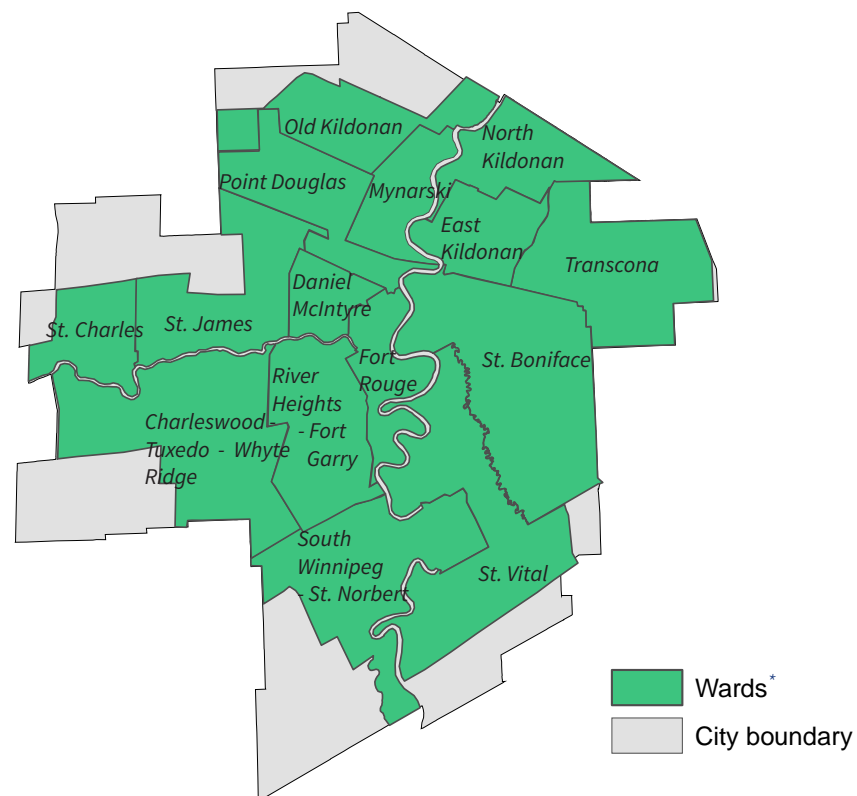


Figure 11: Winnipeg 2014-2018 Wards. \* the ward boundaries shown were adjusted to represent the developed areas of the city for the i-Tree Eco analysis. Note that ward boundaries are those prior to the revised 2018-2022 boundaries.

Table 2: Summary table of whole urban forest i-Tree Eco monetary values.

Compensatory value	CAD \$ (billion)
3,075,000 trees on public and private land	3.31
Functional value	CAD \$ (million)
Carbon storage	39.2
Carbon sequestration (annual)	0.83
Avoided runoff (annual)	3.23
Pollution removal (annual)	4.01
Building energy savings (annual)	5.80
Avoided carbon emissions (annual)	0.61

<sup>2</sup> <https://www.itreetools.org/tools/i-tree-eco>



### Ecosystem services metrics for the whole urban forest and public tree inventory

The City's 2020 inventory of almost 300,000 street and park trees was also run through i-Tree Eco<sup>3</sup> to obtain estimates for ecosystem services. The maps on the following pages show i-Tree Eco results for the whole urban forest and City-owned trees side by side. Figures 12-19 show tree density, compensatory value, structural runoff, and carbon values. Maps for the whole urban forest show values by the developed portion of each ward, while maps for inventoried public trees show values at the finer scale of a city block.

3 i-Tree Eco V6 <https://www.itreetools.org/tools/i-tree-eco>

Tree density - whole urban forest

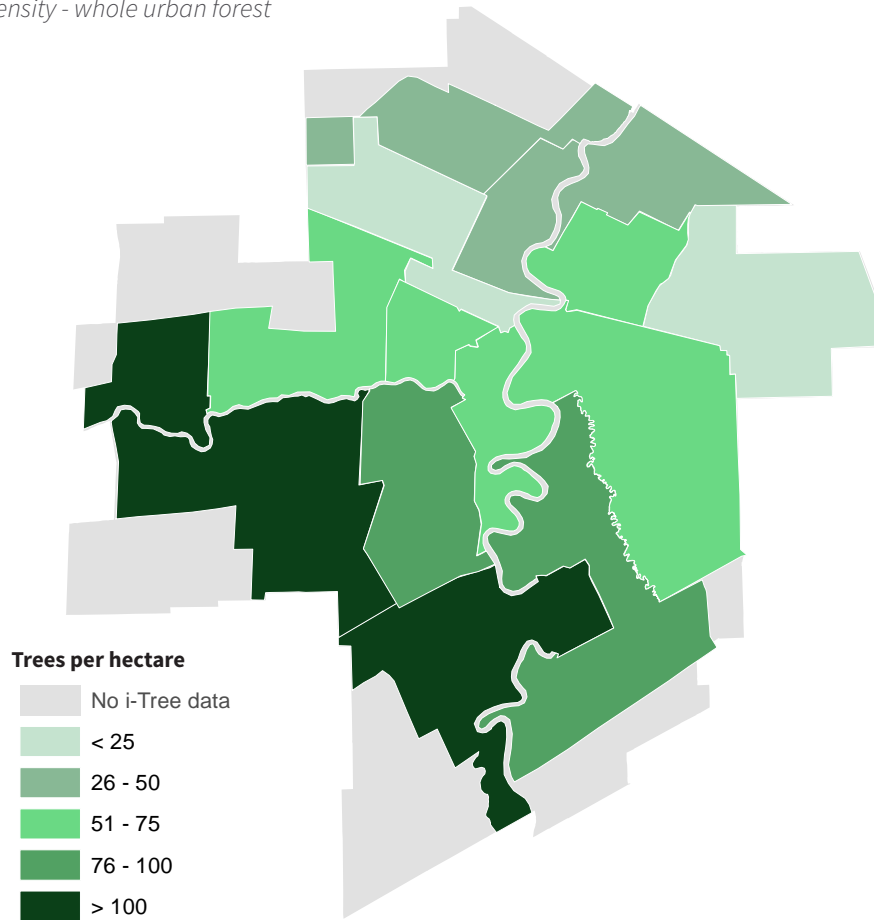


Figure 12: Tree density per hectare for the whole urban forest by ward.

### Tree density

Tree density refers to the number of trees per hectare in a given area. In Figure 12, tree density is illustrated in the developed portion of each ward. St. Charles, Charleswood - Tuxedo, and South Winnipeg - St. Norbert had the highest density of trees. Transcona and Point Douglas had the lowest density of trees, in part due to greater industrial and commercial lands in these areas. Figure 13 shows the density of City-owned trees at the finer scale of the census dissemination block. At the block scale, City-owned trees were more commonly present in residential areas or parks, with most blocks having a tree density of less than 25 trees per hectare. City-owned tree density is highest in parks.

Tree density - public tree inventory

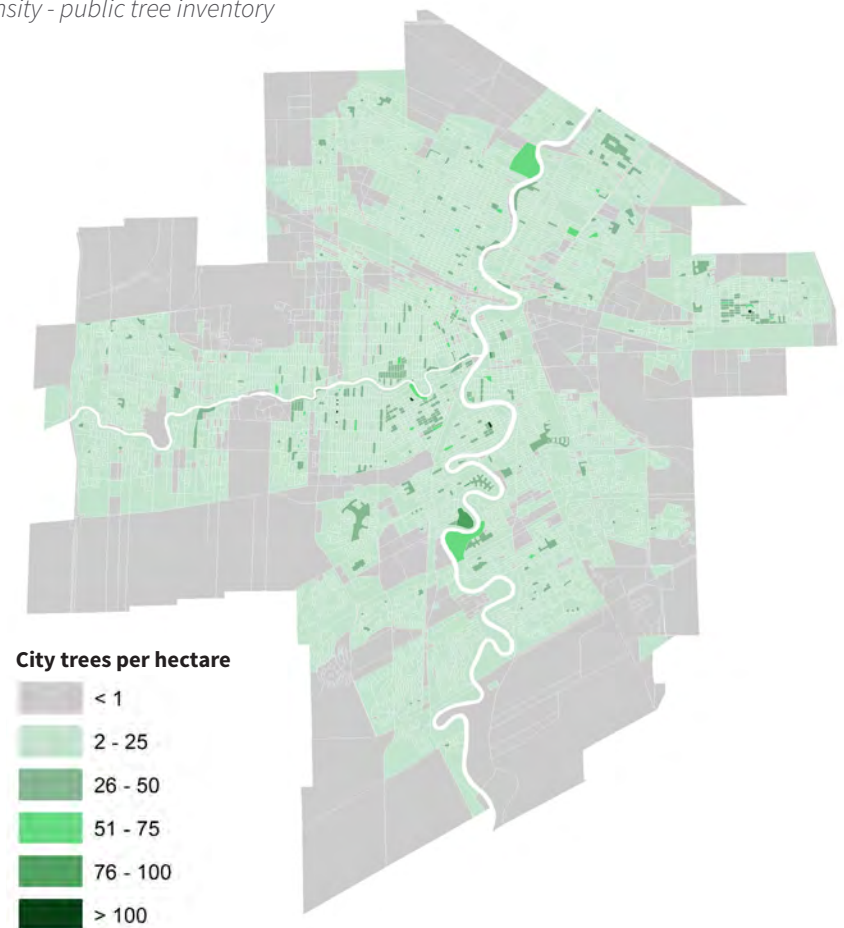


Figure 13: Inventoried public trees per hectare by dissemination block.

### Compensatory value

The estimated compensatory value to replace Winnipeg's entire urban tree population was more than \$3 billion dollars. Trees in the public tree inventory had an estimated compensatory value of \$640 million. The compensatory value reported by i-Tree Eco was based on the Council of Tree and Landscape Appraisers valuation method using four tree/site characteristics: trunk area (cross-sectional area at diameter at standard height), species, condition, and location to estimate the cost of replacing tree assets. Figure 14 illustrates the compensatory value of the urban forest per hectare in each ward; the wards with the higher numbers of large trees tended to have the highest values. Figure 15 shows the compensatory value of the public tree inventory per hectare by city block; blocks with the highest values tended to be parks or blocks in older neighbourhoods containing higher numbers of mature trees.

Compensatory value- whole urban forest

Compensatory value - public tree inventory

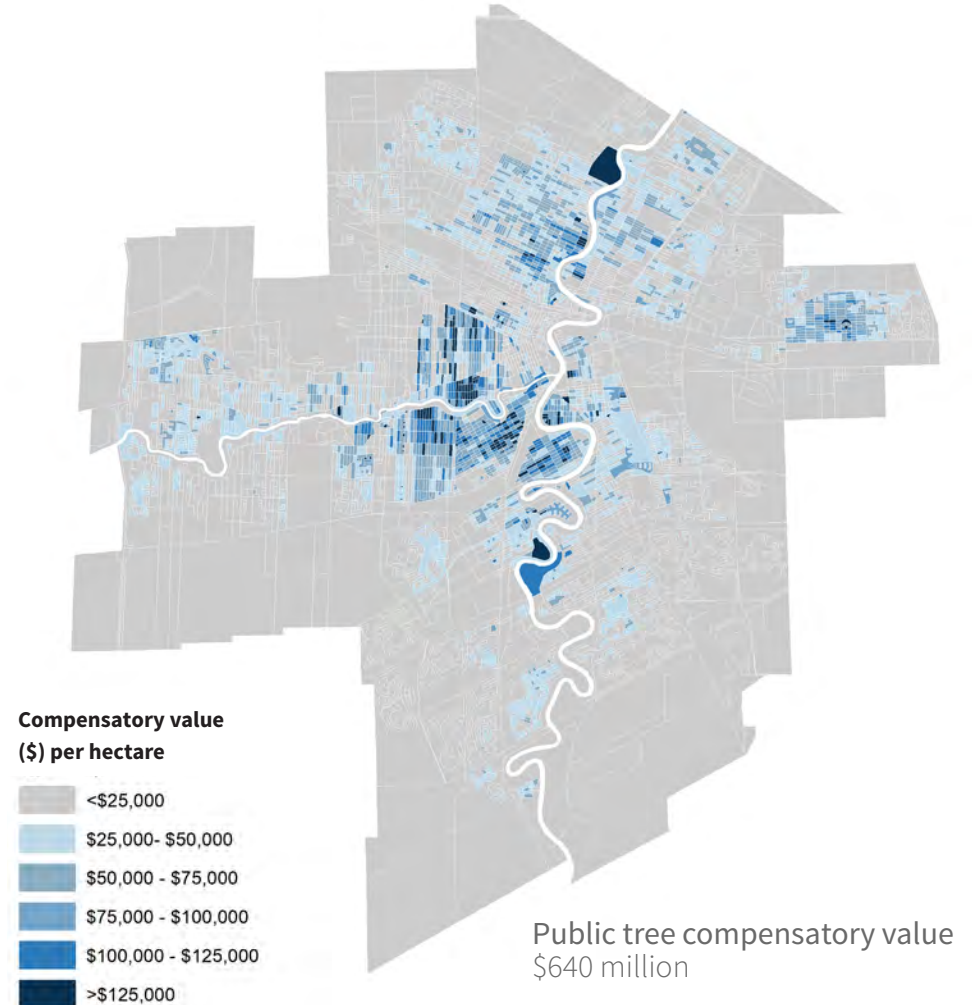
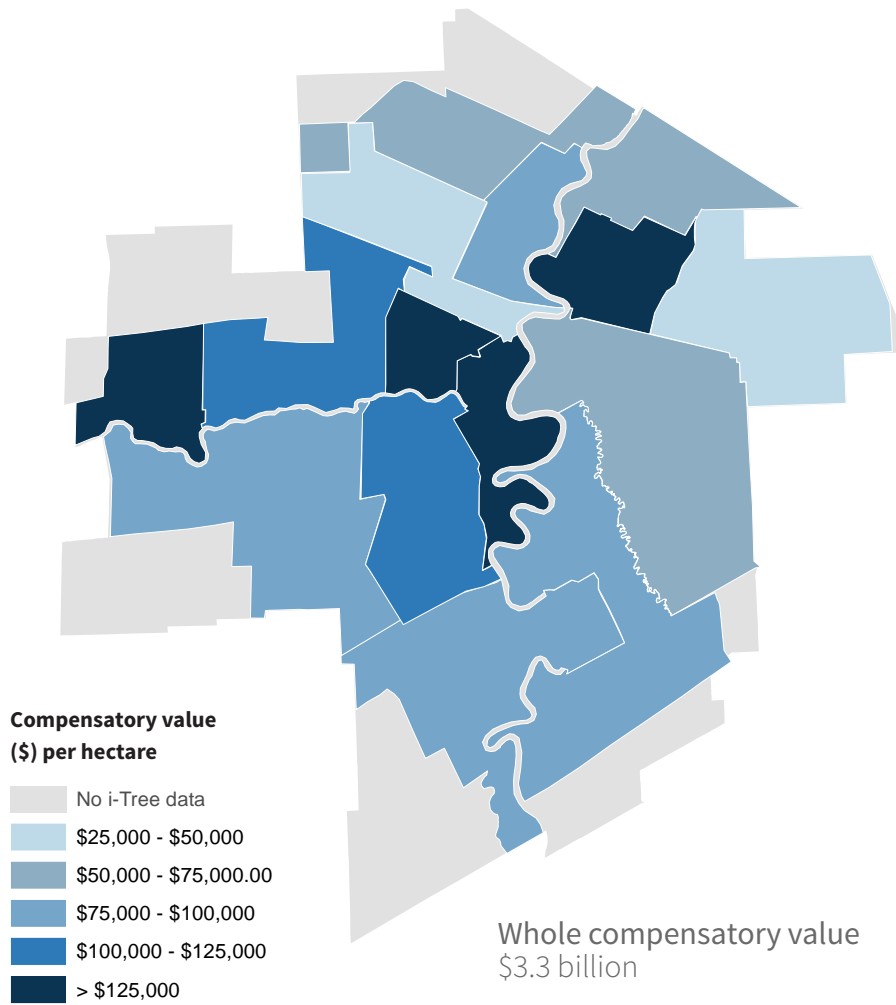


Figure 14: Compensatory value estimated for the whole urban forest of Winnipeg by ward.

