
by

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Most of all I wish to thank my family, in particular my parents, who have supported me in every way throughout my academic career, and who most importantly are responsible for instilling in me a love of trees.
Executive Summary

This report identified best practices for larger Ontario municipalities to develop urban forest management plans (UFMPs). The report addressed the following research question:

What lessons can large Ontario municipalities learn from London and Mississauga’s urban forest management plans?

Urban forests are urban ecosystems that benefit urban environments and their inhabitants by providing valuable ecosystem services; however, North American urban forests are facing increasing pressures from intensification, invasive pests, and climate change. Some municipalities have developed UFMPs to address these threats and to maintain and enhance their urban forests.

A UFMP is a planning document that outlines a long-term strategy to manage and maintain, and in some cases to enhance and expand, a defined urban forest or portion thereof. Municipalities in Ontario have only recently begun to adopt UFMPs. This has occurred in the context of a lack of leadership and involvement in urban forest management by the provincial and federal governments.

London and Mississauga were chosen as case studies because they are the first and only Ontario municipalities with populations between 200,000 and 750,000 to adopt UFMPs. As such, they can provide a model for other large Ontario municipalities to follow in the management of their own urban forests.
Existing research by forestry experts has already explored best practices for urban forest management planning from a forestry perspective. To complement the existing literature, this report studied urban forest management planning from a planning perspective.

The methodology for this report comprised document analysis of the two case study plans, a literature review, and semi-structured interviews with three academics with expertise in the field of urban forestry.

The document analysis evaluated case study UFMPs using twelve criteria which were adapted from those developed by Julia Cziraky in her 2012 report *A Comparative Case Study of Urban Forest Planning in Oakville and Kingston, Ontario*. The twelve criteria are divided into four categories as follows:

**Category A: Context and Goal-Setting Process**
1. Defining the urban forest
2. Scope of the plan
3. Setting effective goals

**Category B: Incorporation of Ecological Principles**
4. Conducting an inventory of existing trees and associated ecosystems
5. Identification of plantable space
6. Identification of threats and disaster management

**Category C: Stakeholder Involvement and Collaboration**
7. Inclusion of public input into visioning process and final plan
8. Collaboration among groups
9. Public education efforts and ongoing citizen participation strategies

**Category D: Implementation Strategies**
10. Active adaptive management techniques
11. Identification of groups responsible for implementation
12. Regulatory instruments
Both plans satisfy all twelve of the evaluation criteria, to differing degrees. London’s plan was somewhat weak on defining key terms and setting effective targets by which to measure success. A key strength of London’s plan was its strong public consultation process. Mississauga’s plan could have been strengthened by a more effective consultation with the general public as part of plan development. The key strengths of Mississauga’s plan are its highly detailed implementation strategy and its emphasis on active adaptive management.

The analysis of the case study plans, combined with the literature review and interviews with urban forestry experts, provided the following lessons for large Ontario municipalities that are considering adopting an urban forest management plan:

1. All municipalities with urban forestry programs can benefit from adopting an urban forest management plan.
2. Clearly define the terms of reference and scope of the plan.
3. Conduct a thorough inventory of the urban forest to provide data on which to base the plan.
4. Set targets that will be effective in achieving the vision for the urban forest.
5. Utilize regulatory instruments as one of many means to protect trees.
6. Include the public and key stakeholder groups in the development and implementation of the plan.
7. Adopt an “active adaptive management” approach to maximize plan effectiveness.
8. Adopt a collaborative approach to urban forest management, internally and externally.

Additional lessons were identified for planners, as well as for Ontario provincial policy makers:

1. Lessons for planners:
   a. Become educated in the basics of urban forestry, and consider forestry concerns early in the planning process.
   b. Explore how planning tools, such as zoning by-laws, can support urban forestry efforts.
2. Lessons for Ontario provincial policy makers:
   a. Develop policies to guide municipal urban forest management.
   b. Support municipal urban forest management by taking a lead role in research to inform active adaptive management practices.
This report found that urban forest management plans can be beneficial for municipalities of any size that have the capacity to implement them, and that large municipalities in particular should have this capacity and stand to benefit from UFMP adoption.

As intensification, climate change, invasive pests, and other factors place increasing pressures on urban forests, large Ontario municipalities can look to the example set by London and Mississauga for lessons in how to develop their own urban forest management plans. By implementing such plans, these municipalities can address the pressures facing their urban forests and work towards securing a healthier urban forest ecosystem in the future.
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Chapter 1: Introduction

1.1 Research Objective
Urban forests benefit urban environments and their inhabitants by providing valuable ecosystem services; however, North American urban forests are facing increasing pressures from intensification, invasive pests, and climate change. Some municipalities have developed urban forest management plans (referred to in this report using the acronym UFMP) to address these threats and to maintain and enhance their urban forests. This trend has only recently taken hold in Ontario.

Previous research has examined best practices for urban forest management planning in Ontario, with a focus on mid-sized municipalities. This report expanded upon the existing research by attempting to identify best practices for larger Ontario municipalities to develop UFMPs. This was accomplished through a comparative case study of the recently created UFMPs of London and Mississauga, Ontario. The report addressed the following research question:

What lessons can large Ontario municipalities learn from London and Mississauga’s urban forest management plans?

It is hoped that, as early adopters of UFMPs, London and Mississauga can provide a model for other large municipalities to follow in the management of their own urban forests.

1.2 Case Studies
The cities of London and Mississauga are early adopters of UFMPs among large municipalities in Ontario. London’s City of London Urban Forest Strategy: Enhancing the Forest City and Mississauga’s Urban Forest Management Plan were both adopted in 2014.
These two cities were chosen as case studies because they are the first and only municipalities in their size class in Ontario to adopt UFMPs; therefore, it is hoped that they can provide an example and lessons for other Ontario municipalities of a similar size which may decide to adopt UFMPs in future. London and Mississauga adopted their plans in the same year, and are ecologically similar: both are located in the northern extent of the Carolinian Forest zone, as shown in Figure 1.2.2. These similarities contribute to the validity of the comparison.

![Location of London and Mississauga in Southern Ontario](Source: Google Maps)
These two municipalities are also interesting in their differences: Mississauga is a completely urbanized lower-tier municipality located in the heart of the Greater Toronto Area (GTA), while London is a single-tier municipality with both an urban and a large rural area, located in an otherwise rural part of the province. Furthermore Mississauga has a higher growth rate than London. These differences allow an examination of urban forest management planning in contexts with differing levels of development pressure.

The plans of both case study municipalities consist of multiple documents. A list of these documents appears in Table 1.2.1, as well as a guide to abbreviations used to refer to these documents throughout the report.
Table 1.2.1: Comparison of geographic and organizational information for City of London and City of Mississauga, Ontario (Source: Statistics Canada).

<table>
<thead>
<tr>
<th></th>
<th>London</th>
<th>Mississauga</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Municipality</td>
<td>Single-tier (separated from Middlesex County)</td>
<td>Lower-tier (within Peel Regional Municipality)</td>
</tr>
<tr>
<td>Population (2011)</td>
<td>366,151</td>
<td>713,443</td>
</tr>
<tr>
<td>Population Growth (2011-2006)</td>
<td>3.9%</td>
<td>6.7%</td>
</tr>
<tr>
<td>Total area (sq km)</td>
<td>420.57</td>
<td>292.4</td>
</tr>
<tr>
<td>Name of UFMP</td>
<td>City of London Urban Forest Strategy: Enhancing the Forest City</td>
<td>Urban Forest Management Plan</td>
</tr>
<tr>
<td>Year of adoption of UFMP</td>
<td>September 2014</td>
<td>January 2014</td>
</tr>
</tbody>
</table>

1.3 Background

1.3.1 Defining the Urban Forest

Three out of four Americans (Nowak et al 2001, 38) and four out of five Canadians (Rosen et al 55) live within urban forests. Once referring simply to street trees, the term “urban forest” now connotes a broader urban ecosystem (van Wassenaer et al 2000, 242). As the discipline of urban forestry changed, the urban forest’s benefits became a more central focus of the definition of the urban forest itself. The twenty-first century urban forest is “the aggregate of all community vegetation and green spaces that provide a myriad of environmental, health, and economic benefits for a community” (Young 2011, 369). Perhaps the most comprehensive definition of all for the urban forest is that put forward by van Wassenaer, Schaeffer, and Kenney, which subsumes not only trees, vegetation, and greenspace, but also the wildlife and people they...
benefit: “A single consolidated forest composed of flora and fauna within the urbanized area that facilitates the social, economic and ecological well-being of the community” (van Wassenaer et al 2000, 242).

It is worth noting that definitions of urban forest do not distinguish between “urban” and “suburban”. While suburbs are home to at least two thirds of all Canadians (Gordon and Janzen 214), these communities are not considered different from urban cores where forestry is concerned, except to note that “those small communities that surround major urban centres” are home to the urban forests which face the greatest pressure from urban expansion (van Wassenaer et al 241).

1.3.2 Benefits of the Urban Forest
Urban forests provide many benefits, including positive impacts on natural ecosystems, the built environment, the economy, and public health.

The ecological benefits provided by the urban forest are referred to as “ecosystem services”, and are among the urban forest’s most apparent benefits. Just like trees in rural areas, urban trees provide habitat for wildlife, including endangered species (Rosen et al, 55). With their root systems they provide soil stability and improve water quality (van Wassenaer et al 2000, 242-243). Meanwhile with their leaf systems they improve air quality by absorbing ozone and other pollutants (McPherson et al, 53). It is with good reason that the urban forest is considered the “lungs of the city” (Rosen et al 55).