Figure 15: Compensatory value estimated for the public tree inventory by dissemination block.

**Avoided runoff**

Avoided runoff is the total amount of water intercepted by trees that does not become surface runoff and flow into the storm system. The avoided runoff each year was estimated at over one million cubic metres for the entire tree population, the equivalent of 488 Olympic swimming pools. The public tree inventory was estimated to avoid 160 thousand cubic metres of runoff into the storm system. Figure 16 illustrates the annual avoided runoff from the urban forest per hectare in each ward. Figure 17 shows the annual avoided runoff from the public tree inventory per hectare in each city block.

*Avoided runoff each year- whole urban forest*

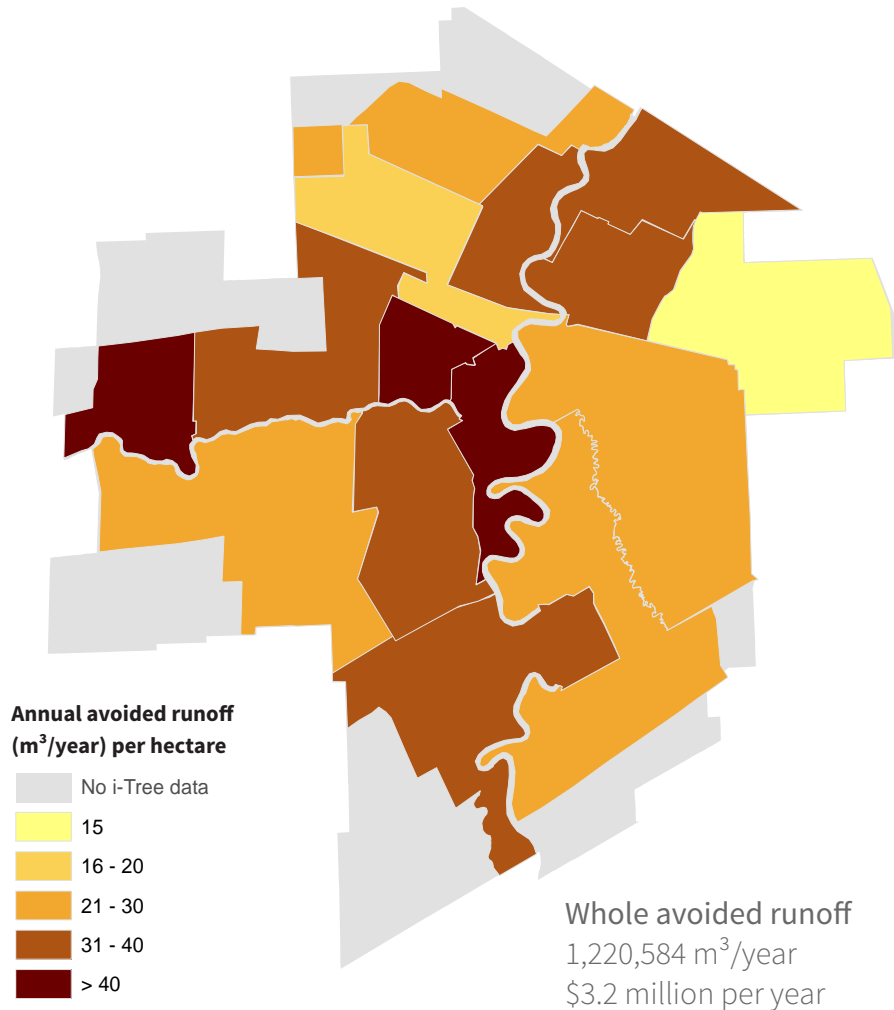


Figure 16: Annual avoided runoff for the whole urban forest of Winnipeg.

*Avoided runoff each year- public tree inventory*

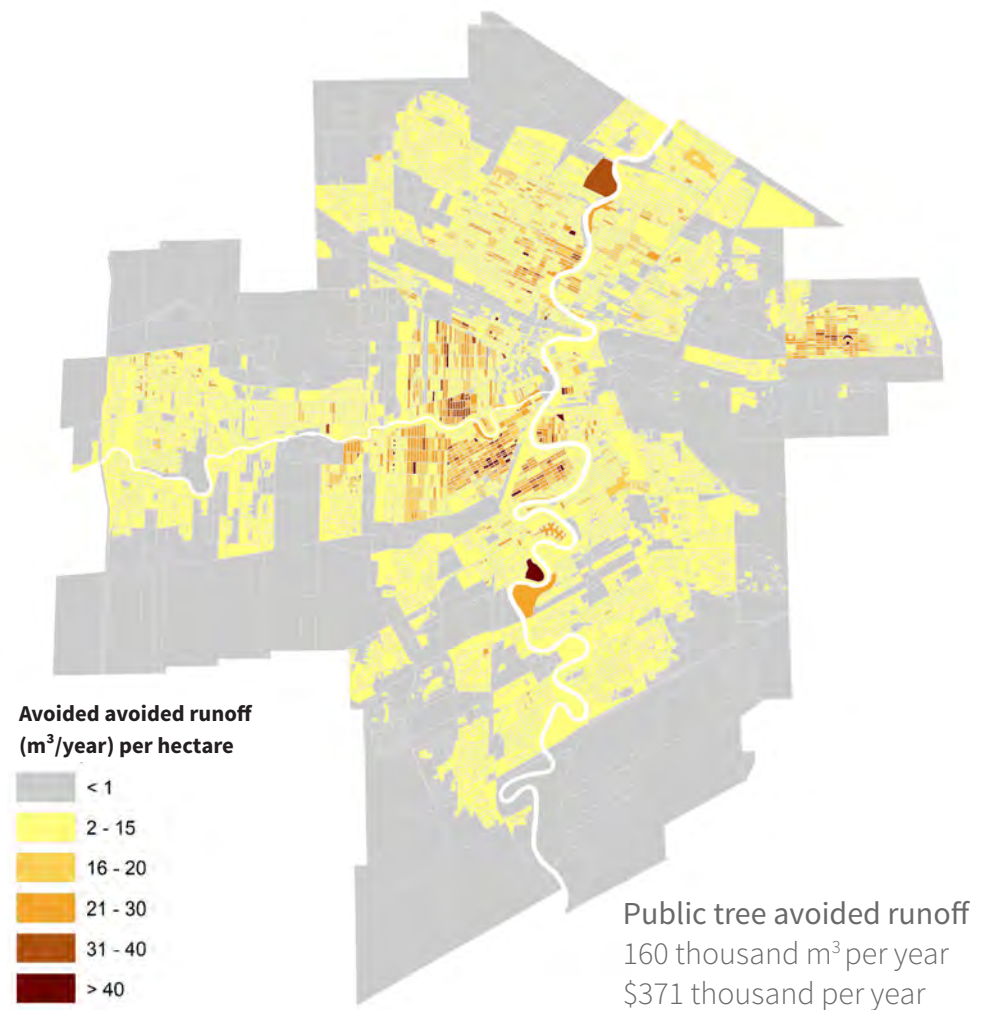


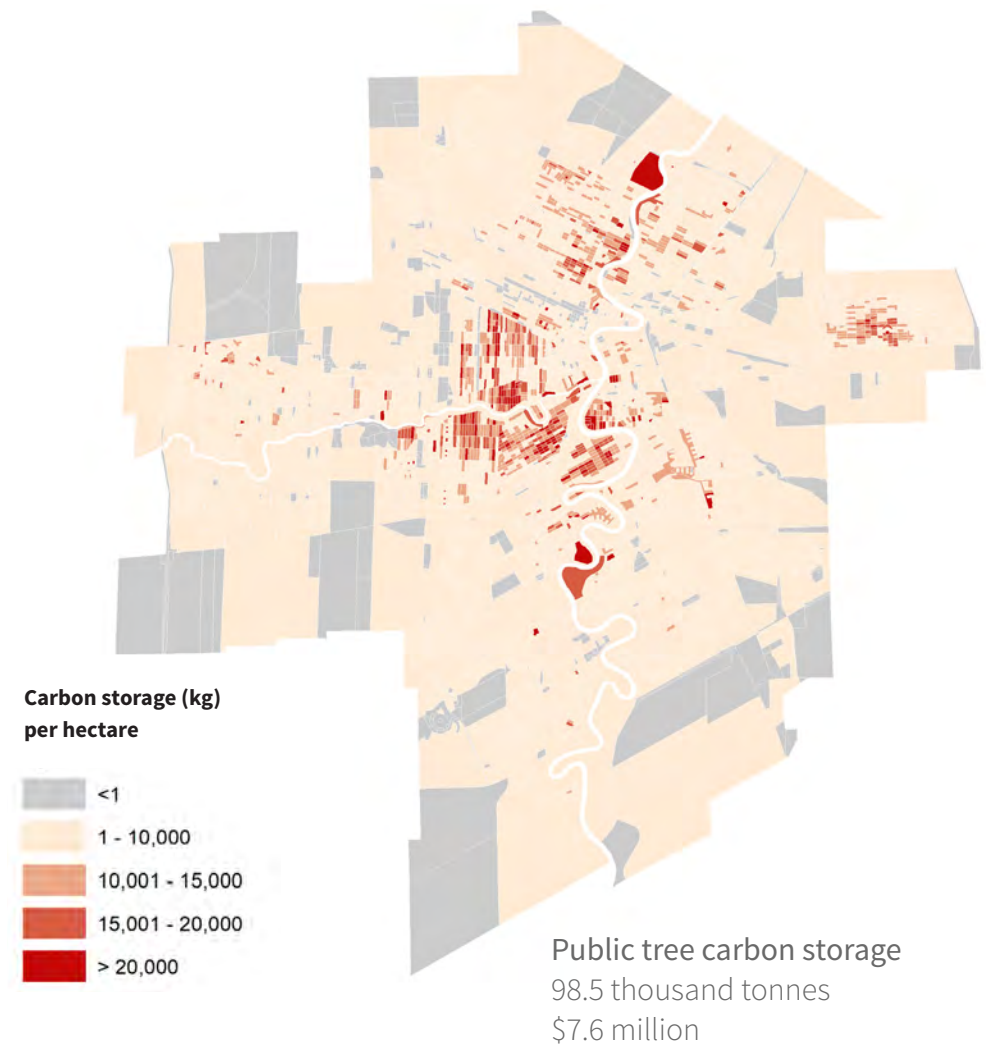
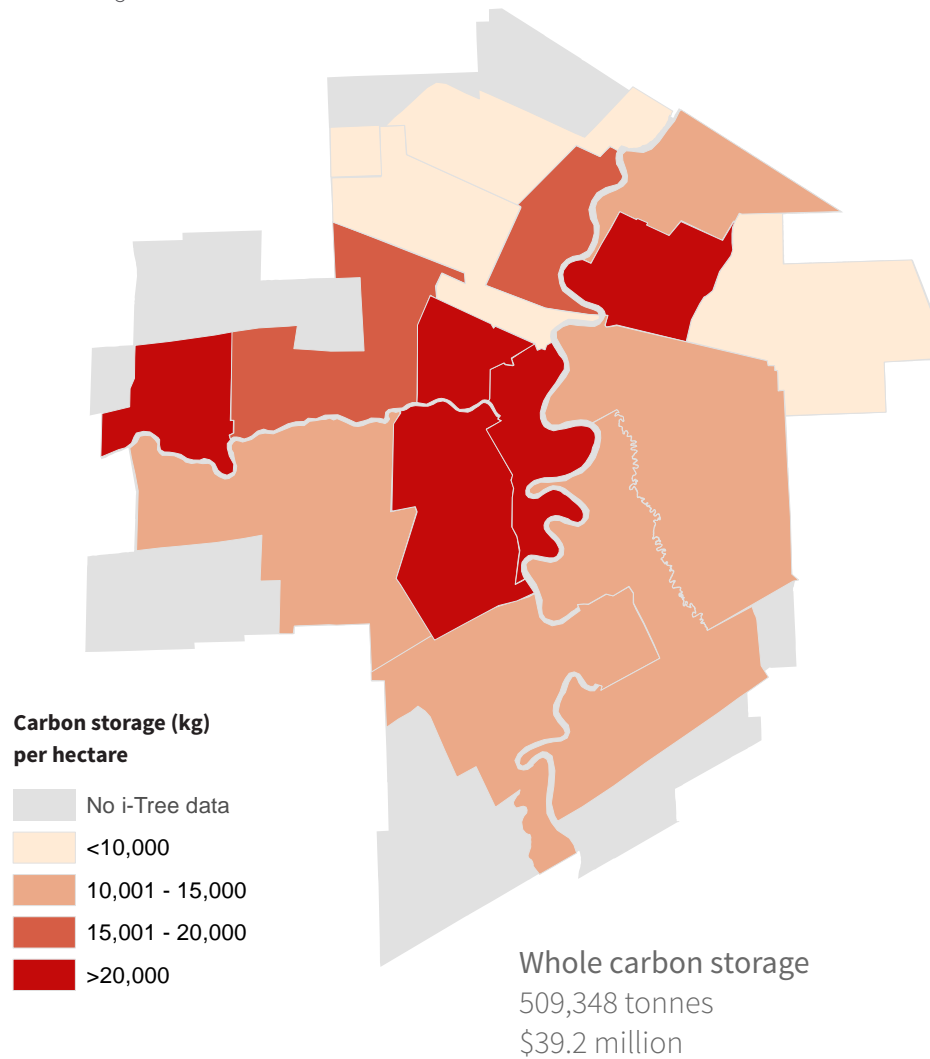
Figure 17: Annual avoided runoff for the public tree inventory.

**Carbon storage**

The estimated carbon stored in the whole urban forest is over 509 thousand tonnes and valued at more than \$39 million. Figure 18 shows the carbon storage per hectare in each ward. Carbon storage in the public tree inventory is valued at approximately \$7.6 million. Figure 19 illustrates the carbon stored by trees in the public tree inventory per hectare in each city block.

*Carbon storage - whole urban forest*

*Carbon storage -public tree inventory*



*Figure 18: Carbon stored per hectare in the whole urban forest by ward.*

*Figure 19: Carbon stored in the public tree inventory by dissemination block.*

### **Pollution removal and oxygen production**

Pollution removal and oxygen production is also estimated by i-Tree Eco. Pollutant removal by trees was estimated for carbon monoxide, nitrogen dioxide, sulfur dioxide, ozone and PM2.5 particulate matter. For trees in Winnipeg, pollution removal is greatest for ozone and PM2.5.

Trees in the whole city are estimated to remove 274.2 tonnes of pollutants per year from the air, a service valued at approximately \$4 million per year. Winnipeg trees produce an estimated 14.98 thousand tonnes of oxygen annually.

Trees in the public tree inventory are estimated to remove approximately 31 tonnes of pollutants per year at a value of \$446 thousand. Public inventoried trees produce an estimated 3.5 thousand tonnes of oxygen annually.



*Trees in Winnipeg improve air quality by removing pollutants and producing oxygen.*

### **Population metrics for trees on public land**

On public land, trees can be assigned one of two broad categories: street and park trees or native and naturalized forest. Street and park trees are typically intensively managed by the City, and receive individual attention throughout their life-cycle from planting, through maintenance, and eventually removal. The Urban Forestry Branch is responsible for managing the street and park tree population. By contrast, trees in native and naturalized forest are managed as an ecosystem where natural processes of regeneration and mortality are left to occur with limited management intervention. The Naturalist Services Branch oversees the native and naturalized forest areas. Street and park trees and native forest are both important parts of Winnipeg's whole urban forest and provide different types of services.

### **Street and park trees**

Winnipeg's public tree inventory is almost 300,000 strong, the makeup of which is approximately 69 percent street trees and 21 percent planted park trees. The following sections report some key metrics for Winnipeg's street and park trees based on 2020 inventory data. When best management practices (BMP) guidance has been established for a specific metric, Winnipeg's tree inventory is compared to that metric and highlighted in a blue text box at the top right of the page.

### **Tree population and distribution**

Looking back to 2013, Winnipeg's tree population has remained relatively stable, decreasing by just under 1,000 trees based on the City's 2020 inventory data. Street and park trees are not distributed evenly across the city. The density of City-owned trees is highest in the wards of Mynarski, Fort Rouge - East Fort Garry, River Heights - Fort Garry. Density is lowest in St. James, Old Kildonan, Charleswood - Tuxedo - Westwood, St. Norbert - Seine River, and Daniel McIntyre.

Species diversity

The public tree inventory population is dominated by elm and ash trees. American elm trees were a long-standing tree of choice because they were native, reliable as a street tree, and also created beautiful arching canopies. The fact that Winnipeg has the largest urban population of American elms in North America is testimony to how successful they have been as an urban tree. With the arrival of Dutch elm disease (DED) in the 1970s, the City began planting more ash trees and initiated its DED management program. At the time, there was very little diversity in shade trees available for planting on streets. The City has recently stopped planting ash due to the arrival of emerald ash borer. With the two most abundant species of urban trees now under threat, the City is seeking reliable alternatives to both elm and ash.

Diversity in species, genus and family is one of the measures commonly applied to the urban forest. At the species level, green ash (28 percent) and American elm (18 percent) greatly exceed the recommended five percent threshold. At the genus level, elm and ash make up 58 percent of the urban canopy as shown in Figure 20, which graphs the dominant genera in Winnipeg's public tree inventory. The remaining 42 percent are primarily composed of linden, maple, spruce, oak, and poplar.

Managing diversity at the neighbourhood or ward scale is also important. All wards of the city favour either elm or ash with some wards such as St. Norbert - Seine River favouring ash over elm by 74 percent (Figure 21). Diversity at the genus level, when measured using the Shannon-Weiner Diversity Index, is highest in St. Vital and lowest in Daniel McIntyre.

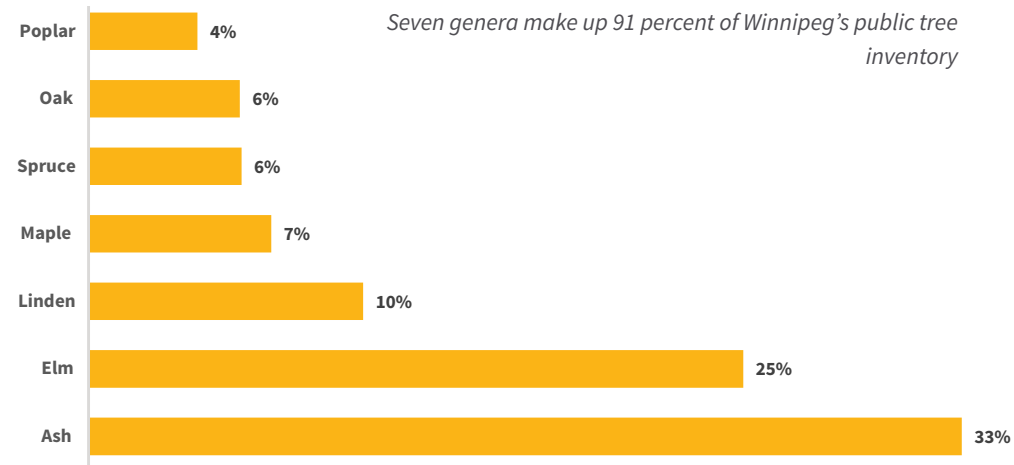


Figure 20: The dominant genera in Winnipeg's public tree inventory (2020).

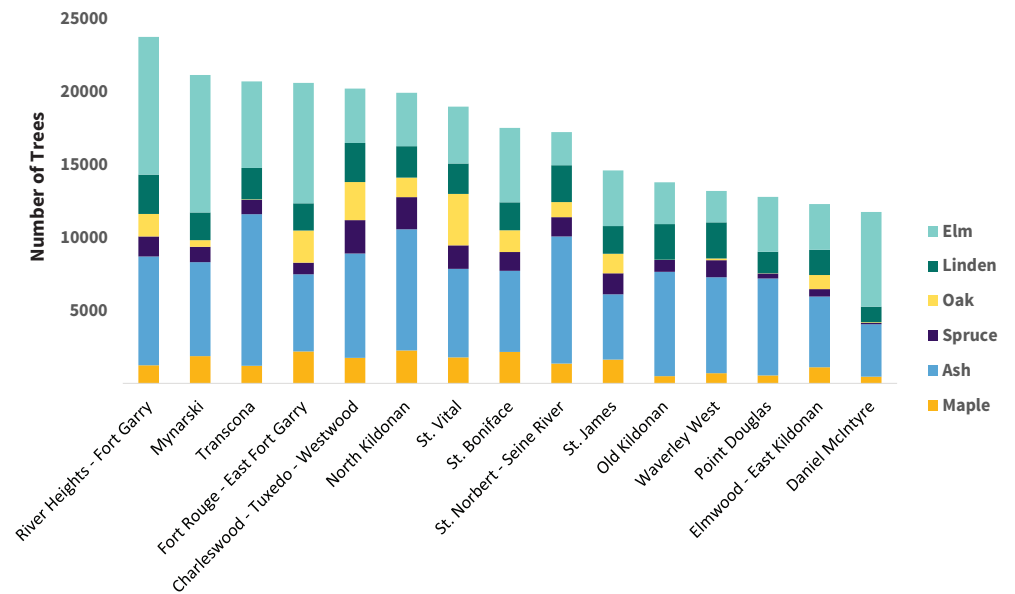


Figure 21: Distribution of dominant genera by ward.

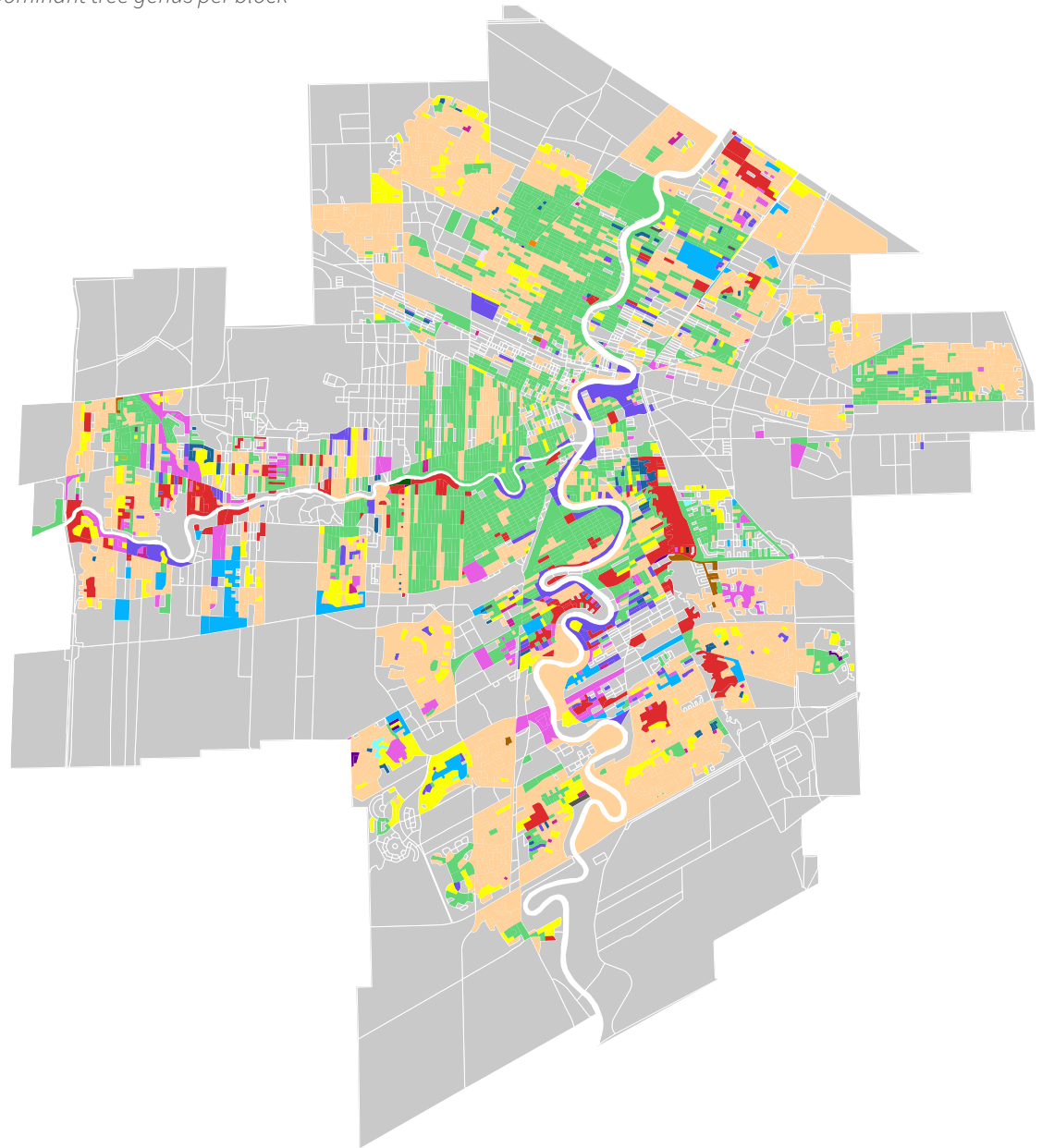
Dominant tree genus per block

The map in Figure 22 shows which type of tree, by genus, is most abundant in each city block. Only blocks with more than five City-owned trees per hectare are shown. Discernible patterns are visible and are likely related to the time period of the tree planting.

Blocks with older plantings tend to be dominated by elm, with ash becoming more dominant in plantings from the 1970s onwards. Today, ash is no longer planted by the City and linden, maple, oak, hackberry, poplar, crabapple, tree lilac, and buckeye are planted in higher proportions. Elm is also planted with an effort to plant DED-tolerant varieties in neighbourhoods not dominated by elm.

**Tree genus**

<span style="display:inline-block; width:15px; height:15px; background-color:darkgreen;"></span> Fir	<span style="display:inline-block; width:15px; height:15px; background-color:darkred;"></span> Willow
<span style="display:inline-block; width:15px; height:15px; background-color:lightgreen;"></span> Elm	<span style="display:inline-block; width:15px; height:15px; background-color:orange;"></span> Cedar
<span style="display:inline-block; width:15px; height:15px; background-color:yellowgreen;"></span> Silverberry	<span style="display:inline-block; width:15px; height:15px; background-color:red;"></span> Oak
<span style="display:inline-block; width:15px; height:15px; background-color:pink;"></span> Hawthorn	<span style="display:inline-block; width:15px; height:15px; background-color:yellow;"></span> Linden
<span style="display:inline-block; width:15px; height:15px; background-color:lightorange;"></span> Ash	<span style="display:inline-block; width:15px; height:15px; background-color:purple;"></span> Maple
<span style="display:inline-block; width:15px; height:15px; background-color:magenta;"></span> Spruce	<span style="display:inline-block; width:15px; height:15px; background-color:darkpurple;"></span> Lilac
<span style="display:inline-block; width:15px; height:15px; background-color:darkmagenta;"></span> Prunus	<span style="display:inline-block; width:15px; height:15px; background-color:grey;"></span> Birch
<span style="display:inline-block; width:15px; height:15px; background-color:cyan;"></span> Hackberries	<span style="display:inline-block; width:15px; height:15px; background-color:black;"></span> Pine
<span style="display:inline-block; width:15px; height:15px; background-color:blue;"></span> Poplar	<span style="display:inline-block; width:15px; height:15px; background-color:lightgrey;"></span> Not mapped
<span style="display:inline-block; width:15px; height:15px; background-color:darkblue;"></span> Malus	



Note: Data mapped for blocks with more than 5 trees per hectare only.

Figure 22: Dominant tree genus per city block in Winnipeg.

Size and age diversity

Maintaining a diversity of ages in the urban forest is important for ensuring there is a continuous supply of trees maturing to replace older trees that die or are removed. Tree size is often used as a proxy for age because we rarely know the age of older trees. Figure 23 shows tree size classes, measured by diameter at breast height (DBH), and the percentage of trees in each class in Winnipeg's public tree inventory.

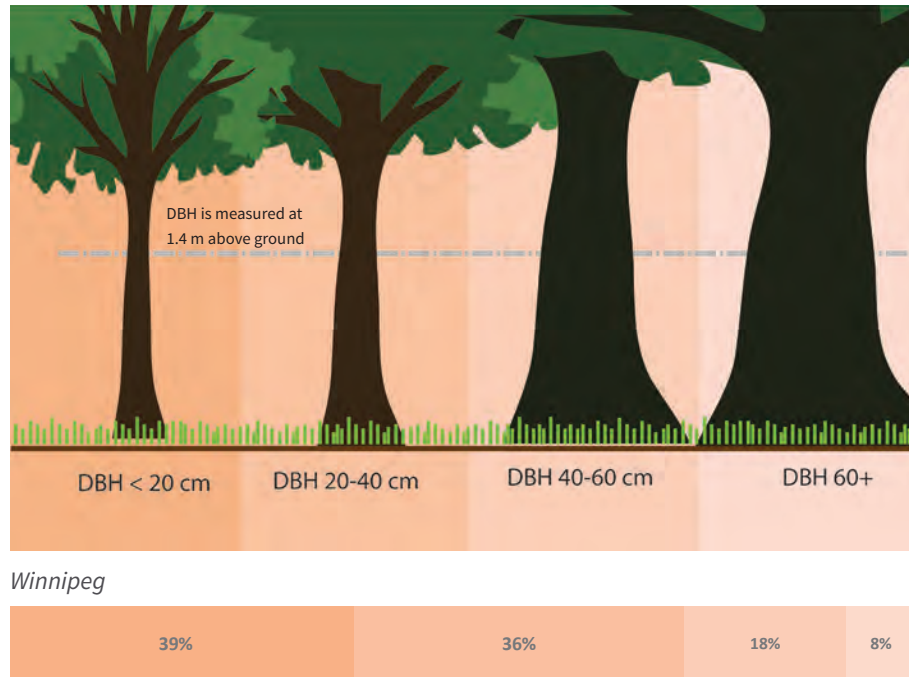


Figure 23: Percentage of trees in each size class in the public tree inventory.

Large, old trees are not distributed evenly across the city (Figure 24). Fifty percent of Winnipeg's largest trees are found in five wards: Fort Rouge - East Fort Garry, St. Boniface, Mynarski, Daniel McIntyre, and River Heights - Fort Garry. The other 10 wards contain the remaining 50 percent.

Small, young trees follow a similar pattern, with 55 percent of young trees found in five wards: Waverley West, North Kildonan, Transcona, St. Norbert - Seine River, and St. Vital.