Mature, large-stature trees are the greatest providers of ecosystem services, because their greater height and diameter result in exponentially higher leaf area (Kenney 2000, 236). This is measured as Leaf Area Density, which is “an estimate of the sum of the area of all leaves on a
“plant (or group of plants)” relative to a specified land area, such as the area on the ground occupied by that plant (or those plants), the area of a community, or per hectare (Kenney 2000, 236). As shown in Figure 1.3.2.1, a higher leaf area density corresponds to a higher level of ecosystem services provided by that plant or plants.

![Figure 1.3.2.1: Leaf area and benefits increase exponentially with increased tree size.](source: Urban Forest Innovations 2014a, 41).

Due to the difficulty in calculating Leaf Area Density, a more popular metric for measuring urban forest assets is Canopy Cover, which indicates the extent of the urban forest by providing an estimate of the area covered by a tree’s (or group of trees’) canopy (Kenney et al 2011, 109). Canopy Cover is limited in that it is a two-dimensional metric which does not take into account factors such as species diversity, age class distribution, or tree height (Kenney et al 2011, 109).

At first glance the urban forest may appear to be at odds with the built environment and economic interests, with tree branches coming into conflict with power lines, roots interfering with sewers and sidewalks, and broken branches causing damage to property (McPherson et al 56). In fact the urban forest has been found to be a net benefactor of the built environment and
economy (McPherson et al 57). In extreme weather events, trees protect the built environment from damage through wind buffering and storm-water retention (Kenney 2000, 235).

Wind buffering by coniferous trees has the added economic benefit of reducing building-heating costs in winter; likewise, deciduous trees planted near a home reduce cooling and heating costs by shading buildings in summer and allowing sunlight through in winter (McPherson et al, 54-55). This reduction in energy needed for heating and cooling also benefits the environment by reducing the amount of emissions from power plants (McPherson et al, 54).

A healthy and mature urban forest enhances the aesthetic of an urban environment, as well as lowering noise levels (Nowak et al 2001, 38). These benefits contribute to higher property values: a study in Finland found that homebuyers would pay more for a dwelling with a forest view or a close proximity to a forested park (Tyrväinen & Miettinen 218-220).

The urban forest’s benefits also extend into public health. For urban residents, the urban forest is the primary – and in some cases the only – connection to nature (Nowak et al 2001, 38). Those areas of the urban forest constituting public green space enhance social equity by providing social gathering areas, and enhance physical and mental health (Tratalos et al 309, Barbosa et al 187). A healthy urban forest also mitigates the Urban Heat Island effect, which, in addition to helping lower cooling costs and consequent energy use, can “lower medical expenses for at-risk populations” (McPherson et al 50). The urban forest therefore is beneficial to both public health and social equity.

1.3.3 Pressures on the Urban Forest

Urban forests are threatened by invasive pests, storms, competition with underground and overhead infrastructure, drought, nutrient loss caused by development, natural mortality, lack of
diversity, and climate change (Rosen et al 55, Nowak & Greenfield 28, Ordonez & Duinker 37). Tree canopy cover in American cities is disappearing at a rate of 0.9 percent per year, in spite of municipal planting campaigns (Nowak & Greenfield 28-29). The planting of new trees at current rates cannot keep up with the loss of mature trees which have much larger canopies and exponentially higher leaf area densities (Nowak & Greenfield 28, Kenney 2000, 236).

Maintenance is essential to protect these mature trees and their high leaf areas. Young trees also require diligent watering, pruning, pest and disease control, and inspecting if they are to survive into maturity (Young 2011, 373). The fragmented land ownership in urban environments presents a barrier to large-scale urban forest maintenance efforts (Ordonez and Duinker 36). The largest portion of the urban forest is located on low-density residential properties; consequently the condition of the urban forest is largely influenced by the household-level decisions of residents (Conway & Shakeel 2012, 2).

A lack of diversity in the species composition and age distribution of trees increases the vulnerability of urban forests to the threats posed by invasive pests, climate change, and natural mortality. In communities with low species diversity, large swaths of the urban forest can be wiped out in a short period of time due to the arrival of invasive pests or diseases which affect a particular overrepresented species, such as Emerald Ash Borer (ash trees) or Dutch Elm Disease (elm trees). A similar threat is posed by climate change: species of tree which once thrived in an environment can be left maladapted to that environment and unable to survive after its climate changes (Ordonez and Duinker 37).

In newer suburban communities, the urban forest consists almost entirely of young trees which were all planted at the same time, and which will therefore age and eventually die at
approximately the same time. The risk of widespread tree loss in a short time due to natural mortality is more immediate in older communities which consist almost exclusively of mature trees (Ordonez & Duinker 37).

Throughout Canada and the U.S., forests in formerly rural areas have suffered as a result of the “poorly controlled” greenfield development that has created urban sprawl (van Wassenaer et al 2000, 241). In recent years, Ontario municipalities have shifted away from greenfield development in favour of increasing density through intensification of existing urban areas. This trend has mitigated the impact of sprawl on urban forests (Kenney 2003, 788); however, intensification poses a different set of threats to the urban forest, for example increasing the lot coverage of buildings at the expense of growing space for trees. Increasing urbanization contributes to tree loss and creates challenging conditions for surviving and newly planted trees (Ordonez & Duinker 36).

1.3.4 Urban Forest Management Planning in Ontario
In order to preserve the beneficial effects of urban forests, the threats described above must be addressed, managed, and mitigated. This can be accomplished through the implementation of Urban Forest Management Plans (UFMPs). A UFMP is a planning document that outlines a long-term strategy to manage and maintain, and in some cases to enhance and expand, a defined urban forest or portion thereof.

The Canadian federal government plays virtually no role in the management of the country’s urban forests (Kenney, Conway, Almas; personal interviews May 29 and June 16, 2015). Similarly, the Ontario provincial government does not directly involve itself in urban forest management, although it is responsible for developing the legislative and policy framework within which urban forest management occurs, as shown in Table 1.3.4.1.
Table 1.3.4.1: Provincial Acts and Policies Guiding Urban Forest Management Planning in Ontario (Source: Urban Forest Innovations 2014a, 16)

<table>
<thead>
<tr>
<th>Statute or Policy</th>
<th>Relevance</th>
</tr>
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<tbody>
<tr>
<td><strong>Planning Act, 1990</strong></td>
<td>Establishes the framework for municipal planning in the province. Empowers municipalities to develop official plans and regulate development, including requiring landscaping with trees and shrubs.</td>
</tr>
<tr>
<td><strong>Ontario Heritage Act, 1990</strong></td>
<td>Allows for the designation of heritage properties and/or landscapes in the Province, including trees on such lands that may have heritage value.</td>
</tr>
<tr>
<td><strong>Forestry Act, 1990</strong></td>
<td>Provides a legal definition for “woodlands” and “good forestry practices”, as well as certain provisions pertaining to boundary/shared trees.</td>
</tr>
<tr>
<td><strong>Conservation Authorities Act, 1990</strong></td>
<td>Establishes conservation authorities as watershed-based authorities with various responsibilities, including regulation of lands adjacent to watercourses, wetlands and shorelines.</td>
</tr>
<tr>
<td><strong>Municipal Act, 2001</strong></td>
<td>Establishes municipal powers. Sec. 223.2 allows any municipality greater than 10,000 people to regulate the injury or destruction of trees, while Sec 135-146 provides the legal framework for municipal tree and site alteration by-laws.</td>
</tr>
<tr>
<td><strong>Places to Grow Act, 2005</strong></td>
<td>Enables Province to designate population growth areas, requiring certain jurisdictions to meet established growth targets by certain dates.</td>
</tr>
<tr>
<td><strong>Provincial Policy Statement, 2005</strong></td>
<td>Provides guidance for land use planning, protection for significant woodlands.</td>
</tr>
<tr>
<td><strong>Greenbelt Act, 2005</strong></td>
<td>The Greenbelt Act and the supporting Greenbelt Plan were recently amended to provide an additional designation of Urban River Valleys to the Natural Heritage System. This designation is intended to include publicly owned lands located in the urban river valleys extending south from the Greenbelt Plan. The lands within the Greenbelt Urban River Valleys are to be governed by the applicable municipal Official Plan policies provided they have regard for the objectives of the Greenbelt Plan.</td>
</tr>
</tbody>
</table>

Absent direct involvement in urban forest management from the federal or provincial governments, some Ontario municipalities have assumed responsibility for protecting their urban forests by developing UFMPs within the policy framework set by the province. This has only
begun to occur in the last decade, and a minority of Ontario municipalities have so far adopted UFMPs. As more municipalities enter the field of urban forest management planning, the early adopters of UFMPs, such as London and Mississauga, will provide examples of best practices for other municipalities to follow.

1.4 Report Outline
This report consists of four chapters:

Chapter 1 provides background information and introduces the research question and the case studies.

Chapter 2 explains the methods used in the report, and introduces the evaluation criteria.

Chapter 3 describes the analysis of the case study documents using the methods outlined in chapter 2.

Chapter 4 discusses lessons learned from the analysis and provides recommendations to other large Ontario municipalities wishing to develop a UFMP.
Chapter 2: Methods

2.1 General Approach
This report followed the methods used by Julia Cziraky in her 2012 report, *A Comparative Case Study of Urban Forest planning in Oakville and Kingston, Ontario*. A qualitative case study provided detailed understandings of two manifestations of urban forest management planning from which conclusions were drawn about best practices for the design and implementation of urban forest management plans (UFMPs) in larger cities. A comparative, two-case study was conducted because this type of study allows for stronger conclusions to be drawn than would a single-case study (Yin 64). A literature review and semi-structured interviews were also conducted to supplement the case study analysis.