Average tree size class by block based on DBH (trunk diameter measured at 1.4 metres above the ground)

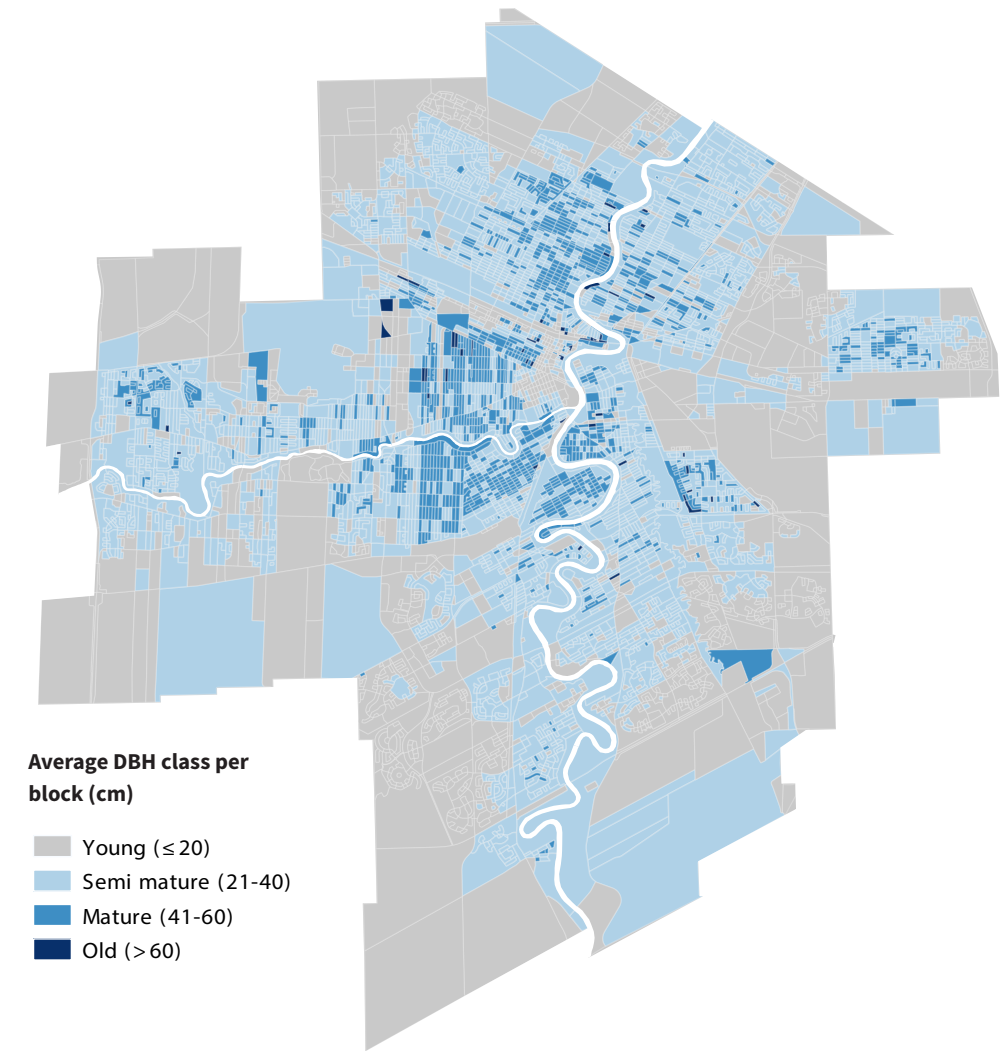


Figure 24: Average size of public inventory trees by city block in Winnipeg.



Tree condition

Condition ratings are used to report on the health and structure of urban trees. Health is typically determined by the appearance of foliage, new growth, and anticipated life expectancy. Structure is determined by the condition of the roots, trunk, and crown in terms of decay, damage, or defects that might impact the trees service life. Trees in excellent and good condition have no or only minor health and structural issues, and can be expected to remain in the landscape for a long time. Trees in fair or poor condition will have signs of dieback in the crown, visible decay, obvious pest problems, or may have structural defects that are likely to lead to tree or branch failure in the future unless corrective action is taken. Corrective actions commonly involve watering, pruning, or removal. Trees that are in fair or poor condition, or that are dead, require more management intervention than trees in good or excellent condition.

The City’s current tree inventory indicates that approximately 94 percent of street and park trees are in fair, good, or excellent condition and six percent are in poor or dead condition (Figure 25). Figure 26 shows where the trees that are dead, poor, or fair condition are distributed across the city. Several factors are impacting tree condition in Winnipeg at the moment. DED and cottony ash psyllid are impacting elm and ash, respectively. Warm, dry summers in 2018 and 2019 likely exacerbated these health issues by increasing tree drought stress. The 2019 October snow-storm damaged 10 percent (30,000) of the City’s public trees and many of those left in the landscape potentially have structural defects requiring assessment and action.

In terms of dead trees, most are ash (23 percent) followed by poplar (15 percent), elm (13 percent), and oak (11 percent). For the dominant genera, the proportion of trees in fair, good, and excellent condition is relatively consistent with the pattern shown in Figure 25. However, lindens stand out as having a higher proportion of their population in good and excellent condition.

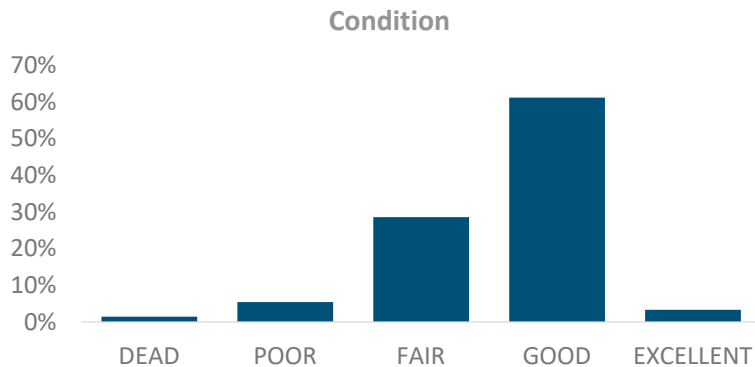


Figure 25: The overall distribution of tree condition for the public tree inventory.

Trees in dead, poor, and fair condition per hectare by block

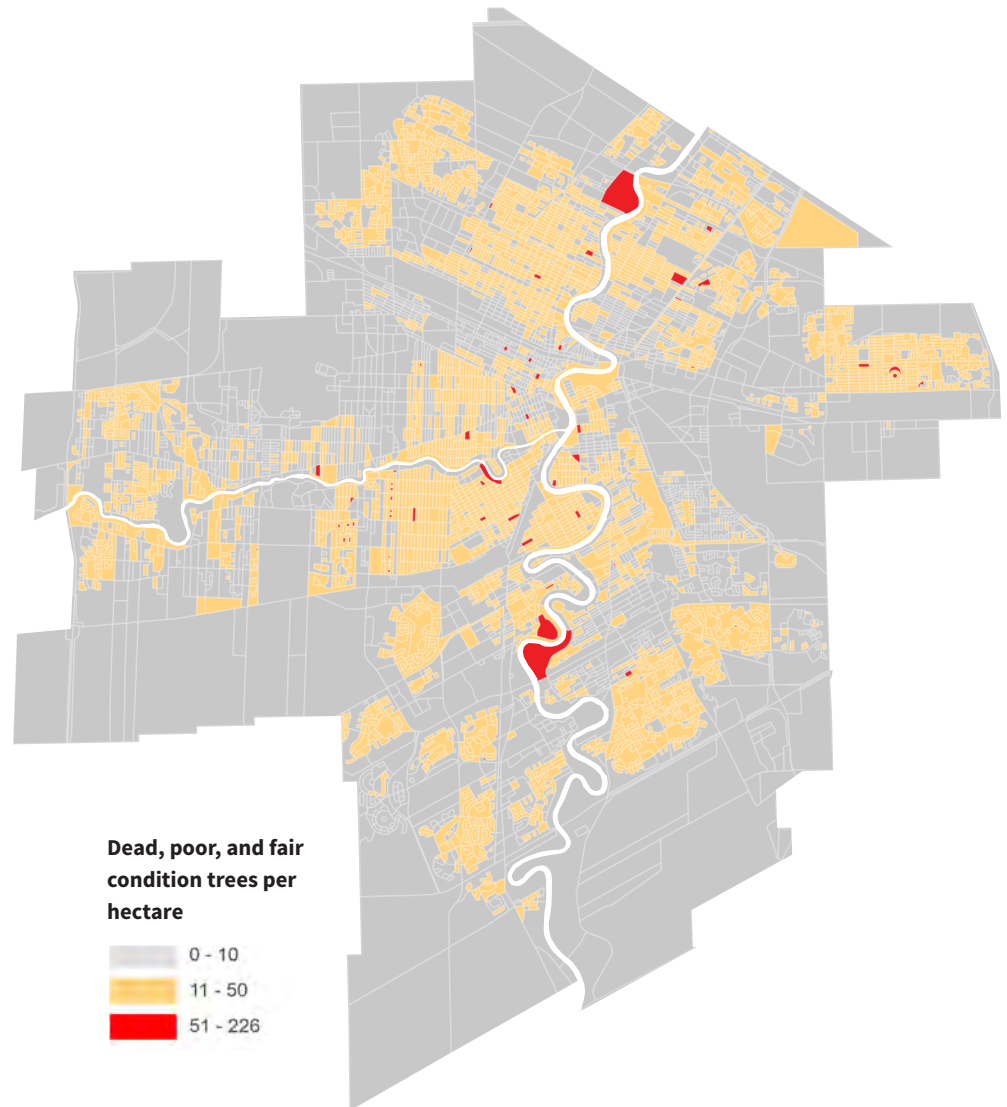


Figure 26: Distribution of trees in dead, poor, and fair condition by dissemination block in Winnipeg.

*Distribution of vacant potential tree planting sites*

Figure 28 illustrates the number of vacant potential planting sites per block for new trees (not replacement trees). Historically, only 60 percent of vacant sites have been assessed as suitable for tree replacement. Considering this result, a high level estimate of 26,000 planting sites may be suitable for new tree plantings. Replacement tree planting opportunities have not been mapped as these sites change annually as trees are removed and replacement trees are planted. From 2013 to 2019, approximately 30,000 street and park trees were removed, and only 15,500 were replaced; up to 14,500 potential replacement tree planting sites may exist across the city. These estimates are tempered by factors such as conflicts with services, inadequate soil volume to support healthy trees, or repeated mortality due to road salt or poor soil conditions (Figure 27) that reduce the suitability of vacant or replacement tree sites for tree planting.



Figure 27: An example of a vacant planting sites in Winnipeg.

*Vacant planting sites per block*

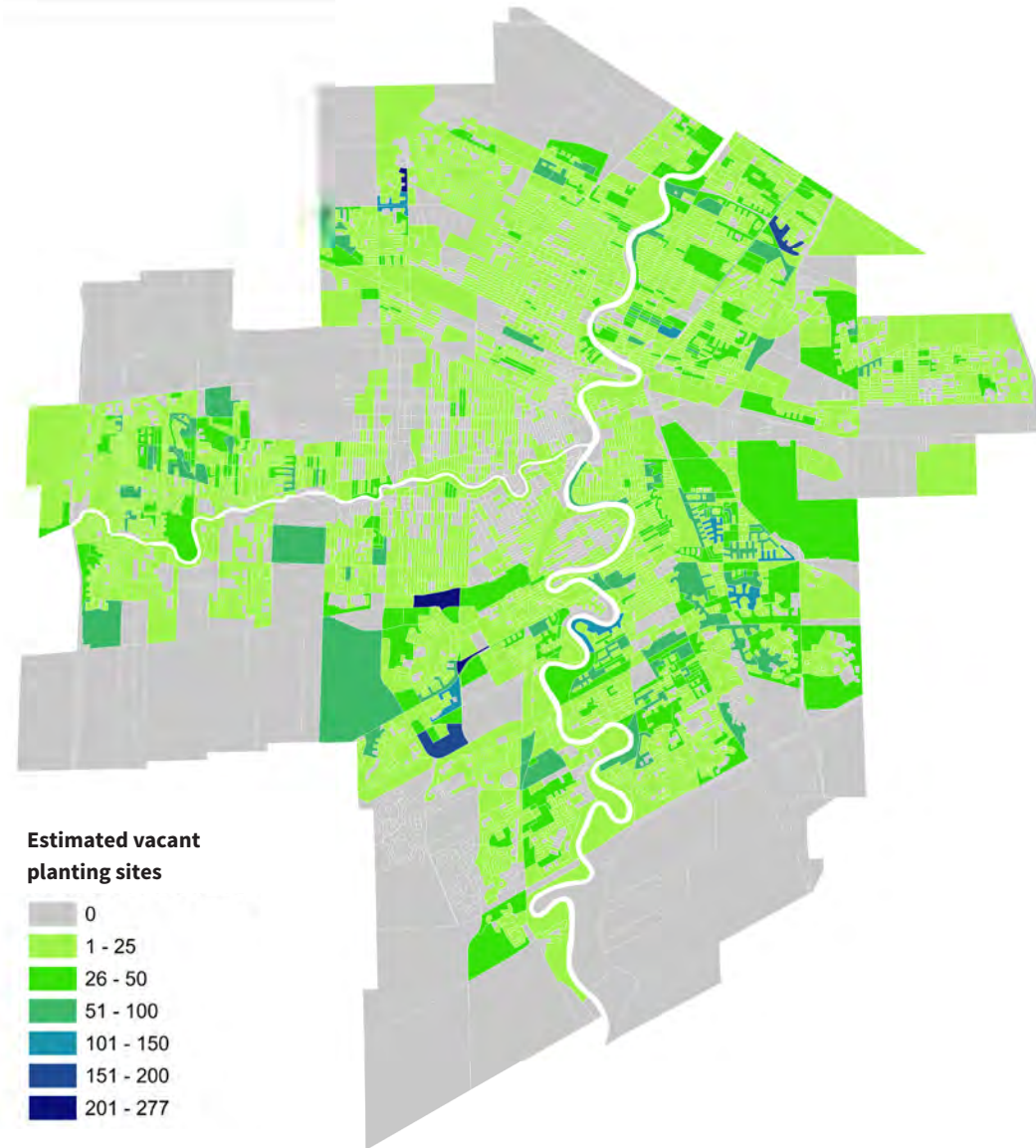


Figure 28: Approximate vacant planting sites by dissemination block in Winnipeg.

## City natural areas

Hundreds of thousands of uninventoried native and naturalized forest trees grow in Winnipeg's natural areas. While Winnipeg is located in the Tall Grass Prairie portion of the Prairies Ecozone dominated by grasses and herbaceous plants, several forest types are also common in the city. Winnipeg has three main native forest types; riverbottom forest, aspen forest, and oak forest. The following descriptions come from Winnipeg's Ecologically Significant Natural Lands Strategy<sup>4</sup>.

### Riverbottom forests

Winnipeg is located in the Red River Valley at the point where the Assiniboine and Red Rivers meet. Riverbottom forests are riparian habitats and can generally be divided into riverbank, floodplain, and terrace sections. The riverbank is the edge of a waterway, and is dominated by willow and cottonwood trees. The floodplain is dominated by green ash (*Fraxinus pennsylvanica*), basswood (*Tilia americana*), American elm (*Ulmus americana*), and Manitoba maple (*Acer negundo*), while the terrace is dominated by bur oaks (*Quercus macrocarpa*), which prefer drier sites. These forests depend on the Red River to deposit silt and replenish soil with nutrients, and in return they stabilize streams and riverbanks against erosion and filter urban stormwater runoff before it enters the river.

### Aspen forests

Aspen forests are the most common forest type throughout Winnipeg and its surrounding region. Dominated by trembling aspen trees, these forests also contain bur oak trees in dry areas and balsam poplar in low lying wet areas. Manitoba maple and green ash trees also make occasional appearances in these forests. Aspen forests are typically mixed with openings of native prairie sometimes referred to as 'aspen parkland'. Grassland openings that are undisturbed still contain relatively intact native tall-grass or mixed-grass prairie vegetation.