Existing research by forestry experts has already explored best practices for urban forest management planning from a forestry perspective. To complement the existing literature, this report studied urban forest management planning from a planning perspective.

2.2 Case Study Selection
In her 2012 report, Julia Cziraky examined the UFMPs of two Ontario municipalities with populations between 100,000 and 200,000, and questioned whether different considerations and best practices may be applicable to urban forest management planning in larger municipalities (Cziraky 19). This report explored that question by investigating examples of urban forest management planning in Ontario municipalities with populations over 200,000. There are ten such municipalities, the three largest of which are each of a fairly unique size with no similarly sized comparator within Ontario. Therefore, a ceiling of 600,000 population was set to exclude these three municipalities.
A search of the municipal websites of the seven Ontario municipalities with populations between 200,000 and 600,000 was completed to ascertain which of them had implemented urban forest management plans. This search revealed that in fact only one of these municipalities, the city of London, had implemented an urban forest management plan.

The search for case studies was then expanded to include plans from several municipalities which were of a comparable size to London but located outside Ontario (Quebec City, Quebec; Halifax, Nova Scotia; Pittsburgh, Pennsylvania), and also plans from other Ontario municipalities which did not fit the desired population size class (Toronto; Mississauga; Burlington; Guelph). It was hoped that one of these plans which met only one of the desired criteria (Ontario context or within the stated population range) could be studied in comparison with London’s plan.

Quebec City’s plan was removed from consideration due to uncertainty about the researcher’s ability to effectively analyse it, given that it is written in French. Halifax was deemed to be too dissimilar an ecological context relative to London. Pittsburgh, being in a different country, was decided to have too dissimilar a political and administrative context. Toronto, with a population of approximately 2.3 million, was considered too large relative to London for a valid comparison; Burlington and Guelph’s populations were deemed to be too small.

Ultimately, Mississauga was chosen as the best comparator for London. London and Mississauga are municipalities within the same political and administrative context as well as the same ecological context: the Carolinian forest zone (as shown in Chapter 1, Figure 1.2.5.1). Although Mississauga’s population is almost double London’s, the two cities are nonetheless
representative of Ontario’s large municipalities, which are the focus of this report (excluding Toronto, which is so large as to be unique in the province).

London’s plan, entitled *Urban Forest Strategy: Enhancing the Forest City*, was developed by B.A. Blackwell & Associates Ltd, a forestry firm based in British Columbia. Mississauga’s *Urban Forest Management Plan* was developed by Urban Forest Innovations Inc., an urban forestry firm based in Mississauga. This provides the opportunity to study two plans created by firms with different backgrounds and perspectives. London and Mississauga’s plans were both adopted in 2014, making them an especially valid pair for comparison.

Despite the different names of the case study documents, the term “urban forest management plan” (UFMP) is used in this report to refer to urban forest management plans in general, including the case study documents. The acronym UFMP is also used to describe Mississauga’s *Urban Forest Management Plan*, while London’s *Urban Forest Strategy* is abbreviated as UFS.
Table 2.2.1: Case Study Candidates Considered. The urban forest management plans of London and Mississauga, shown in bold, were selected for a comparative case study.

<table>
<thead>
<tr>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Toronto, Ontario</td>
<td>2,615,060</td>
<td><em>Sustaining and Expanding the Urban Forest: Toronto’s Strategic Forest Management Plan</em> (2013)</td>
</tr>
<tr>
<td>Ottawa, Ontario</td>
<td>883,391</td>
<td>(No plan)</td>
</tr>
<tr>
<td><strong>Mississauga, Ontario</strong></td>
<td><strong>713,443</strong></td>
<td><em>Urban Forest Management Plan (2014)</em></td>
</tr>
<tr>
<td>Brampton, Ontario</td>
<td>523,911</td>
<td>(No plan)</td>
</tr>
<tr>
<td>Hamilton, Ontario</td>
<td>519,949</td>
<td>(No plan)</td>
</tr>
<tr>
<td>Quebec City, Quebec</td>
<td>516,622</td>
<td><em>Plan directeur des milieux naturels et de la forêt urbaine</em> (2008)</td>
</tr>
<tr>
<td><strong>London, Ontario</strong></td>
<td><strong>366,151</strong></td>
<td><em>City of London Urban Forest Strategy: Enhancing the Forest City</em> (2014)</td>
</tr>
<tr>
<td>Markham, Ontario</td>
<td>301,709</td>
<td>(No plan)</td>
</tr>
<tr>
<td>Vaughan, Ontario</td>
<td>288,301</td>
<td>(No plan)</td>
</tr>
<tr>
<td>Kitchener, Ontario</td>
<td>219,153</td>
<td>(No plan)</td>
</tr>
<tr>
<td>Windsor, Ontario</td>
<td>201,891</td>
<td>(No plan)</td>
</tr>
</tbody>
</table>

2.3 Data Collection Methods
Data collection for this report was triangulated through the use of three methods: a literature review, document analysis, and semi-structured interviews.

2.3.1 Literature Review
A review of academic literature on the topic of urban forest management planning was conducted before the design of the rest of the methodology. This literature review provided an understanding of the discipline of urban forestry in Canada and a general knowledge of the challenges and trends facing contemporary urban foresters. From this experience the researcher developed the research question, and adapted Cziraký’s methods to reflect more recent trends in urban forestry and to suit the different aim and research question of this study.
2.3.2 Document Analysis

Urban forest management plans from case study municipalities were analyzed utilizing an evaluation framework adapted from the twelve criteria developed by Cziraky (2012). Cziraky’s framework was refined slightly for this study based on the literature review and on feedback from the three experts who were interviewed for this report.

Case study plans were not graded or ranked; rather, the criteria were applied to qualitatively analyze the two plans, framing the comparison of them and prompting discussion. A list of the evaluation criteria used is in Table 2.3.2.1, while a discussion of how each criterion was developed and applied can be found in section 2.4. Evaluation results are discussed in chapter 3, Analysis.

<table>
<thead>
<tr>
<th>Category</th>
<th>Evaluation Criterion</th>
<th>Case Study Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Context and Goal-Setting Process</td>
<td>1. Defining the urban forest</td>
<td>City of London UFS</td>
</tr>
<tr>
<td></td>
<td>2. Scope of the plan</td>
<td>City of Mississauga UFMP</td>
</tr>
<tr>
<td></td>
<td>3. Setting effective goals</td>
<td></td>
</tr>
<tr>
<td>B. Incorporation of Ecological Principles</td>
<td>4. Conducting an inventory of existing trees and associated ecosystems</td>
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<td>6. Identification of threats and disaster management</td>
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<tr>
<td>C. Stakeholder Involvement and Collaboration</td>
<td>7. Inclusion of public input into visioning process and final plan</td>
<td></td>
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<tr>
<td></td>
<td>8. Collaboration among groups</td>
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</tr>
<tr>
<td></td>
<td>9. Public education efforts and ongoing citizen participation strategies</td>
<td></td>
</tr>
<tr>
<td>D. Implementation Strategies</td>
<td>10. Active adaptive management techniques</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11. Identification of groups responsible for implementation</td>
<td></td>
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<tr>
<td></td>
<td>12. Regulatory instruments</td>
<td></td>
</tr>
</tbody>
</table>
2.3.3 Interviews
To supplement the literature review, semi-structured interviews were conducted with three
Ontario-based academics with expertise in urban forestry. The academics were not asked about
the case study plans; rather they offered insights into challenges and best practices for urban
forestry in Ontario more generally. They also provided feedback on the evaluation criteria
discussed in sections 2.3.2 and 2.4, which was used to refine the criteria before document
analysis commenced.

To supplement the document analysis, additional interviews were planned with professional
foresters who were directly involved in the creation and implementation of the case study plans.
The intent of these interviews was to gain information about the case study plans that was not
evident from the content of the plans themselves, specifically information about plan creation
and implementation.

To this end, interview requests were submitted to urban forestry staff from the city of London,
and to a forestry consultant who had been project co-ordinator for the creation of London’s
UFMP. Both the consultant and the City of London staff expressed interest in the report but were
unavailable for interviews. The senior urban forestry consultant responsible for the development
of Mississauga’s UFMP was also contacted but did not respond to requests for an interview. City
of Mississauga urban forestry staff were not contacted for interviews due to timing and
scheduling constraints.

Ultimately it was not possible to interview any municipal or consultant foresters involved in the
creation or implementation of either of the case study plans. This report therefore relies on the
literature review, document analysis of the case study plans, and the general interviews originally
conducted with three Ontario urban forestry academics.
Questions and results from the interviews that were conducted are discussed in section 2.5.

2.4 Evaluation Criteria Rationale
This report evaluated case study UFMPs using twelve criteria developed by Cziraky (10-17).

These criteria are divided into four categories, as shown in Table 2.3.2.1. Cziraky’s criteria were adapted slightly to reflect new information about best practices gleaned from the literature review. The adapted criteria were then further refined using feedback from the three urban forestry researchers interviewed for this report, prior to commencement of document analysis. The rationale for the use of each criterion is explained below, with the twelve criteria organized in four categories.

2.4.1 Context and Goal-Setting Process

1. Defining the urban forest

In an urban forest management plan it is important to define what is meant by the term “urban forest” so that all parties involved with creating and implementing the plan agree on what is being managed. The definition of “urban forest” in academia has evolved over the years, once referring only to street trees and now connoting the broader urban ecosystem (van Wassenaer et al 2000, 242). This criterion was applied to the London and Mississauga plans to ascertain whether and how clearly they defined their urban forests.

2. Scope of the plan

Once the urban forest has been defined, a municipality may decide how much of this urban forest is to be subject to a given management program. Some plans may exclude portions of the urban forest outside a designated boundary, or within naturalized areas such as ravines. Some plans may apply only to trees on public property or even only...
to street trees. The decision to manage all or part of an urban forest may vary depending on a municipality’s priorities or operational capacity.

This criterion also explored the plans’ temporal scope. Different municipalities may choose different timelines for their plans to balance long-term strategic directions with short- and medium-term operational considerations (van Wassenaer et al 2012, 30). The London and Mississauga plans were analyzed to compare their temporal scope and the scope of their subject matter.

3. Setting effective goals

This criterion was modified from Cziraky’s original framework which assessed whether plans set “ambitious and attainable goals” (Cziraky 11). While it is important for plan-makers to set goals that strike a balance between ambition and attainability, it is beyond the scope of this report to determine what is or is not a sufficiently ambitious or attainable goal for a particular municipality. This is supported by Ordonez and Duinker’s assertion that “numeric targets are ultimately arbitrarily set, as there is no standard as to what, for instance, canopy cover should be for all cities” (43).

Rather than assess the target levels set by case study municipalities for a given indicator, this report examined the choice of indicators for which the municipalities set targets. This was done in recognition of the fact that a particular target may be ambitious and attainable without being the only or best type of target to achieve the overarching goal of a stronger urban forest. For example, a municipality may set an ambitious and attainable goal to increase city-wide canopy coverage to a certain percentage by a certain date, but as Kenney et al point out, “setting overly ambitious canopy cover targets can unduly focus urban forest management activities on planting… to the detriment of other
strategic and more comprehensive approaches” (2011, 109). For this reason, the goals laid out in the plans of London and Mississauga were assessed based on how effectively they will contribute to achieving the vision of a healthy and well-managed urban forest.

2.4.2 Incorporation of Ecological Principles

4. Conducting an inventory of existing trees and associated ecosystems

Conducting an inventory of an urban forest’s existing attributes is a prerequisite to be able to identify threats and set goals to maintain and enhance the urban forest in future. Inventories may be conducted using frameworks such as the UFORE or i-Tree Eco model (Ordonez & Duinker, 37) and may examine urban forest attributes such as species composition, age and size class distributions, tree health, and the presence of rare or endangered species (van Wassenaer et al 2000, 244). Mississauga and London’s plans were analyzed to determine whether an inventory was conducted as part of plan creation and whether inventory methods were in keeping with acknowledged best practices identified in the literature review.

5. Identification of plantable space

Identifying plantable spaces is a necessary step in setting goals for the extent of the urban forest such as canopy cover. A canopy cover target may be impossible to achieve and therefore meaningless if there is insufficient habitat for new trees to grow and contribute to the forest canopy. By identifying plantable spaces, plan-makers can ascertain an urban forest’s potential canopy cover, and can then set goals to realize that potential according to a certain timeline (Kenney et al 2011, 109). This criterion was applied to case study plans to ascertain whether and in how much detail plantable space was identified and inventoried within the plan area.
6. Identification of threats and disaster management

Threats to the urban forest such as development pressures and invasive species are a common source of motivation for municipalities to develop urban forest management plans (Ordonez & Duinker, 38). Threats must be identified and understood in order for a municipality to set goals and take appropriate actions to protect the urban forest from them. London and Mississauga’s plans were evaluated for how comprehensively they outline the threats to their urban forests and the management strategies they will employ to mitigate them.

2.4.3 Stakeholder Involvement and Collaboration

7. Inclusion of public input into visioning process and final plan

Members of the public are majority stakeholders in urban forest management planning, owning the entire urban forest, “either as individuals or collectively as ratepayers” (Kenney 2003, 786). The largest share of urban canopy cover is found on residential land, and residents directly control most of that land with their household-level decisions (Conway and Shakeel, 2). Nowak et al view this as an opportunity to involve the public in natural resource management (Nowak et al 2001, 38). Others see citizen involvement not only as an opportunity but as a necessity (Kenney 2000, 235).

Urban forest planners require the public’s co-operation to implement the urban forest management plan and achieve its goals. The public should therefore be consulted and included in the creation of these goals so they will be more invested in working together to achieve them. This report examined the extent to which public input was sought out and incorporated into the plans of Mississauga and London.

8. Collaboration among groups
The urban forest affects and is affected by a wide range of different professional and community groups, including foresters, engineers, planners, landscape architects, neighbourhood associations, and conservation authorities (Kenney 2003, 786). A successful urban forest management program requires the co-ordination of all of these diverse groups, each with its own priorities and expertise. This criterion was applied to see the degree to which the London and Mississauga plans drew from the skills, knowledge, and priorities of diverse groups to create well-rounded and carefully considered urban forest management programs.

9. Public education efforts and ongoing citizen participation strategies

“A frequent obstacle to community co-operation around sustainable urban forest management is a lack of awareness of trees as a community resource” (Kenney et al 2011, 111). This lack of awareness makes trees on private property particularly vulnerable, as they may be lost to infill development or paved over at the whim of the property owner (Barbosa et al 193-194). It is therefore essential to educate the public on the benefits of planting and maintaining trees on their property (Young 2011, 371).

For this reason many urban forest management plans include education components focused on raising awareness and engaging the public to promote participation in the implementation of the plan (Ordonez & Duinker, 45). Case study plans were evaluated for the scope of their public education components.

2.4.4 Implementation Strategies

10. Active adaptive management techniques

Long-term plans must evolve to suit changing conditions over the course of their implementation to align the plan’s vision with the realities of “daily, on-the-ground
operations” (Kenney 2011, 112). This requires monitoring and updating of the plan at regular intervals.

Case study plans were evaluated not only based on how they will monitor progress and be adjusted in reaction to unexpected results or changing conditions, but also based on the degree to which they promote active adaptive management. Active adaptive management is not a reactive but a proactive system of management which consists of conducting trials of unproven methods (such as planting a certain species of tree for a new purpose or in a new context), evaluating their outcomes, and incorporating successful new methods into the management framework. This system of trial and error is “crucial for experimenting with uncertain components” (Ordonez & Duinker, 45) and for expanding the knowledge base and tool kit available to urban forestry planners within a municipality and in the broader urban forestry community.

11. Identification of groups responsible for implementation

With various municipal departments such as forestry, engineering, planning, and parks maintenance doing work that has implications for the urban forest, there is the opportunity to collaborate on urban forest management plan implementation but also the potential for conflict. Co-ordination is required to ensure that the actions of one group support those of the others and that none undermines the achievement of the goals of the plan (Kenney et al 2011, 111). This criterion was used to assess how case study plans offer a framework for interdepartmental co-operation to facilitate the efficient allocation of resources to achieve the goals laid out in the plan.
12. Regulatory instruments

Regulatory instruments such as private tree removal by-laws and policies offer municipalities a means of protecting the urban forest by regulating what landowners can do with trees on their property (Ordonez & Duinker, 45). This criterion assessed whether case study plans call for the adoption of regulatory instruments to protect the urban forest.

2.5 Interview Approach
Interviews were conducted with three academics with expertise in the field of urban forestry.

Two of these academics, Tenley Conway and Andrew Almas, are not associated with the case study municipalities or the firms that created their UFMPs. The third, Andy Kenney, is associated with Urban Forest Innovations Inc., the firm that developed Mississauga’s UFMP.

Interviews were semi-structured to allow the flexibility for the informants to answer the researcher’s questions while also offering relevant insights that were not specifically asked about. In some cases during interviews the researcher deviated from the planned question order to facilitate the smooth flow of conversation. These interviews were conducted after the literature review but before case study selections were finalized and document analysis was begun. The interviews were audio-recorded and reviewed at a later date. Interview results were analyzed and used to draw lessons about best practices, which helped to frame evaluation of case study plans.

A standard set of questions was asked of all three academics but was adjusted slightly to cater to the expertise of each individual academic. Questions for academic interviews can be organized into four categories, as follows:

A. General questions about urban forest management planning in Ontario
These questions were intended to determine why a municipality might adopt a UFMP, who should adopt them, and what the challenges are to developing them. These are fundamental questions to provide lessons to Ontario municipalities considering UFMP adoption.

B. Questions about different groups involved in urban forest management planning

These questions asked about what role in urban forest management is played by various municipal departments, non-governmental groups, private interests, and community members; they also asked what potential roles these groups could play but do not currently. The questions sought insights into how varying groups can collaborate with one another and in particular how municipal foresters can optimally engage the public to manage the urban forest.

C. Questions about the governmental and administrative framework for urban forest management planning in Ontario

These questions asked about the involvement of higher levels of government in urban forest management planning: what guidance and support do they provide to municipalities managing their urban forests? Would it be beneficial for them to provide more? While these questions do not offer lessons to municipalities currently developing urban forest management plans, they prompt a discussion among Ontario municipalities and other urban forest stakeholders regarding how the practice of urban forest management planning could be improved with more (or less) involvement from higher levels of government.

D. Questions about specific practices in urban forest management planning
These questions were meant to seek expert opinions about certain forestry practices which were found in the literature review to be controversial. The insights gained from asking these questions were expected to advance the discussion of various urban forest management tools and systems of urban forest measurement.
Table 2.5.2.1: List of questions asked in interviews with academics
Checkmarks are used to indicate that the question in that row was asked of the informant in that column. Informants are Andy Kenney (AK), Tenley Conway (TC), and Andrew Almas (AA).