### Oak forests

Bur oak forests occur on very dry sites where flooding rarely occurs. Historically, their formation and maintenance was often dependent on wildfire. Thick stands of pure oak are not common in Winnipeg; oaks are more often mixed in with aspen forests.



A stand of trembling aspen in Bois-Des-Esprits.



A stand of bur oak in Bois-Des-Esprits.

<sup>4</sup> City of Winnipeg. 2007. Ecologically Significant Natural Lands (ESNL) Strategy & Policy. City of Winnipeg.

### 3. Winnipeg's urban forestry program

The previous section presented the diverse characteristics and benefits of Winnipeg's urban forest resource on both private and public land. This section describes the City's urban forestry program to manage street and park trees on public land. The City's Urban Forestry Branch delivers services and programming within approved operating budgets and capital funding.

#### Urban forestry budget

Figure 29 shows the urban forestry approved service-based budgets from 2016 to 2021. The annual urban forestry budget has increased by seven percent in the last five years primarily due to capital budget increases allocated to Dutch elm disease management and tree planting, and partly to emerald ash borer and cottony ash psyllid response. The overall budget is projected to grow by another two percent, to 12.5 million, by 2023. Dutch elm disease control and tree pruning and removal account for more than 80 percent of the budget, with tree planting accounting for about 20 percent.

As noted above, in addition to the annual operating budget, urban forestry receives capital funding for specific projects and to augment regular services. That funding varies from year to year and supports projects such as reforestation improvement, or reducing the backlog of Dutch elm disease removals. From 2020 to 2024, the City has committed \$25 million in capital funding to urban forest enhancement and reforestation.

Despite Winnipeg's increased capital funding levels, maintenance, removal and planting rates are falling behind planned targets due to factors not yet accounted for in budgets, such as:

- Comprehensive emerald ash borer management planning
- Increasing tree removal rates
- Growing tree replacement deficit
- Delayed pruning cycle
- Added inventory of young trees inherited from new developments (higher maintenance costs are associated with young trees due to watering and pruning requirements)
- High numbers of services calls for demand pruning and storm response

#### Customer service calls

The City of Winnipeg tracks customer service levels related to the services delivered by the Urban Forestry Branch. Data on customer service 311 calls in 2020 (Figure 30) shows that more than 10,000 calls were received that year. More than 50 percent of calls relate to pruning, hazard tree or sick/dead tree service requests.

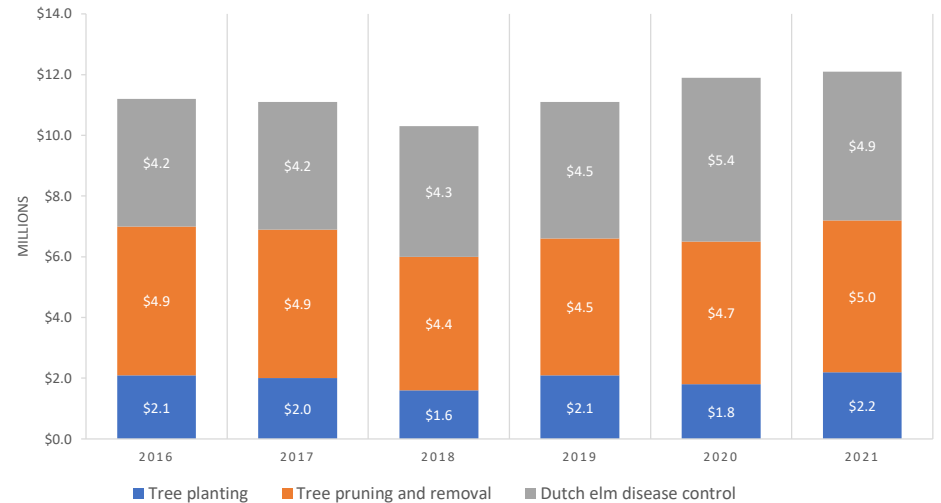


Figure 29: Urban forestry approved service-based budgets from 2016 to 2021.

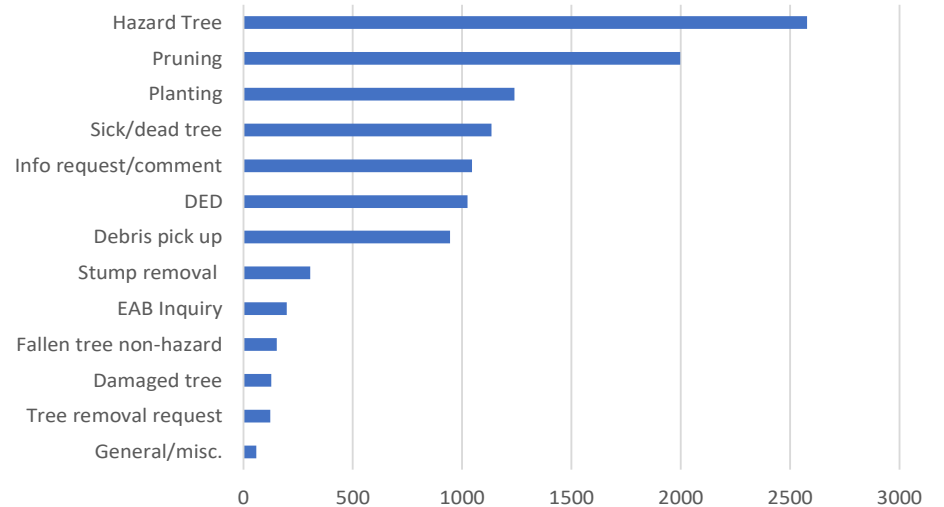







Figure 30: The number of urban forest related 311 service calls in 2020 by broad category of service request.

## Urban forestry services

Winnipeg's Urban Forestry Branch is responsible for managing all aspects of inventoried trees along streets and in parks. The Branch also manages Dutch elm disease surveillance and subsequent removals on public and private properties including natural areas, and partners with the City's Naturalist Services Branch on tree risk assessment and removals of natural forest trees as necessary. As shown in Table 3, the state of Winnipeg's urban forestry programs and services has been reviewed under five themes of urban forest management, along with their associated services. The following sections outline key service indicators provided as part of Winnipeg's urban forestry services.

Table 3: Table of urban forestry programs and services reviewed and associated services.

Urban Forestry Branch Core Services				
Planning	Planting	Management	Protection	Engagement
 <ul style="list-style-type: none"> <li>Budgeting and service delivery</li> <li>Developing an annual work plan</li> <li>Reporting to Council</li> <li>Procuring bids and equipment</li> <li>Developing long-term strategic plans</li> </ul>	 <ul style="list-style-type: none"> <li>Planting trees</li> <li>Assessing planting sites</li> <li>Administering planting contracts</li> <li>Procuring nursery stock</li> <li>Maintaining the civic nursery as a holding area for delivered stock</li> <li>Contributing to review and approval of Downtown enhancement planting sites</li> <li>Contributing to review and approval of developer tree planting on public land</li> <li>Assuming responsibility for developer-planted trees two years post-planting</li> </ul>	 <ul style="list-style-type: none"> <li>Maintaining the tree inventory</li> <li>Conducting risk inspection</li> <li>Coordinating and conducting removal and pruning (including administering contracts for supplementary services)</li> <li>Responding to resident service requests</li> <li>Managing emergency/storm response</li> </ul>	 <ul style="list-style-type: none"> <li>Advising on protection of public trees</li> <li>Developing and maintaining tree protection standards</li> <li>Appraising City trees</li> <li>Administering tree removal guidelines</li> </ul>	 <ul style="list-style-type: none"> <li>Participating in media interviews and outreach</li> <li>Sitting on external committees</li> <li>Providing technical input to project-specific public engagement programs (such as community tree planting)</li> <li>Partnering with other agencies on education, community tree planting, and outreach</li> </ul>

## Pruning cycle

The City tracks the percentage of City trees pruned annually and the pruning cycle (how frequently every tree on an average is inspected and pruned if needed). Table 4 shows those figures for 2013 to 2019. The percentage of trees pruned per year has been declining and the pruning cycle has lengthened as more resources have been allocated to increases in DED, priority tree removals, and emergency response. Pruning cycle is a standard used as a performance indicator in the industry.

## Tree condition and survival rates

Tree condition is an indicator of the health and structure of a tree. A tree in poor condition is generally expected to have a shorter life expectancy than a tree in good condition. The condition rating can provide a broad indicator for trees that are likely to require replacement in the near term. Currently, one percent of the public tree population is dead, while five percent is in poor condition. There is particular concern over newly planted tree survival rates in the downtown and in new developments where poor planting technique and soil conditions can ultimately lead to early tree death. Winnipeg's removal rate has been between one and two percent of the public tree population per year since 2013. However, the condition profile and removal rate could worsen dramatically if EAB becomes more active in the region.

Preventative maintenance such as rapid removal of DED infested trees, young tree watering, and a best practices pruning cycle are proactive ways to maintain a tree population in good condition, and could reduce the annual removal rate.

Table 4: The percentage of trees pruned in each year and the resulting pruning cycle for the years 2013 to 2017.

Year	Percentage of Trees Pruned Annually Meeting Best Practice <b>Target: 14%</b>	Tree Pruning Cycle (cycle on which each tree is pruned on average) <b>Target: 5 - 7 years</b>
2013	8	13
2014	8	12
2015	6	17
2016	5	22
2017	4	27
2018	4	27
2019	3	31

## Removal and replacement levels

On average, City crews remove 9,000 trees per year - half of which are due to DED removals on private property (Figure 31). The average annual public tree removal rate has increased over the last two years from 4,300 trees per year to more than 5,500. Roughly 40 percent of removals on public land are due to DED, with the remainder due to risk, other tree health issues, or conflict with infrastructure. The recent increase in removal rates is primarily due to the combined effect of drought, cottony ash psyllid infestations, and an increase in declining trees caused by the backlog of DED-infested trees in the landscape.

Planting on streets and in parks has remained steady with a five-year average of 2,000 trees planted per year (just 52 percent of the tree removal rate). It is estimated that, since 2013, more than 14,500 trees remain un-replaced - a deficit that is growing by an average of 2,000 trees per year. In 2020, the ratio of boulevard and park trees planted for those removed was at 19 percent. Up to 40,600 planting sites are estimated to exist on boulevards and in parks when the estimated number of vacant planting sites (Figure 28) and outstanding replacement trees are combined.

Despite the replacement deficit, the total tree population has been fairly stable since 2013 (fluctuations of one to two percent) because many new trees have been added with development. This stability suggests that trees and canopy are being lost in older parts of the city, and gained in more recently developed areas.

## Equity considerations

Areas of higher needs were identified in the 2020 Defining Higher Needs Neighbourhoods report to the Standing Policy Committee on Protection, Community Services and Parks. Higher needs neighbourhoods were identified using 2016 Census data using a Market Basket Measure of low income. The City's public tree inventory was compared with this higher needs 2016 census data by ward. Several correlations were found between the two datasets:

- The number of large trees (60 cm or greater) increases in wards with increasing population density
- Diversity in the genus of trees decreases with increasing population density and population of visible minorities
- The total number of trees, trees per person and diversity of trees increases with increasing median income, and decreases with population of visible minorities
- Prevalence of large trees and lower diversity of tree species in areas with high population density tends to reflect the dominance of mature elm canopies in inner city neighbourhoods

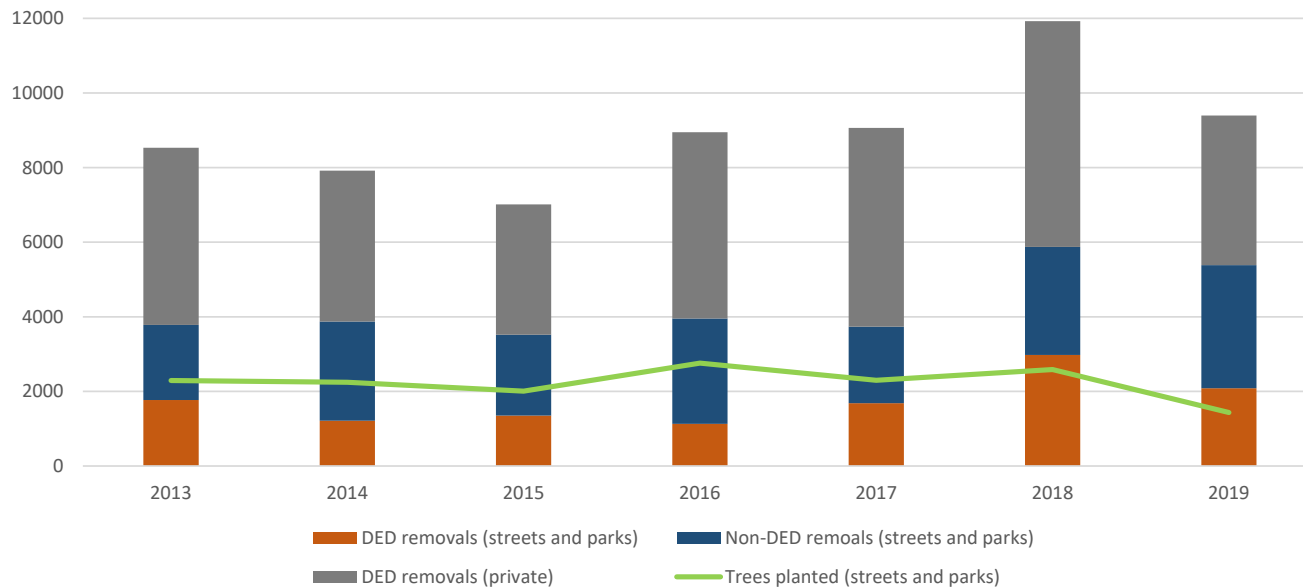
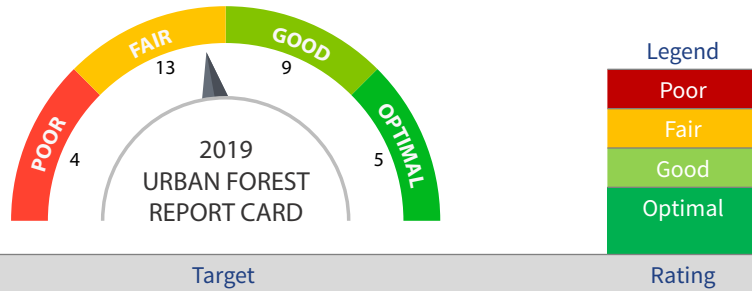


Figure 31: Annual rates of removal and replacement in City streets and parks.

### Winnipeg's urban forest sustainability report card

Winnipeg's urban forestry program and services have been evaluated within an urban forest sustainability model first proposed by Clark et al (1997) and recently updated in Leff (2016). These models define a set of performance indicators to establish the current and optimal state of urban forest programs. In some cases, indicators have been adapted to better reflect Winnipeg's urban forest context and direction for the Comprehensive Urban Forest Strategy. Optimal conditions provide a benchmark to measure against but are not a commitment by any stakeholder to achieve that rating. Most actions will require further study to understand



Target	Rating
<b>PLAN</b>	
Awareness of the urban forest as a community resource	Fair
Interdepartmental and inter-agency cooperation on Comprehensive Urban Forest Strategy implementation	Good
Clear and defensible urban forest canopy assessment and goal	Fair
Green infrastructure asset valuation	Fair
Municipal-wide biodiversity or green network strategy	Good
Municipal urban forestry program capacity	Fair
Urban forest funding to implement the Strategy	Fair
<b>PLANT</b>	
City tree planting program design, planning and implementation	Fair
Development requirements to plant trees on private land	Fair
Streetscape specifications and standards for planting trees	Fair
Equity in planting program delivery	Poor
Forest restoration and native vegetation planting	Good
Stock selection and procurement in cooperation with nurseries	Fair
Ecosystem services targeted in tree planting projects and landscaping	Fair

what level of service is achievable and what level of performance the City will ultimately strive for. The ratings are summarized in Figure 32. Overall, the City's program rates as fair to good, with significant strengths evident in areas of management and partnership. There are gaps in tree protection, and in the capacity of the program to deliver improvement in any area given backlogs in planting and maintenance, and the uncertainty of future tree removal requirements related to EAB.