<table>
<thead>
<tr>
<th>Interview Question</th>
<th>Academic Asked</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. General questions about urban forest management planning in Ontario</strong></td>
<td></td>
</tr>
<tr>
<td>What do you think are the biggest challenges for Ontario municipalities to maintain and enhance their urban forests?</td>
<td></td>
</tr>
<tr>
<td>What are the benefits of a city adopting an urban forest management plan? What are the consequences of not adopting one, even in a city with an urban forestry department? Should all cities adopt a UFMP?</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td><strong>B. Questions about different groups involved in urban forest management planning</strong></td>
<td></td>
</tr>
<tr>
<td>Who are the important players in managing a municipality’s urban forest?</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>What role can urban planners play in managing urban forests? Do you think that role is being adequately fulfilled?</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>How important is public involvement in first developing and then implementing an UFMP? What strategies would you recommend for a municipal forestry department that wants to fully realize the potential of the public to manage and enhance the urban forest?</td>
<td>✓ ✓</td>
</tr>
<tr>
<td><strong>C. Questions about the governmental and administrative framework for urban forest management planning in Ontario</strong></td>
<td></td>
</tr>
<tr>
<td>How did the Canadian Urban Forest Strategy come to be, and how does it guide municipal urban forest strategies?</td>
<td>✓</td>
</tr>
<tr>
<td>Apart from the Canadian Urban Forest Strategy, are there any other upper-level policies that guide urban forestry in Ontario? Do you think it would be beneficial to have more?</td>
<td>✓</td>
</tr>
<tr>
<td>What role do the provincial, federal, and regional governments play in managing urban forests? Do you think it would be beneficial for upper-level governments to take a more active role in UFM?</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td><strong>D. Questions about specific practices in urban forest management planning</strong></td>
<td></td>
</tr>
<tr>
<td>There are many different metrics which can be used to measure an urban forest, including Leaf Area Density, Tree/Stem Density, and Canopy Cover. From an inventory-taking, goal-setting, and success-measuring perspective, what is the best metric? And from other perspectives?</td>
<td>✓ ✓ ✓</td>
</tr>
<tr>
<td>How important are regulatory instruments (such as private tree removal by-laws) in a city’s urban forest strategy?</td>
<td>✓ ✓</td>
</tr>
<tr>
<td>Can an UFMP succeed without regulatory instruments such as private tree removal by-laws? Do you think, in general, that an urban forest strategy should make use of regulations, public education and outreach, or a mix of both?</td>
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</tbody>
</table>
2.6 Limitations
This report was constrained by several limitations. Foremost, the researcher is a planner and lacks expertise in forestry; the report was therefore written with a focus on the planning aspect of urban forest management planning, and could not authoritatively analyse the case study documents based on their application of forestry principles. To mitigate this, the research was informed by interviews with urban forestry experts and a literature review, which provided a general understanding of urban forestry.

This report analyzed the UFMPs of two large Ontario municipalities; the results may therefore not be applicable to municipalities of a different size class or those located outside Ontario. Due to the paucity of large Ontario municipalities which had adopted UFMPs, it was necessary to select London and Mississauga as case studies, the latter of which has approximately double the population of the former. Additionally, these two municipalities vary significantly in their proportion of urban and rural land, and in their context, as discussed in chapter 1, section 1.2.5. These differences make for an imperfect comparison in some instances. Nonetheless, the two case study selections are representative of the large Ontario municipalities which are the focus of the report, and illustrate the applicability of urban forest management planning in a range of conditions.

Both case study documents had only recently been adopted at the time of analysis, so it was not possible to assess the progress or effects of plan implementation. Future research is warranted to evaluate the success of municipalities in achieving the goals of their UFMPs over time.

A poor response rate combined with time constraints made it impossible to interview anyone involved in the creation or implementation of either of the case study UFMPs; therefore conclusions could be drawn only from the analysis of the UFMP documents themselves. To
mitigate this, interviews were conducted with three urban forestry experts who had not been
directly involved with the case study UFMPs but could provide general insights into UFMP
principles and best practices.

The Implementation Guide for the Mississauga UFMP was not publicly available, and
Mississauga staff did not respond to a request for access to this plan. Consequently the document
analysis of Mississauga’s UFMP was based on incomplete data. This was mitigated by the
analysis of a summary of the Implementation Guide found in the parent UFMP document.
Chapter 3: Analysis

This chapter presents an analysis of the two case study plans, using the evaluation criteria described in Chapter 2: Methods. Section 3.1 contains a detailed discussion of how the two plans performed with respect to each evaluation criterion. This discussion is subdivided based on the four categories of evaluation of criteria identified in Chapter 2, with a table presenting a summary of findings for each category. General impressions and an overall evaluation of the case study plans are discussed in Section 3.2.

3.1 Discussion
The following is a detailed discussion of the analysis of the case study plans using the twelve evaluation criteria from Chapter 2: Methods. The discussion of each evaluation criterion follows a consistent structure: first the London plan is analysed, then the Mississauga plan, and then the two plans are compared.
### 3.1.1 Context and Goal-Setting Process

#### Table 3.1.1.1: Summary of Findings: Category A, Context and Goal-Setting Process

<table>
<thead>
<tr>
<th>Evaluation Criterion</th>
<th>City of London</th>
<th>City of Mississauga</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Defining the urban forest</td>
<td>• Defined as all trees within the municipal boundary, including on private property and street boulevards, and in parks, woodlands, wetlands, ravines, and fields. (B.A. Blackwell 2014a, 3) • Distinction between two types of urban forest: man-made environments and natural ecosystems (B.A. Blackwell 2014a, 3) • Urban forest benefits are well-defined; structural value of urban forest defined in monetary terms (B.A. Blackwell 2014a, 4-7)</td>
<td>• Defined as “a dynamic system that includes all trees, shrubs and understory plants, as well as the soils that sustain them, located on public and private property” (Urban Forest Innovations 2014a, 2) • Recognized as component of city’s green infrastructure (Urban Forest Innovations 2014a, 2) • Urban forest benefits are well defined, structural value of urban forest defined in monetary terms (Urban Forest Innovations 2014a, 9-11)</td>
</tr>
<tr>
<td>2. Scope of the plan</td>
<td>• Includes “all trees within the municipal boundary, regardless of land use type or ownership” (B.A. Blackwell 2014a, 1) • Plan has 20-year scope, to be reviewed every 5 years. Strategy divided into 1-2 year, 3-5 year, and &gt;5 year time frames (B.A. Blackwell 2014a, 1) • Also includes targets for 20 and 40 years into the future (B.A. Blackwell 2014a, 20) • Canopy cover targets apply only to Urban Growth Boundary (B.A. Blackwell 2014a, 19)</td>
<td>• UFMP is twinned with <em>Natural Heritage and Urban Forest Strategy</em>, for a broader program of natural heritage management (Urban Forest Innovations 2014a, 3) • UFMP applies to “all trees, shrubs and understory plants, as well as the soils that sustain them, located on public and private property” in Mississauga (Urban Forest Innovations 2014a, 3) • Plan has 20-year scope, divided into three tiers of time frame: 20-year strategic direction (2014-2033), five 4-year management plans, and annual 1-year operating plans (Urban Forest Innovations 2014a, 3)</td>
</tr>
</tbody>
</table>
1. Defining the Urban Forest

London’s *Urban Forest Strategy* defines the urban forest as “all trees within the municipal boundary, regardless of land use type or ownership”, and makes explicit mention that this definition includes “trees in private yards, street boulevards, parks, woodlands, wetlands, ravines and fields” (B.A. Blackwell 2014a, 1). This definition is then subdivided into two types of urban forest: trees in largely man-made environments, which are a part of green infrastructure, and trees in natural ecosystems, which are a part of natural capital (B.A. Blackwell 2014a, 3). “Green infrastructure” and “natural capital” are not defined, although additional references to green infrastructure appear in the recommended Actions of the plan. The London plan proceeds to discuss the urban forest’s benefits, and then provides monetary valuations of the urban forest (B.A. Blackwell 2014a, 7).

Mississauga’s *Urban Forest Management Plan* utilizes the definition of the urban forest provided in the existing *Peel Region Urban Forest Strategy* (2011), defining the urban forest as “a dynamic system that includes all trees, shrubs, and understory plants, as well as the soils that sustain them, located on public and private property” (Urban Forest Innovations 2014a, 2). This
broad definition of the urban forest is used to justify the scope of the plan and its multidisciplinary, interdepartmental approach. The urban forest is identified as a component of the city’s green infrastructure, which is defined and contrasted with grey infrastructure (Urban Forest Innovations 2014a, 2).

The Mississauga plan then discusses the benefits of the urban forest, which are divided into environmental services, social and health benefits, and economic benefits. Estimated dollar values are provided for environmental services (Urban Forest Innovations 2014a, 9-11).

In both plans the definition of the urban forest includes all trees on both public and private property, in both urban and rural areas, throughout the extent of the municipal boundary. London’s definition is less comprehensive than Mississauga’s in that it only includes trees, whereas Mississauga’s definition includes trees, shrubs, understory plants, and the soils that sustain them.

Both London and Mississauga describe their urban forest as being a component of green infrastructure; however, London’s plan fails to define green infrastructure and natural capital. This omission allows for differing interpretations of these terms by different stakeholders, which could lead to problems in the implementation of Actions 1.5, 1.8, and 7.7, which make reference to green infrastructure. Mississauga’s plan clearly defines these terms and provides specific examples of different types of green and grey infrastructure to aid interpretation (Urban Forest Innovations 2014a, 3).

2. Scope of the Plan

London’s Urban Forest Strategy “provides the vision and strategic direction for long-term education, planning, planting, protection and maintenance of trees, woodlands, green space and
related resources in the City of London” (B.A. Blackwell 2014a, 1). This scope covers not only the urban forest as defined above, but also “green space and related resources” which are not defined. The plan is meant to guide London’s urban forest management for 20 years from 2014 to 2035, with short-term (1-2 years), medium-term (3-5 years), and long-term (more than 5 years) time frames for goals and actions (B.A. Blackwell 2014a, 1). In some cases the long-term goals exceed the 20-year scope of the plan, with 40-year targets provided for canopy cover (B.A. Blackwell 2014a, 20).

Mississauga’s Urban Forest Management Plan (UFMP) is twinned with the Natural Heritage and Urban Forest Strategy (NHUFS). The two documents were prepared together and have the same vision, guiding principles, objectives, and targets. The NHUFS outlines “opportunities for protecting, enhancing, restoring, and expanding both the Natural Heritage System and Urban Forest together”, as well as strategies for implementing them. The UFMP provides “more specific technical, operational and tactical guidance… as it relates to Urban Forest and Natural Areas management and stewardship” (Urban Forest Innovations 2014a, 3). Recognizing that the urban forest and natural areas are affected by many factors, the UFMP’s guidance applies to topics including tree maintenance, urban planning, infrastructure development, natural areas connectivity, naturalization, public education, and partnerships (Urban Forest Innovations 2014a, 2).

The NHUFS and UFMP have a 20-year scope from 2014 to 2033. This time frame is divided into three tiers: a 20-year Strategic Direction, five 4-year Management Plans, and twenty Annual Operating Plans (Urban Forest Innovations 2014a, 3). The tiered structure will allow for naturally occurring plan assessments and reviews, ensuring that the plan evolves as a “living document” to respond to changing priorities and conditions. This will be further discussed in the
discussion of criterion 10, Adaptive management techniques. It is intended that a new NHUFS and UFMP will be developed at the end of the 20-year period (Urban Forest Innovations 2014a, 4).

London and Mississauga have both developed plans with a twenty-year timeframe. Kenney identifies this as a minimum amount of time required to realize results on a forest-wide level due to the slow-growing nature of trees; for this reason he considers a UFMP to be a long-term investment (personal interview, May 29, 2015). London and Mississauga’s plans also both apply to the entirety of their urban forest within their municipal boundaries. Notwithstanding London’s more restrictive definition of what constitutes the urban forest, both plans apply not only to trees but also to other natural features such as green space – but the exact parameters of such other natural features are not clearly laid out in the London plan. This ambiguity may have been intended to allow for flexibility in the implementation of the plan; however, it may prove to cause uncertainty or conflict over what falls within the plan’s purview.

3. Setting Effective Goals

London’s plan presents a Vision for the city’s urban forest as “A healthy, diverse, and extensive urban forest for today and the future. London is the Forest City” (B.A. Blackwell 2014a, III). This vision clearly establishes the importance of the urban forest as central to London’s brand.

To quantify the vision, the plan establishes a set of canopy cover targets for different land use types, for twenty and forty years in the future. The twenty-year target of 25% is to restore the city’s canopy cover to 2008 levels, before the Emerald Ash Borer (EAB) caused significant canopy losses. The forty-year target is to expand the canopy cover to 32%, which is believed to be the city’s capacity (B.A. Blackwell 2014a, 21). The canopy cover target appears to address
the vision of an “extensive” urban forest; however, no targets are provided to address the “healthy” or “diverse” aspects of the vision.

The canopy cover targets apply only to the area contained within the Urban Growth Boundary (UGB), to reflect the fact that the Urban Forest Effects study (UFORE) conducted in 2012, which provided the data on existing conditions, only applied to the UGB. The plan acknowledges that the UGB could change in the future, which would likely decrease canopy cover values due to the predominance of agricultural land uses outside the current UGB, which typically have low canopy coverage (B.A. Blackwell 2014a, 19). No targets are provided for the area outside the current UGB. The plan notes that the targets which are provided are provisional only and must be adjusted pending additional data from a future plantable space analysis, canopy growth modeling, and a completed inventory database (B.A. Blackwell 2014a, 19), and the completion of the new Official Plan (B.A. Blackwell 2014a, 21).

To achieve the canopy cover targets and vision, the plan outlines eighteen Strategic Goals, and a series of Actions to realize the goals (B.A. Blackwell 2014a, 24). The Strategic Goals are guided by a set of Guiding Principles: Plant More, Protect More, Maintain Better, and Engage the Community (B.A. Blackwell 2014a, 8). Three of these Guiding Principles are enshrined in the plan’s overall Mission Statement: “Plant more, protect more, maintain better” (B.A. Blackwell 2014a, III). Each of the Actions in the plan is assigned a high or medium priority level, as well as an implementation timeframe of short-term (1-2 years), medium-term (3-5 years), long-term (>5 years), or ongoing (B.A. Blackwell 2014a, 24).

While the targets of the plan address only the extent of the urban forest described in the vision, the strategic goals and guiding principles are more comprehensive in addressing the vision of “a
healthy, diverse, and extensive urban forest” (B.A. Blackwell 2014a, III). This is exemplified in strategic goals 1, “Achieve appropriate canopy cover across the community”; 3, “Establish a diverse tree population city-wide as well as at the neighbourhood level”; and 6, “Improve urban forest health” (B.A. Blackwell 2014a, 22-23).

Mississauga’s NHUFS and UFMP share a vision, twelve guiding principles, and nine objectives. All of these apply generally to both the natural heritage system and the urban forest, as exemplified in the vision: “Together we will protect, enhance, restore, expand and connect Mississauga’s Natural Heritage System and Urban Forest to sustain a healthy community for present and future generations” (Urban Forest Innovations 2014a, 18). The NHUFS and UFMP also share six targets which will be used to measure the success of the two plans at the end of their twenty-year duration. Three of these apply specifically to the natural heritage system, and the other three to the urban forest. These three urban forest targets provide quantifiable benchmarks for city-wide canopy cover, distribution of canopy cover across the city, quality of street and park tree inventory, species distribution of city and street trees, and proportion of invasive species among city and street tree population (Urban Forest Innovations 2014a, 19).

In order to achieve the targets and objectives, the UFMP presents thirty recommended actions, which are organized into five categories: Urban Forest Program Administration; Tree and Natural Area Health and Risk Management; Tree Establishment, Naturalization, and Urban Forest Expansion; Tree Protection and Natural Area Management; and Promotion, Education, Stewardship, and Partnerships (Urban Forest Innovations 2014a, 54). The explanation of each action includes “implementation guidance”, essentially a checklist of steps which must be taken to implement the action. For each action there is also a discussion of how the action relates to
current practices in Mississauga, relevant best practices in other jurisdictions, and a rationale for the action (Urban Forest Innovations 2014a, 55).

The recommended timing and anticipated required resources for each action are outlined in the separate Urban Forest Management Plan Implementation Guide, which was not available for review for this report. The UFMP does include a summary of the Implementation Guide, which explains the allocation of required resources across the five categories of recommended actions (Urban Forest Innovations 2014a, 79).

This plan-evaluation criterion explored whether London and Mississauga’s plans had set goals which would be effective in achieving their visions. Both municipalities took a structured approach to goal-setting, beginning with setting a long-term vision for their urban forest. They then developed guiding principles which were used to establish more specific goals or objectives to fulfil the vision. Both plans then outlined a series of detailed actions which were necessary to achieve their stated objectives. To differing extents, both plans established a set of targets which will provide direction for the implementation of plan actions, and will be used as benchmarks to measure successful achievement of objectives.

Whereas Mississauga’s plan sets performance targets for a number of dimensions of its urban forest, London’s plan sets targets only for canopy coverage. This metric has its advantages, including being easy to monitor and enabling foresters to identify and focus plantings in areas with unequal canopy cover distribution (B.A. Blackwell 2014a, 19). In the literature review and in interviews conducted with three urban forestry experts for this report, however, there was a consensus that while canopy cover targets have a role to play in good urban forest management
planning, they do not provide a complete picture of the quality of the urban forest (Kenney, Conway, and Almas, personal interviews, May 29th and June 16th, 2015).

Without quantifiable targets for other dimensions of its urban forest – such as urban forest health and diversity, both of which are specifically mentioned in its plan’s vision – London will have no way to measure success in those areas. Having only set targets for canopy cover (corresponding to urban forest extent in the vision), London risks realizing a scenario described by Andy Kenney, whereby resources are disproportionately allocated to tree-planting in order to achieve canopy cover targets, to the detriment of other measures which would be more effective in improving overall urban forest quality (Kenney et al 2011, 109).