<b>MANAGE</b>	
Tree inventory	Optimal
Knowledge of trees on private property	Optimal
Natural areas inventory related to elm and ash	Good
Maintenance of publicly-owned, intensively managed trees	Fair
Extreme weather response planning	Good
Tree risk management	Fair
Pest and disease management as it pertains to DED and EAB	Optimal
Waste biomass utilization	Optimal
<b>PROTECT</b>	
Regulating the protection and replacement of private and City trees	Poor
Regulating conservation of sensitive ecosystems, soils or permeability	Poor
Internal protocols guide City tree or sensitive ecosystem protection	Fair
Interdepartmental cooperation on Strategy implementation	Good
Standards of tree protection and tree care observed during development or by local arborists and tree care companies	Poor
Cooperation with utilities on protection (and pruning) of City trees	Good
<b>PARTNER</b>	
Citizen involvement and neighbourhood action	Optimal
Involvement of large private and institutional landholders	Good
Urban forest research	Good
Regional collaboration	Good

Figure 32: Winnipeg's Urban Forest Report Card summary of ratings.



## 4. Peer city comparison

Benchmarking against other, similar sized cities can be useful in understanding how levels of service and resourcing are affecting urban forestry programs. In Table 5, Winnipeg is compared to four Canadian municipalities of similar land area and population density (Calgary, Edmonton, Saskatoon, and Surrey) as well as to three higher density, high profile cities (Montreal, Toronto, and Vancouver).

Table 5: The City of Winnipeg's levels of service compared to similar sized cities throughout Canada.

	Winnipeg	Calgary	Edmonton	Saskatoon	Montreal	Toronto	Surrey	Vancouver
<b>CONTEXT</b>	PRAIRIES ECOZONE				MIXED WOOD PLAINS ECOZONE		PACIFIC MARITIME ECOZONE	
<b>Population</b> (2016 census)	705,244	1,239,220	812,201	246,376	1,704,694	2,731,571	517,887	675,218
<b>Population density</b> (people/km <sup>2</sup> )	1,519	1,501	1,361	1,080	4,662	4,334	1,637	5,400
<b>Land area</b> (km <sup>2</sup> )	464	826	685	228	366	630	316	115
<b>PLANNING</b>								
<b>Canopy cover</b>	17%	8%	10%	9%	20%	28%	28%	23%
<b>City tree population</b> (inventoried street and park trees)	301,402	502,559	371,537	104,000	310,248	1,140,000 est. on pruning cycle	103,985	145,534 (streets only)
<b>Approximate urban forestry budgets</b> (CAD millions)	\$12 (2020 service-based budget, includes public planting and DED costs for private elm trees)	\$15 (2020 Urban forestry service plan net operating budget - excludes planting, which is funded through capital budget)	\$12 (2019, uncertain if it includes planting)	\$4 (2020 operating budget urban forest expenses including planting plus \$150,000 capital budget for ash psyllid removal and planting)	\$16 (approx.)	\$65 (2020 operating budget, excludes planting)	\$5 (uncertain if it includes planting)	\$6 (2020 operating budget- excludes planting. 2020 capital budget of \$3.1 million for planting)
<b>Approx. budget</b> (excl. tree planting) as an average \$ per tree	\$34 (\$15 per tree if DED control is excluded)	\$30 (No DED)	\$32 (No DED, may include planting)	\$38 (No DED, may include planting)	Not comparable due to borough system	\$57 (includes DED and EAB control)	\$48 (no DED, may include planting)	\$41 (no DED)

Table 6: Continued.

	Winnipeg	Calgary	Edmonton	Saskatoon	Montreal	Toronto	Surrey	Vancouver
<b>Approx. budget</b> (total operating) as an average \$ per person	\$17 (\$9 if DED control is excluded)	\$12 (excl. planting)	\$15	\$16	Not comparable	\$24	\$10	\$9 (excl. planting)
<b>Tree inventory</b>	Streets & landscaped parks	Streets & landscaped parks	Streets & landscaped parks	Streets & landscaped parks	Streets & landscaped parks	Street trees only	Streets & landscaped parks	Street trees only
<b>Pruning cycle</b> (2017)	31 years	Shifting to proactive	7 years, elms every 4	7 years for boulevard trees, once every 13 years for park trees	7 years	7 years (young trees 3 years)	Streets: 5 years Parks: 10 years (young tree pruning cycle separate)	Not reported
<b>Major pest</b> (DED/EAB) <b>management</b> <b>programs</b>	DED, EAB not yet funded	No	No	No	DED/EAB	DED/EAB	No	No
<b>Urban Forest</b> <b>Management</b> <b>Strategy/Plan</b>	In development	Calgary... A city of trees Park Urban Forest Strategic Plan (2007)	Urban Forest Management Plan (2012)	In development	Le Plan d'action Canopee 2012- 2021	Sustaining and Expanding the Urban Forest: Toronto's Strategic Forest Management Plan 2012-2022	Shade Tree Management Plan (2016)	Urban Forest Strategy (2018 Update)

## 5. Enabling policies

Section five presents policies that enable Winnipeg urban forest management activities and a brief discussion on tree protection by-laws and industry standards applied by the City of Winnipeg in urban forest management.

### Winnipeg's urban forest policy context

Bylaws, policies, and guidelines are tools to implement the various plans and strategies on the ground. An extensive background review was conducted of Winnipeg's plans and policies relevant toward developing Winnipeg's Comprehensive Urban Forest Strategy.

Figure 33 outlines the three pieces of **enabling legislation** that primarily define the City's powers to act on issues related to urban forest management including the City of Winnipeg Charter (S.M. 2002, c. 39), Forest Health Protection Act (C.C.S.M. c. F151), and the Planning Act (C.C.S.M. c. P80).

**Guiding policy and plans**, such as OurWinnipeg, provide broad direction and support for the Comprehensive Urban Forest Strategy. They provide key directions that lay the groundwork for development and help inform the Strategy.

**Associated strategies and plans**, such as the Ecologically Significant Natural Lands Strategy, complement and will be complemented by the implementation of the Comprehensive Urban Forest Strategy. They guide key components and elements that impact the urban forest, such as infill construction and transportation, and can both directly and indirectly support the Comprehensive Urban Forest Strategy goals.

**Bylaws and policies** aim to regulate and enforce guiding and associated policies, strategies and plans by establishing key requirements and metrics for work around trees. Bylaws such as the Zoning By-law (No. 200/2006), establish general requirements for landscaping during development and presents a credit system for trees retained.

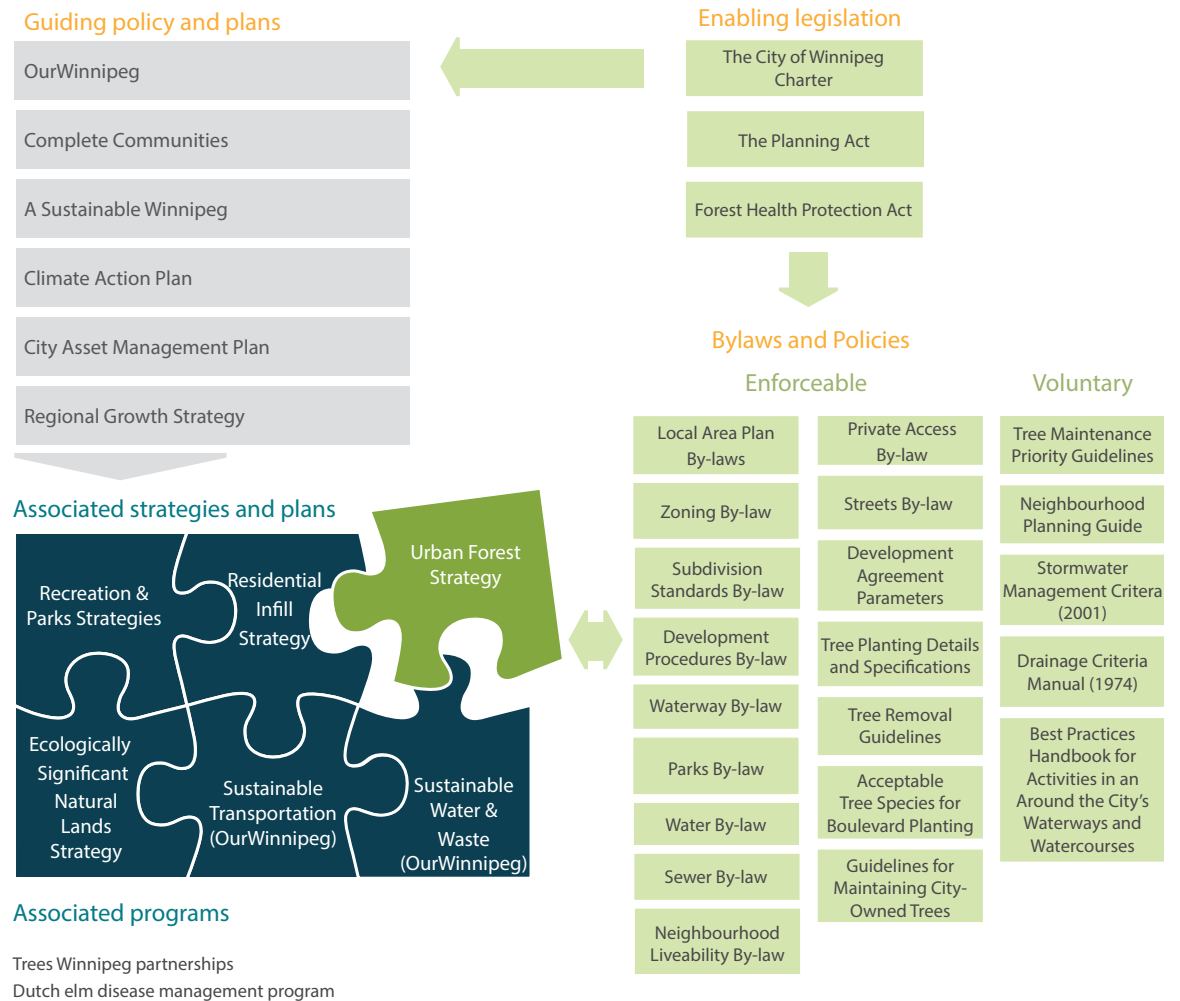


Figure 33: Enabling legislation that define urban forest management and powers to act and the policies and plans currently in place in Winnipeg.

Figure 34 describes how various Winnipeg bylaws and policies regulate planting, retention, removal and maintenance of trees on public and private land.

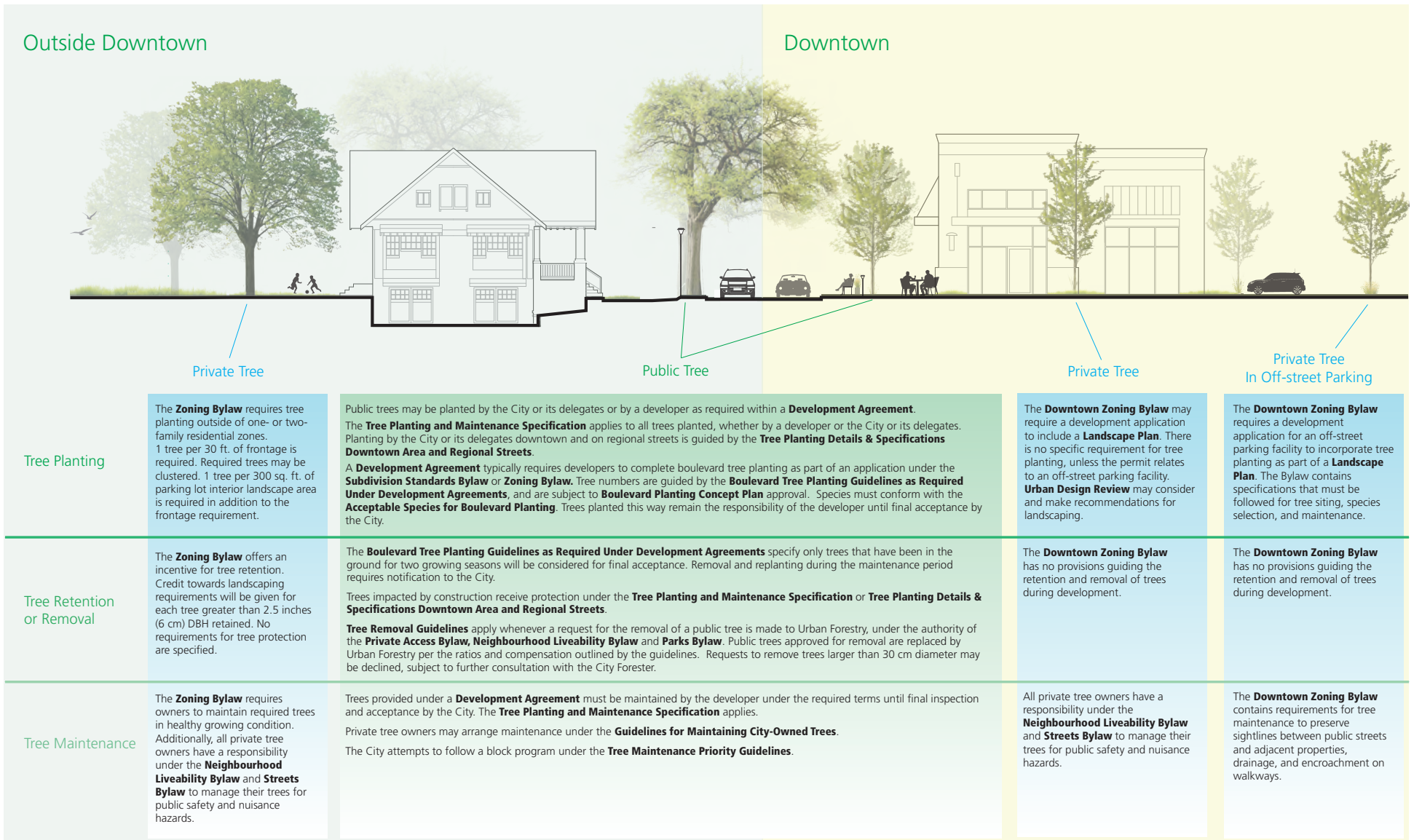


Figure 34: Bylaws and policies that currently regulate the planting, retention, removal, and maintenance of Winnipeg's trees on public and private land.

## Tree protection bylaws

The City currently does not have a tree bylaw. However, two City bylaws act to regulate trees through development, namely:

1. The Zoning By-law influences the space that will be available to retain or plant trees on private land, and can also include landscaping requirements for development
2. The Subdivision Standards By-law provides the authority for Development Agreement Parameters which outline the space and requirement for trees in streets by controlling soil volume, boulevard widths, spacing, and the location of utilities

Winnipeg's current Zoning By-law establishes landscaping requirements for developments to plant a tree on private lots for every 30 feet of linear street frontage (excludes Downtown). Owners can get planting credits for trees that were retained through development. There are no requirements for tree retention on private land in relation to the Subdivision Standards By-law.

Tree bylaws tend to have consistent components that define what is protected, reasons why removal would be permitted, measures for protecting retained trees, and requirements for tree replacement (Figure 35). The Appendix provides a comparison between several Canadian cities and how their tree bylaws address each of these components.