London’s targets are still only provisional (B.A. Blackwell 2014a, 19). Pending the gathering of additional required data, the city could make its targets more effective by applying them to the entire municipality. At present, there are no targets at all for the city’s rural areas, and the existing targets apply only to the city’s Urban Growth Boundary, which by the plan’s own admission is subject to change during the twenty-year plan timeframe (B.A. Blackwell 2014a, 19). London could make its overall plan more effective by introducing additional targets for other dimensions of its urban forest, such as the dimensions of species diversity and forest health, which are referenced in the vision.
3.1.2 Incorporation of Ecological Principles

Table 3.1.2.1: Summary of Findings: Category B, Incorporation of Ecological Principles

<table>
<thead>
<tr>
<th>Evaluation Criterion</th>
<th>City of London</th>
<th>City of Mississauga</th>
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</table>
| 4. Conducting an inventory of existing trees and associated ecosystems | • Inventory conducted in 2012 within Urban Growth Boundary only, using UFORE model (B.A. Blackwell 2014a, 19, B.A. Blackwell 2012, 7)  
• Completion of a more complete inventory is a strategic goal (B.A. Blackwell 2014a, 34) | • Inventory for entire City of Mississauga completed by Peel Urban Forest Working Group in 2011 using i-Tree Eco method (Urban Forest Innovations 2014a, 6)  
• Completion of a more complete inventory is a recommended action (Urban Forest Innovations 2014a, 57) |
| 5. Identification of plantable space                      | • Emphasizes planting “Right Tree, Right Place” (B.A. Blackwell 2014a, 8)  
• Acknowledges “comprehensive plantable space analysis” is needed (B.A. Blackwell 2014a, 19 & 2012, 36) and commits to conduct this analysis as high-priority action 11.1 (B.A. Blackwell 2014a, 35) | • Plantable-space inventory not completed at time of publication of UFMP, but recommended as component of Actions 11 and 12 (Urban Forest Innovations 2014a, 62-63) |
| 6. Identification of threats and disaster management       | • Discussion of key threats (B.A. Blackwell 2014a, 17-18)  
• “Protect More” Guiding Principle subsumes several goals and actions to mitigate threats (B.A. Blackwell 2014b, 5-7)  
• Separate strategy has been developed to respond to Emerald Ash Borer threat (B.A. Blackwell 2014a, 18) | • Identification of threats (Urban Forest Innovations 2014a, 13) and opportunities to mitigate them (Urban Forest Innovations 2014a, 15)  
• Action 9 recommends developing urban forest pest management approach based on existing Emerald Ash Borer management plan (Urban Forest Innovations 2014a, 60)  
• Actions 8 and 10 also address risk management (Urban Forest Innovations 2014a, 60-61) |
4. Conducting an Inventory of Existing Trees and Associated Ecosystems

The City of London conducted an inventory of existing trees and associated ecosystems within the Urban Growth Boundary in 2012 using the Urban Forest Effects (UFORE) model (B.A. Blackwell 2012, 1), an inventory standard that allows the calculation of urban forest environmental services (Ordonez & Duinker 37). This inventory provided data on many dimensions of the urban forest including canopy coverage by land use type in the Urban Growth Boundary, species distribution and percentage of native species, and condition of publicly owned trees (B.A. Blackwell 2012, 36-37). Prior to the UFORE, London’s existing tree inventory database provided information on size class distribution for street and park trees (B.A. Blackwell 2012, 36). London’s plan acknowledges a completed inventory database is needed in order to establish final targets (B.A. Blackwell 2014a, 19, B.A. Blackwell 2012, 61), and the completion of a comprehensive urban forest inventory that can be applied to management decision-making is identified as a strategic goal of the plan (B.A. Blackwell 2014a, 34).

Mississauga’s entire urban forest was inventoried in 2011 by the Peel Urban Forest Working Group, using the i-Tree Eco field sampling methodology, combined with satellite imagery analysis and computer modeling tools (Urban Forest Innovations 2014a, 6). This inventory provided information on Mississauga’s urban forest including tree cover and distribution, age and size class distribution, species diversity, and approximate monetary valuations for ecosystem services provided (Urban Forest Innovations 2014a, 6).

Mississauga recognizes a comprehensive tree inventory as being “critical to moving the City towards more proactive and effective management of its treed assets”, and having great potential as a tool for public outreach and education (Urban Forest Innovations 2014a, 80). For this
reason, one of the recommended actions of the UFMP is to improve and continuously update the city’s inventory of street and park trees, expanding it to include additional information such as tree site type, maintenance requirements, risk assessment, and approximate age. This inventory is to be made available to the public and used to better manage tree-related risks on public lands (Urban Forest Innovations 2014a, 57).

Thorough urban forest inventories were conducted for both London and Mississauga in recent years, and were used to provide baseline data for the creation of their urban forest management plans. Both cities maintain inventories of public street trees, and in fact London’s inventory is praised by Mississauga as being exemplary (Urban Forest Innovations 2014a, 37). Both London and Mississauga’s plans place high priority on the further improvement and continuous updating of their public tree inventories, so that these may guide more informed urban forest management decisions.

5. Identification of Plantable Space

London’s plan identifies that a comprehensive analysis of plantable space has not yet been completed and is necessary (B.A. Blackwell 2014a, 19 & B.A. Blackwell 2012, 36). The completion of such an analysis is identified as a high-priority strategic goal, to be completed within the first two years of the plan (B.A. Blackwell 2014a, 35). The concept of “Right Tree, Right Place” is emphasized repeatedly, and considered “fundamental to urban forest management” (B.A. Blackwell 2014a, 8). This principle will be used when planting new trees to match the most appropriate species, size, and shape of tree to the conditions of each planting site identified by the plantable space analysis, to optimize the provision of urban forest benefits (B.A. Blackwell 2014a, 8).
At the time that its plan was completed, Mississauga also had not yet conducted a plantable space analysis. The identification and utilization of plantable spaces are considered necessary steps to develop and implement a targeted urban forest expansion program as per Actions 11 and 12 (Urban Forest Innovations 2014a, 62-63). The use of plantable space data to guide planting locations for proactive urban forest expansion will complement the city’s existing program of planting reactively in response to requests from the community (Urban Forest Innovations 2014a, 63).

While neither city had completed a comprehensive inventory of plantable space at the time their plans were completed, both cities’ plans identified the completion of this analysis as a necessary and high-priority action towards achieving their goals.

6. Identification of Threats and Disaster Management

London’s plan includes a discussion of key threats to its urban forest. These include urban intensification, insects and diseases, and climate change and severe weather events (B.A. Blackwell 2014a, 17). The plan then outlines specific proactive and reactive measures which will be necessary to manage these threats. These measures are reflected in the plan’s stated actions under the “Plant More” and “Maintain Better” guiding principles (B.A. Blackwell 2014a, 5-7).

Prior to the development of the Urban Forest Strategy, the City of London had already developed a separate strategy for managing one of its most pressing threats, the Emerald Ash Borer (EAB) (B.A. Blackwell 2014a, 18).

Mississauga’s plan identifies a number of key challenges for its urban forest, including invasive species, pests, and pathogens; ongoing development and redevelopment pressures; conflicts between green and grey infrastructure; climate change and related stressors; difficult growing
conditions for trees in urban environments; fragmented ownership of the urban forest; and limited community awareness and stewardship (Urban Forest Innovations 2014a, 12). The plan then provides a discussion of opportunities to mitigate threats and manage the specific challenges described above. The recommended actions of the plan provide a framework for Mississauga to avail itself of these opportunities.

Like London, Mississauga already had a strategy in place for managing the threat of Emerald Ash Borer at the time of development of its Urban Forest Management Plan. Action 9 of the plan advocates for the development of a city-wide urban forest pest management plan to address future threats from invasive species, based on the existing EAB management strategy already in place (Urban Forest Innovations 2014a, 60-61).

The plans of both London and Mississauga identify specific threats to the urban forest, and outline existing and recommended strategies to mitigate these threats.
### 3.1.3 Stakeholder Involvement and Collaboration

#### Table 3.1.3.1: Summary of Findings: Category C, Stakeholder Involvement and Collaboration

<table>
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<tr>
<th>Evaluation Criterion</th>
<th>City of London</th>
<th>City of Mississauga</th>
</tr>
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</table>
| 7. Inclusion of public input into visioning process and final plan | • Online survey completed by >1700 members of public (B.A. Blackwell 2014a, 13)  
• Interviews and questionnaires with key external stakeholders (B.A. Blackwell 2014a, 13) | • 11 stakeholder sessions and 2 public open houses held (Urban Forest Innovations 2014b, 87-99) |
| 8. Collaboration among groups | • 32 City staff from different departments provided input (B.A. Blackwell 2012, 5)  
• Numerous external stakeholders provided input (B.A. Blackwell 2012, 7)  
• Recommends establishing an interdepartmental implementation team, holding interdepartmental staff workshops, streamlining policy approaches, and establishing a corporate philosophy whereby trees are managed as infrastructure assets (B.A. Blackwell 2014a, 32) | • Used data and recommendations from Peel Urban Forest Working Group, comprising representatives of municipalities and conservation authorities in Peel Region (Urban Forest Innovations 2014a, 2)  
• Numerous internal and external stakeholders consulted (Urban Forest Innovations 2014a, 2)  
• Discussion of best practices for interdepartmental co-ordination (Urban Forest Innovations 2014a, 37)  
• Action 3 recommends involvement of Forestry staff in Planning processes (Urban Forest Innovations 2014a, 56)  
• Action 12 calls for training of staff in other departments on tree establishment best practices (Urban Forest Innovations 2014a, 65) |
| 9. Public education efforts and ongoing citizen participation strategies | • Strong public engagement in urban forestry prior to plan creation (B.A. Blackwell 2012, 40)  
• “Engage the Community” Guiding Principle subsumes numerous strategic goals and actions to educate the public and encourage public participation (B.A. Blackwell 2014a, 38-40) | • Extensive public outreach programs in place prior to plan creation (Urban Forest Innovations 2014a, 32-33)  
• Seven Actions recommended for promotion, education, stewardship, and partnerships (Urban Forest Innovations 2014a, 71-75) |
7. Inclusion of Public Input into Visioning Process and Final Plan

To develop its plan, London conducted extensive public consultation over the course of five months in 2012. Fifteen external stakeholders were consulted, including local community groups, environmental groups, business associations, and youth groups, among others (B.A. Blackwell 2014a, 13; B.A. Blackwell 2012, 8-9). These stakeholder groups were interviewed and then asked to complete a questionnaire (B.A. Blackwell 2012, 5). Additionally, an online survey for the general public was filled out by over 1700 respondents, almost 600 of whom provided additional written comments (B.A. Blackwell 2014a, 13). The input provided by this consultation was applied to the shaping of the Urban Forest Strategy’s vision and recommended actions, for example in determining whether London has enough trees to merit its brand as “The Forest City”, and whether this brand was important enough to be retained. Residents indicated that this brand was important to them, and consequently it is now a component of the UFS’s vision (B.A. Blackwell 2014a, 13).