## TREE BYLAWS TYPICALLY...



Define **WHAT IS PROTECTED**

- Tree size
- Tree species



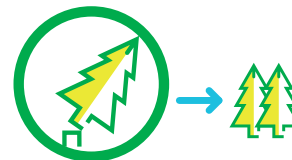
State **ACCEPTABLE REASONS FOR REMOVAL**

- Hazardous trees
- Within proposed building footprint



Where trees are retained, specify **TREE PROTECTION MEASURES**

- Protection barrier
- Arborist supervision



Where trees are removed, state **REPLACEMENT REQUIREMENTS**

- Replacement ratio or target
- Cash-in-lieu options

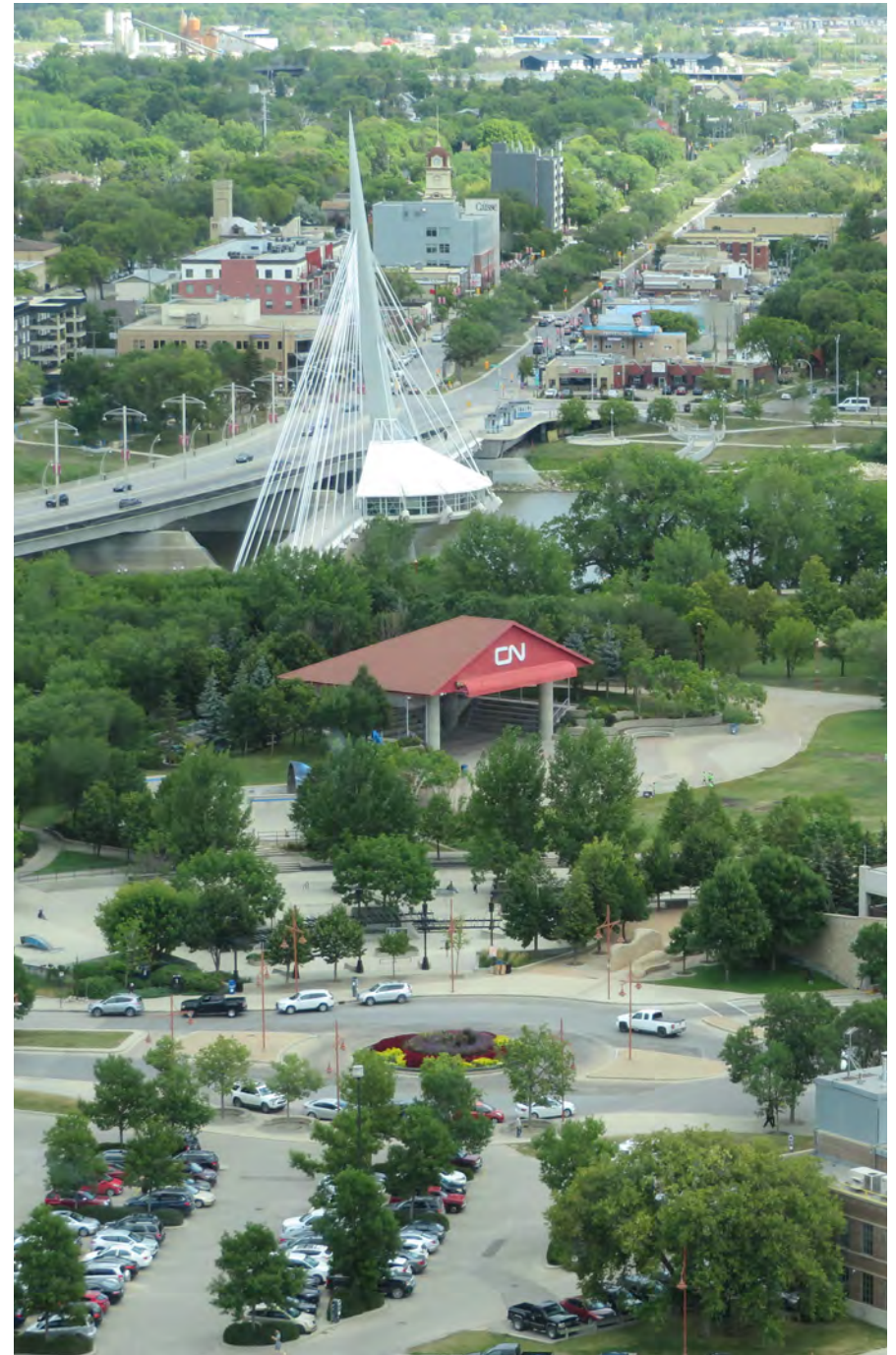
Figure 35: Tree bylaws typically have standards identified for protection, removal, and replacement.

## Tree care industry standards and best practices adopted by the City of Winnipeg

A number of Winnipeg's policies and procedures have been implemented based on tree care industry best practice from across Canada and North America. Table 6 describes the most pertinent and valuable resources that Winnipeg has at its planning disposal.

Table 6: Industry standards and best practices most pertinent to the City of Winnipeg.

Publisher	Standard	Detail
International Society of Arboriculture (ISA)	Best Management Practices	The ISA publishes best management practices on many subjects in tree care, maintenance, and urban forestry applications. Certified arborists are encouraged by the ISA to follow all applicable best management practices.
American National Standards Institute	Z133, A300	The American National Standards Institute releases and updates the accepted industry standards for safety in arboriculture operations (Z133) and tree care (A300). ANSI Z133 covers criteria in general safety, electrical hazard, use of vehicles and mobile equipment, power tools, hand tools, climbing, and other procedures for workers engaged in arboriculture. A300 contains ten parts addressing the major aspects of arboriculture planning and practice, including pruning, soil management, tree planting and establishment, protection during construction, tree risk assessment, and integrated pest management.
Council of Tree and Landscape Appraisers	The Guide for Plant Appraisal	The Guide, now in its 10th edition, outlines industry standards and protocols for tree appraisal. Winnipeg applies the Guide when requests to remove significant trees are made under the City's Tree Removal Guidelines.
Canadian Nursery Landscape Association	Canadian Landscape Standard, Canadian Nursery Stock Standard	The Association publishes standards in common use for landscape construction and nursery stock. Winnipeg incorporates the Canadian Nursery Stock Standard into its Tree Planting and Maintenance Specification and procurement of nursery stock.



## 6. State of specific challenges

A comprehensive background on the state of the urban forest has been presented thus far. However, there are specific issues in the management of Winnipeg's urban forest that are particularly complex at a higher level. The state of these challenging issues listed below are briefly presented in this section:

1. Pests and diseases
2. Climate change and climate hazards
3. Urbanization, development, and tree protection
4. Asset and program management sustainability

### Pests and diseases

In Winnipeg, Dutch elm disease continues to be the cause of significant tree mortality, with upwards of 6,000 American elm trees per year being removed from public and private land.

There are approximately 52,000 American elms in the City's tree inventory, representing more than 37 percent of the total leaf area and carbon stored in the inventoried urban forest. American elm removal rates in the last two years have averaged 2,500 street and park trees per year (7,500 if you include private land). Historically, the target annual loss rate due to disease to prevent exponential increases in DED and depletion of the American elm population is no more than two percent. The City has partnered with researchers to develop a prioritized rapid removal protocol to slow the spread of DED over time and allow more efficient management of DED.



Leaves affected by Dutch elm disease (left) and the orange dot used to mark a diseased elm tree to be removed (right).

Ash is now under threat with the 2017 detection of Emerald ash borer and cottony ash psyllid. Approximately 10,000 of Winnipeg's black ash trees are at risk of cottony ash psyllid. EAB has not yet started to cause widespread mortality and the population is likely still building up. In other parts of North America, EAB has caused 100 percent overstory ash mortality within 10 years of detection, with worth noting that Winnipeg is the northernmost and coldest location where EAB has been detected in North America and there is a possibility that EAB population growth will be slower in Winnipeg as a result<sup>5</sup>.

The City has nearly 100,000 ash trees in its inventory, representing 26 percent of the total leaf area and 16 percent of the carbon stored in the inventoried urban forest. Many more are found in natural areas and on private land. Ash killed by EAB tend to fall over within two years of mortality and must therefore be removed soon after death to mitigate risk. Doing nothing would overwhelm the City's capacity to remove dead trees, so the City has outlined a strategy called "Slowing Ash Mortality" or SLAM<sup>6</sup>. The approach involves proactive removal of dead and declining ash trees, as well as treating infected ash with insecticides to kill the EAB and limit the growth of the beetle population. Since 2009, the City has been reducing the number of ash trees planted and altogether stopped planting ash trees in 2016.

A significant threat for natural areas is the long-term succession pathway from ash to a new dominant species. Elm have already been diminished from the overstory and, once the ash overstory dies an orphan cohort of ash will be left in the understory with no fresh seeds in the seedbank. Trees as small as 2.5-cm diameter can be attacked by EAB<sup>7</sup> and so regenerating ash may be killed before setting seed. If both ash and elm are eradicated from riverbottom forests then invasive species such as European buckthorn could take over. The broader ecological implications of this scenario have not yet been widely studied in our region.

Oak decline has impacted the large bur oak population over the past few decades with expanding development and urban sprawl. The gypsy moth has been detected in Winnipeg but has not become established. A number of other pests and disease affect trees in Winnipeg including cankerworm, elm spanworm, and elm scale which affect trees at varying levels from year to year. A significant potential pest threat present in North America, but not yet established in Winnipeg is the Asian long-horned beetle, which has a wide invasive range and can cause widespread tree mortality.

5 Orlova-Bienkowskaja, M.; Bienkowski, A. 2020. Minimum Winter Temperature as a Limiting Factor of the Potential Spread of *Agrilus planipennis*, an Alien Pest of Ash Trees, in Europe. *Insects*. 11(258)

6 Poland, Therese M.; McCullough, Deborah G. 2010. SLAM: A multi-agency pilot project to Slow Ash Mortality caused by emerald ash borer in outlier sites. *Newsletter of the Michigan Entomological Society*. 55(1&2).

7 Dobesberger, E.J. 2002. Emerald ash borer, *Agrilus planipennis*: pest risk assessment. Canadian Food Inspection Agency, Plant Health Risk Assessment Unit. Nepean, Ontario.

Winnipeg has been responding to these challenges through:

- Long-standing dedicated DED management program for American elms on public and private property
- EAB response treating ash on public property where resources allow and ash removals
- Diversifying tree species planted (ash no longer being planted)
- Community and research partnerships

## Climate change and climate hazards

Trees provide services, such as shade and cooling and rainwater interception, that can help cities adapt to climate change. However, trees are also vulnerable to climate change impacts. According to modelling prepared by the Prairie Climate Centre, Winnipeg can anticipate the average annual temperature to warm by 2.6 -6.9 °C by 2080 (business-as-usual emissions scenario, RCP 8.5). Temperatures will increase in all seasons and the frequency of heatwaves is expected to double. Precipitation is likely to increase during winter, spring, and fall, while remaining constant or slightly decreasing in summer. Figure 36 summarizes the major changes and impacts expected due to climate change.

Relative to the historic baseline, increases in temperature are substantially more than the predicted increase in annual precipitation, which may increase tree drought stress. Higher temperatures will drive other impacts including earlier spring thaws and later fall snowfalls, with heavier, wetter snow that can damage trees. Growing seasons will lengthen, but benefits for trees may be complicated by more variable weather and other effects.

Climate warming will affect the lifecycles of pest insects. Growing Degree Days are a common measurement of the cumulative thermal energy available through the year for plant or insect development. Growing Degree Days Base 10 °C (DD10) are frequently used to predict the emergence and behavior of insect populations. For example, EAB adults emerge after about 400-500 DD10, with peak emergence around 1,000 DD10. Between 1950 and 2013 Winnipeg's DD10 has fluctuated between about 800 and 1,200 and it is likely that EAB often needs two years to complete its life cycle. Under the RCP 8.5 scenario, DD10 it is projected to increase to more than 2,000. For EAB, this will mean that adults emerge earlier and consistently reach peak emergence, lay eggs earlier, and will likely complete their life cycles in one year instead of two. Overwintering success will also increase as minimum winter temperatures in the City rise from -37 to -25 °C.

Climate warming is also associated with increased likelihood of high winds, flash floods, hail, convective storms, drought, and wildfires. Storm damage will be exacerbated where trees are weakened by drought or increased pest activity. Following the snowstorm of October 2019, heavy wet snow damaged approximately 30,000 trees, and trees in poorer condition saw greater branch loss and damage.



One of approximately 30,000 trees damaged during the October, 2019 storm.





One of approximately 30,000 trees damaged during the October, 2019 storm.



In the first two weeks of storm cleanup, 1,700 tonnes of debris or 121 dump truck loads was transported.

## CHANGES TO...



### TEMPERATURES

Much warmer winters, many more hot days



### GROWING SEASONS

Frost-free period longer by 40 days. DD10 increases from 1042 to 1725.



### PRECIPITATION

Slight increase overall, wetter springs, drier late summers



### EXTREME WEATHER

Potential changes in frequency and intensity of extreme weather events.



### MOISTURE AVAILABILITY

Increased rates of evaporation and transpiration may create drier conditions during the growing season.

## WILL LIKELY CAUSE...



### MORE EXTREME WEATHER EVENTS

Heat, extreme precipitation, flooding, icestorms or other events may happen more often leading to more tree damage.



### MORE PESTS AND INVASIVE SPECIES

Pests may reproduce more rapidly and more often. Trees and ecosystems may be more vulnerable to attack and invasion.



### DROUGHT MORTALITY

Less moisture availability may increase drought mortality and urban trees may need more water to establish.

Figure 36: Changes due to climate change will likely cause challenges to the urban forest.

## Urbanization, development, and tree protection

Winnipeg is growing. OurWinnipeg, the City's municipal development plan, anticipates the City's population will increase to 850,000 by 2031. Growth will be accommodated via a mix of new housing at the urban edge and infill housing in established neighbourhoods. OurWinnipeg is a blueprint for sustainable community development and seeks to encourage densification to improve community amenities and servicing costs.

Urbanization and development are an inevitable requirement for growing cities. Some of the typical challenges trees face due to urbanization and development include:

- Poor growing conditions in urban streetscapes
- Removal or damage due to streetscape upgrades, infrastructure renewal/conflicts, building redevelopment, infill, or new construction

As cities grow, areas become more urbanized with more impermeable surfaces to accommodate more people, street furniture, signage, and all the other features of a busy and vibrant public realm. The increase in hard surfaces in urban areas often creates challenging conditions for trees by absorbing more heat, draining water away from trees, requiring clearance pruning, and reducing the soil that roots can grow in. The use of de-icing salts on these hard surfaces also damages trees.

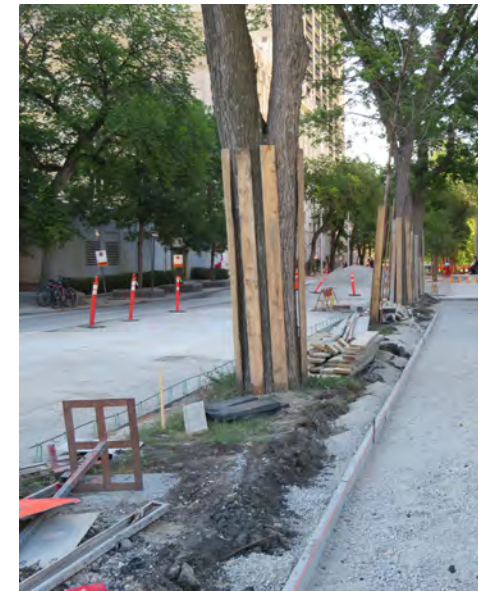
Development often requires trees to be removed or pruned to accommodate construction, and the work itself can cause physical tree damage that shortens the life expectancy of trees in the landscape. Development is both a cause of canopy loss and a source of growth as trees are planted into developments. Trees are also often physically damaged by construction activities. Trees, housing, and infrastructure are integral components of a sustainable city, and policy for each needs to be coordinated to ensure objectives are feasible and can be met.

Winnipeg has several policies that respond to these challenges:

- Zoning By-law requires one tree per frontage in residential areas and credits tree retention in lieu of planting
- Development Agreements require boulevard tree planting
- Tree Planting and Maintenance Specifications require protection of City trees during development
- City Tree Removal Guidelines help to guide when City trees can or cannot be removed
- Guidelines for maintaining City trees provide parameters for who can work on City trees
- Water sensitive urban design strategies to reduce runoff using natural amenities



*Tree damaged by poor pruning for new apartment building, not designed around the existing tree canopy (left).*



*Inadequate tree protection led to blvd. damage during streetscape upgrades (right).*



*Downtown tree planted into soil vault with restricted soil volume and extensive impermeable surface (left) and trees damaged during construction (right).*

Cities in some parts of Canada use tree bylaws to regulate the protection and replacement of trees on private or public land. Tree bylaws typically function so that trees of a certain type (e.g., size, species, location) are protected and cannot legally be removed unless the owner obtains a tree permit. As of the fall of 2019, tree bylaws that regulate private trees were in place in local governments across British Columbia, Ontario, Québec, and Prince Edward Island. See the Appendix for a city comparison overview for six cities in British Columbia and Ontario.

The ability for local governments to regulate tree removal and replacement is controlled by provincial legislation, which explains why tree bylaws vary across the country in terms of whether or not they apply on private land. Where local governments elect to adopt a tree bylaw, they may do so for a variety of reasons and in ways that best respond to their local conditions and community values. Often, tree bylaws are enacted to regulate tree removals and require tree replacements in order to safeguard community tree benefits.

Winnipeg is growing, both through new development at the urban fringe and with densification of existing urban areas. New development can result in both gain (e.g., where trees are added to what was prairie) and loss (e.g., where aspen forest is cleared). Densification of existing urban areas with infill development often means existing trees have to be removed and trees on neighbouring properties may be damaged. Council has directed the public service to consider a tree protection bylaw for private properties.



*New developments adjacent to natural areas.*



*Densification of existing urban areas with infill development.*

## Managing trees as assets

Trees are living assets that appreciate in value as they age due to their ability to deliver more services as they grow. A key objective of urban forest and asset management is to maximize the benefits produced from trees for the least cost, and so we need the trees in our landscape to be healthy and long-lived.

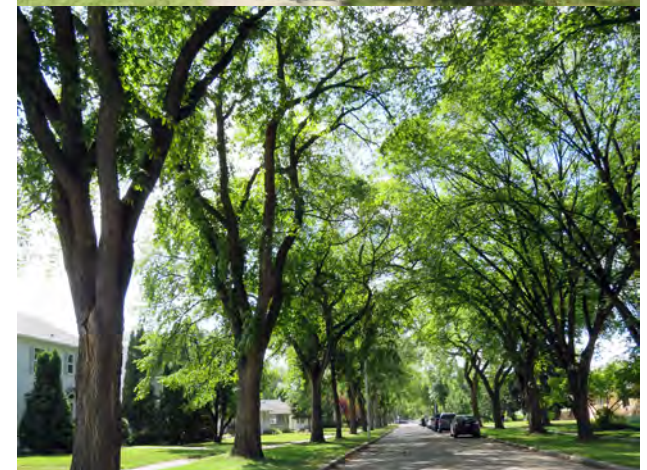
Winnipeg manages an inventory of 300,000 boulevard and park trees, plus an even greater number of forest trees in natural areas. Inventoried trees are managed intensively, in that they are individually planted, pruned, and maintained for health and risk until the end of their life. The bulk of the costs associated with a City's urban forest management program are typically related to managing inventoried trees. Management of trees in natural areas is typically not part of the City's urban forestry programs other than DED management. The City's Naturalist Services Branch oversees natural and naturalized forested areas, including reforestation and afforestation. Management of the areas is limited to addressing high risks to public safety as necessary and pursuing preservation in the case of construction or developing in collaboration with the Urban Forestry Branch. Afforestation efforts will increase over the next 10 years through the Mayor's Million Tree Challenge.

Asset management focuses on maximizing benefits and minimizing the risk for the least cost. Winnipeg's inventoried trees are being removed at more than twice the rate of replacement on average and the maintenance pruning cycle is at 31 years. The number of tree removals has been rising because of higher rates of diseased or pest infested trees. Storm damage is not an annual concern, however, some years have seen an increase in removals such as the 2019 storm with 600 trees damaged.

An asset management framework can help clarify the cost of managing an individual tree (or other type of natural asset) from installation to removal. These costs are typically matched to define levels of service and performance targets. Costs can then be calculated out to the whole population to more accurately estimate the budgets needed to meet the levels of service and performance targets set. Asset management involves:

- Inventorying what we have and its condition
- Identifying life cycle costs
- Budgeting for management and replacement of assets over their life cycle

Municipalities are increasingly incorporating trees into their asset management systems as a means of accounting for their life-cycle costs, maintenance cycles, and replacement time frames, as well as their asset value. Some municipalities are also exploring integrating other natural assets into these same frameworks. The Winnipeg Comprehensive Urban Forest Strategy will explore how Winnipeg's urban forestry program can be more effectively integrated into the City's asset management program.



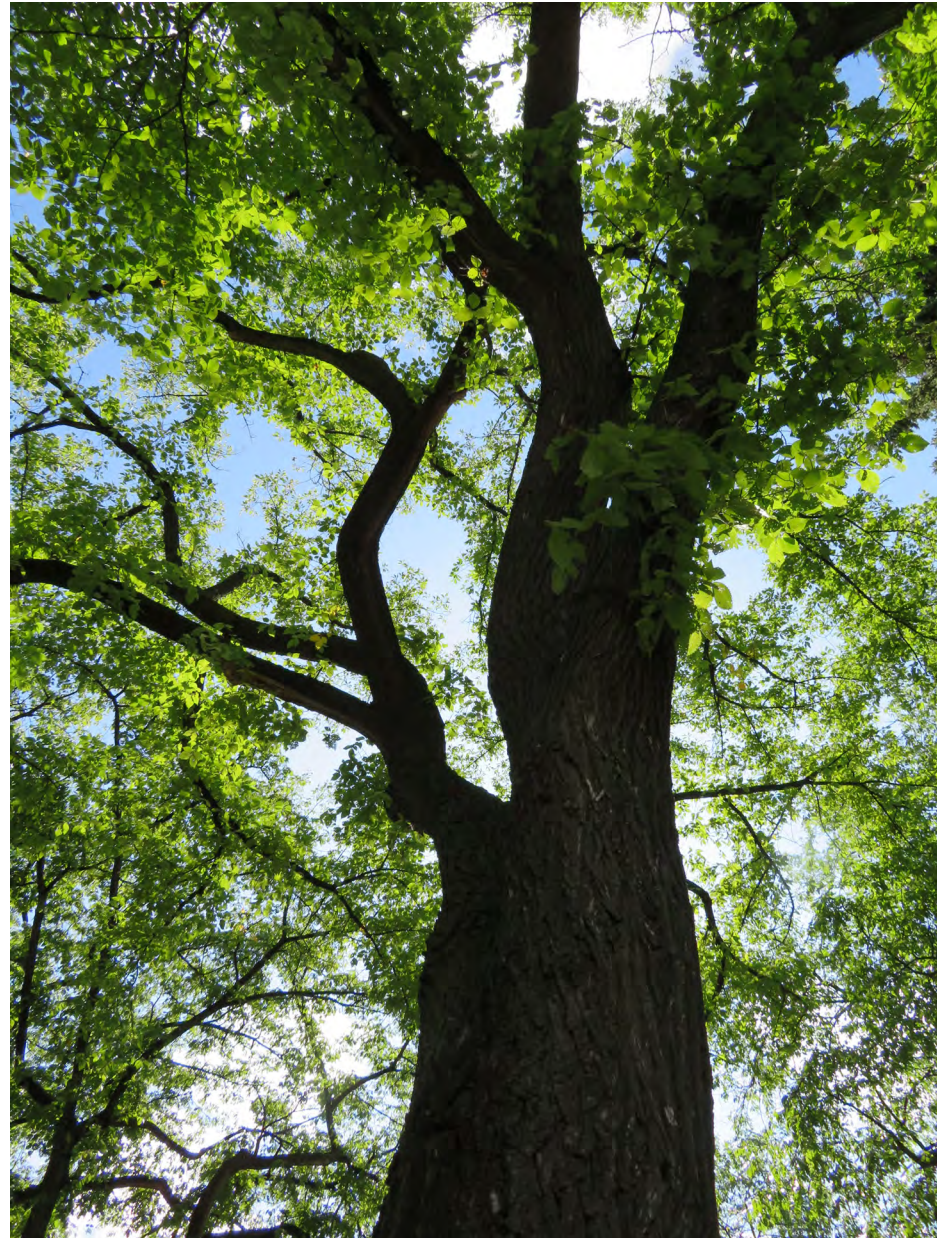
## Final remarks

On December 12, 2017, in response to a report on the additional resources required for Dutch elm disease (DED) management (September 2017) and the detection of Emerald Ash Borer (EAB), Council approved the Urban Forest Enhancement Capital Project which supported the creation of the City of Winnipeg Comprehensive Urban Forest Strategy. This Report prefaces the development and finalization of the Strategy, and summarizes what we know so far about Winnipeg's urban forest canopy and management.

Winnipeg's urban forest faces significant challenges from insects and diseases which threaten the dominant species in its urban tree population. Additionally, climate change and urban development continue to place pressure on the urban tree canopy.

These combined challenges threaten the urban forest's capacity to provide beneficial ecosystem services like shade and cooling, improved air quality, rainwater interception, and habitat connectivity, which are key components of our City's resilience to climate change. The City's capacity to maintain the urban forest is also challenged as staff and budgets struggle to keep up with the demands for disease management, urban development, pruning and tree removals, and replanting.

Winnipeg's Comprehensive Urban Forest Strategy is an opportunity to establish a long-term vision for Winnipeg's urban forest, and to develop clear guidance and measurable outcomes for the funding and levels of service required to sustain an urban forest that is resilient to current and future challenges.



## Appendix - City comparison overview of tree protection policies

The table below provides a comparison of similar sized cities across Canada where approaches have been used. The selected comparison cities have a population of 500,000 to three million people and have a tree by-law that regulates private trees. This comparison includes six cities from British Columbia and Ontario, presented alphabetically in the table below.

Description	Brampton (2012)	Mississauga (2013)	Ottawa (2021)	Surrey (2006)	Vancouver (2018)	Toronto (2015)
<b>Property application</b>	Specific private tree bylaw (also have Woodlot Conservation By-law)	Specific private tree bylaw	Separate sections for protection of trees on municipal property and private tree protection	Applies to public and private properties	Applies to public and private properties	Separate sections on protection of trees on city streets and private tree protection
<b>Protected tree definition</b>	<b>≥30 cm</b>	<b>≥15 cm</b> -includes species of interest, heritage or significant tree, sensitive lands, where significant vistas would be compromised	<b>≥10 cm</b> for properties ≥1 ha, <b>≥50 cm</b> for properties ≤1 ha	<b>≥30 cm</b> -includes species of interest, significant trees, sensitive lands, replacement trees	<b>≥20 cm</b> -includes replacement trees	<b>≥30 cm</b> -includes heritage or significant tree, sensitive lands, where significant vistas would be compromised, where flood or erosion control would be compromised, boundary or neighbouring tree considerations
<b>Reasons to permit removals</b>	N/A	Conflict with pool enclosure or parking, no negative impact to flooding/slopes, heritage lot if not relevant to heritage, removal is acceptable to City.	Causing structural damage to load bearing structures/ roof, required to remediate contaminated soil, will be relocated, required for utilities/water/ sewer, no reasonable alternative as per GM	Interfering with infrastructure, farming, inappropriate location.	Construction access, interference with drainage/sewer.	Causing structural damage to load bearing structures/ roof, inappropriate location and cannot be routinely maintained due to site restrictions, required to remediate contaminated soil, will be relocated, required for utilities/water/sewer, no reasonable alternative as per GM.
<b>Replacements</b>	Ratio at City discretion, no cash-in-lieu, no density target. Guidance - GM may impose species, size and location	Ratio at City discretion, no cash-in-lieu, no density target. GM may impose species, size and location.	Ratio as determined by GM: <b>1:1 to 3:1</b> based on property size and development; <b>1:1</b> for dead/hazardous ash, no cash-in-lieu, no density target. Guidance provided for size.	Ratio <b>2:1</b> , cash-in-lieu \$400 - 700 per tree, no density target. Guidance for the location (proximity to buildings) and size and species may be at the discretion of the GM.	Ratio <b>1:1</b> for planting large tree; 2:1 for planting small tree, cash-on-lieu \$1000 per tree, density target 55-200 trees per ha dependent on lot size. Guidance re: species, timing and size.	Replacement and two years maintenance on site or other location upon plan approval by GM. Cash-in-lieu equal to 120% of cost of replanting and 2 years maintenance; no density target.

Description	Brampton (2012)	Mississauga (2013)	Ottawa (2021)	Surrey (2006)	Vancouver (2018)	Toronto (2015)
<b>Securities</b>	None	Replacement only: cost of planting + 2 yrs maintenance (at GM discretion)	Replacement only; amount at GM discretion	<b>Replacement:</b> \$400 - \$800 per replacement tree re: caliper size/height or size as per GM. <b>Tree protection:</b> \$3,000-10,000 on size/species (development context only)	Replacement only: \$500-750 per replacement tree re: caliper size	Tree Protection and Replacement: amounts not specified (at GM discretion).
<b>Fees and fee structure</b>	\$50	<b>\$0</b> hazard/dead/dying <b>\$320 + \$71</b> per additional tree (up to \$1,433) base fee (up to 5 removals) + per additional tree removed up to max amount.	<b>\$150</b> with no development.  <b>\$500</b> for development application.	<b>\$84 + \$33</b> per additional tree - no subdivision proposed - base fee + per additional tree removed. <b>\$110 - \$554</b> with subdivision based on lot size and zoning.	<b>\$82 + \$236</b> per additional tree - base fee + per additional tree	<b>\$252.83 - \$758.52</b> per tree, Schedule with Fees and Charges
<b>Penalties for offences</b>	<b>\$100,000</b> max + continuing offences can exceed	<b>\$25,000</b> first conviction, up to <b>\$50,000</b> subsequent for individual. Corporation up to <b>\$50,000</b> first and <b>\$100,000</b> subsequent conviction + additional penalties.	<b>\$500 - \$100,000</b> max and liable to special fine that may exceed \$100,000	<b>\$40 - \$10,000</b> ; additional \$1000 per tree of \$10,000 per significant tree	<b>\$500 - \$10,000</b> per offence	<b>\$500 - \$100,000</b> max per tree and liable to special fine of \$100,000
<b>Authority</b>	Community Services	Community Services	Public Works and Planning/City Forestry inspections	Planning and Development	Planning	Parks, Forestry and Recreation
<b>Enforcement</b>	Municipal Bylaw Enforcement Officer	Municipal Bylaw Enforcement Officer	Municipal law Enforcement Officer	Bylaw Enforcement Officer	Bylaw Enforcement Officer	Parks, Forestry and Recreation



**City of Winnipeg**

510 Main Street

Winnipeg, Manitoba - R3B 1B9

[winnipeg.ca/urbanforest](http://winnipeg.ca/urbanforest)





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