Mississauga consulted a wide range of stakeholders in the development of its plan, including community groups and residents’ associations, environmental groups, business and development organizations, and arboriculture firms, among others (Urban Forest Innovations 2014a, 2). Consultation took the form of eleven stakeholder sessions, and two open houses for the general public. Open houses were advertised in local media, on the city website, and on mobile signs, and attracted a total of 21 participants (Urban Forest Innovations 2014b, 90). These consultations provided feedback which shaped the organization, presentation, and wording of the strategies of the NHUFS and UFMP (Urban Forest Innovations 2014b, 87-99).
Both London and Mississauga made use of input from the general public and from key stakeholder groups to inform the creation of their plans. The two cities took different approaches to the consultation of the general public. Despite advertising them through various media, Mississauga was only able to attract 21 people to attend its two open houses. London opted instead for an online survey, which was completed by more than 1700 people. This suggests that in urban forest management planning, forms of consultation which allow the public to provide feedback from home at the time of their choosing may be more effective in securing feedback from a wide selection of the population than forms which require attendance at a meeting.

With respect to external stakeholder engagement, Mississauga took the approach of bringing stakeholders together in groups of four to twenty-one (Urban Forest Innovations 2014b, 88) through a series of meetings and conference calls, whereas London interviewed stakeholder groups separately and then invited them to complete a questionnaire. Local First Nations groups are not listed among the external stakeholder groups consulted in the development of London’s plan (B.A. Blackwell 2012, 8-9), representing a missed opportunity for London to avail itself of traditional knowledge and to gain buy-in to the plan from the local Aboriginal population. By contrast, Mississauga dedicated two of its eleven stakeholder sessions exclusively to consultation with Aboriginal groups. Seven Aboriginal groups were invited to be involved in these sessions, although only two groups participated (Urban Forest Innovations 2014b, 87, 93). This consultation provided Mississauga with feedback on policy language as well as opportunities to align the NHUFS and UFMP with Aboriginal cultural and archaeological initiatives (Urban Forest Innovations 2014b, 87).

The importance of public consultation in the development of a UFMP was a recurring theme in the interviews conducted for this report. Conway highlighted the “nuanced and diverse” attitudes
towards trees among the general public, which must be heard in order to gain widespread buy-in to the plan. Reflection of these attitudes in the plan may result in the promotion of evergreen and food-producing trees, which are appealing to many residents but might be overlooked by municipal foresters working towards achieving a canopy target (Conway, personal interview, June 16, 2015).

8. Collaboration Among Groups

As described above, both cities consulted extensively with external stakeholders and members of the general public to develop their plans. An additional component of the development of both plans was the collaboration of various different groups within the municipal corporations.

London conducted interviews with thirty-two city staff, ranging from senior management to technical support staff, from a range of departments including Land Use Planning; City Managers; Planning, Environmental, and Engineering Services; Community Services; and Finance (B.A. Blackwell 2012, 5). This consultation provided insight into varying perceptions of and attitudes toward the urban forest within the corporation, as well as identifying weaknesses in the city’s existing tree-protection policies and opportunities to improve them. There was a general consensus that trees were among the last things to be considered in the planning and construction processes, resulting in limited opportunities for urban forest improvement (B.A. Blackwell 2012, 6). Input from this consultation was used to prepare the Background Report which supported the development of the Urban Forest Strategy (B.A. Blackwell 2012, 5).

Looking ahead to the implementation of the Urban Forest Strategy, London identifies the co-ordination of goals, objectives, and actions between various city departments as a strategic goal comprising several high-priority actions. These include establishing an interdepartmental
implementation team for the urban forest strategy, holding interdepartmental staff workshops to promote tree-friendly design concepts, streamlining policy approaches to tree retention and planting in the site planning process, and establishing a corporate philosophy whereby trees are managed as infrastructure assets (B.A. Blackwell 2014a, 32).

Mississauga’s consultations with external stakeholders included not only community groups as described in criterion 7 above, but also with organizations involved in forestry and development processes such as neighbouring municipalities, local conservation authorities, committees to city council, and educational institutions. These groups provided input into the vision and guiding principles of the plan, as well as opportunities for engagement and implementation (Urban Forest Innovations 2014b, 88).

To ensure ongoing collaboration in the implementation of the plan, Mississauga’s plan advocates for the inclusion of Forestry staff in development application processes, as well as for the creation of an Urban Forest Working Team composed of city staff from the departments of Community Services, Planning and Building, and Transportation and Works. This group will meet six times annually and will help to ensure interdepartmental coordination, facilitate the identification of urban forest-related issues, enable knowledge sharing, and ensure forestry policies and standards are applied consistently throughout the city (Urban Forest Innovations 2014a, 56).

Externally, the plan recommends collaboration with Peel Region and the Canadian Food Inspection Agency to implement the urban forest pest management strategy (Urban Forest Innovations 2014a, 61). The plan also recommends collaboration with other external groups such as conservation authorities, not-for-profit organizations, postsecondary educational institutions,
and neighbouring municipalities, as an essential component of Actions 26, 27, 29, and 30, to pursue shared research and stewardship objectives (Urban Forest Innovations 2014a, 74-78).

Both London and Mississauga applied a collaborative approach to the creation of their plans. Based on available information, London seems to have undertaken more extensive consultation with internal city staff as part of developing its plan; however, both cities emphasized the importance of interdepartmental collaboration, and collaboration with external stakeholder groups, in developing and implementing their plans. A key element of both plans was the establishment of a working group composed of staff from various city departments which will share knowledge, identify urban forestry issues, and ensure a consistent approach to urban forest management across city departments. The development of these interdepartmental committees was identified as a beneficial practice by both Almas and Kenney (personal interviews, May 29 and June 16, 2015).

9. Public Education Efforts and Ongoing Citizen Participation Strategies

Prior to developing its plan, London already had strong citizen engagement in its urban forestry program: the city’s Million Trees Program had raised the profile of urban forestry in the public, and a community group called ReForest London had partnered with the city in this endeavour. City staff co-ordinated community tree-planting activities and the city provided funding for these activities (B.A. Blackwell 2012, 40). Stakeholder consultations identified that volunteer activities would benefit from increased planning and coordination, and that increasing public education on urban forestry issues would be beneficial (B.A. Blackwell 2014a, 16-17).

Building on this foundation, London adopted “Engage the Community” as one of the four guiding principles of its Urban Forest Strategy. This principle is manifest in numerous strategic
goals and actions to educate the public and encourage public participation, including “facilitate public understanding of urban forest management”, and “consult and cooperate with citizens at the neighbourhood level to embrace citywide urban forest goals and objectives” (B.A. Blackwell 2014a, 38-40).

Mississauga already had an extensive public education and engagement program prior to the development of its plan. The city provided urban forestry information to the public via its website, through social media, and through provision of a telephone call centre, although its street tree inventory was incomplete and was not available to the public (Urban Forest Innovations 2014a, 32). Information was also disseminated using pamphlets and posters, as well as at public open houses on popularly asked-about topics such as the Emerald Ash Borer. The city had launched a One Million Trees Campaign which provided a means for the city to promote as well as track tree plantings by residents and businesses on private property. Other programs launched by the city included an Annual Arbour Day program, Commemorative Tree program, and a program to publicly recognize trees which are significant due to their size, age, or uniqueness (Urban Forest Innovations 2014a, 33).

Nonetheless, because the majority of the urban forest is situated on privately owned land, the city considers increased and improved public engagement to be critical to its urban forest management (Urban Forest Innovations 2014a, 49). For this reason, the Urban Forest Management Plan recommends several actions for promotion, education, stewardship, and partnerships, including making the city’s street tree inventory publicly accessible, publishing short video clips on forestry topics, and generally expanding public awareness and engagement initiatives (Urban Forest Innovations 2014a, 71-74).
Both London and Mississauga had strong public engagement programs in place prior to the creation of their urban forest management plans, with Mississauga apparently utilizing a more diverse range of formats to conduct public outreach and education on urban forestry issues. Programs for public education and for public participation are mutually supportive, as residents become more inclined to participate in urban forestry through education and also become further educated by participating (Almas, personal interview, June 16, 2015). London and Mississauga alike place great emphasis on the importance of expanding and improving upon their existing programs for both public education and participation, and recommend a variety of actions to achieve this goal.
### 3.1.4 Implementation Strategies

#### Table 3.1.4.1: Summary of Findings: Category D, Implementation Strategies

<table>
<thead>
<tr>
<th>Evaluation Criterion</th>
<th>City of London</th>
<th>City of Mississauga</th>
</tr>
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<tbody>
<tr>
<td><strong>10. Active adaptive management techniques</strong></td>
<td>• “Adaptive management approach” explicitly described as “fundamental to successful implementation of the strategy” (B.A. Blackwell 2014b, 1)</td>
<td>• “Active Adaptive Management” defined and described as “embedded in” NHUFS and UFMP in Introduction (Urban Forest Innovations 2014a, 4)</td>
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<td></td>
<td>• Actions 3.8 and 12.1 demonstrate commitment to experiment, monitor, and to adapt plan based on results (B.A. Blackwell 2014a, 28, 36)</td>
<td>• Recommended Actions include ongoing monitoring (Urban Forest Innovations 2014a, 55) and species suitability trials (Urban Forest Innovations 2014a, 65)</td>
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<td></td>
<td>• Plan to be reviewed every 5 years (B.A. Blackwell 2014a, 1), progress reports to be published annually and “state of the forest” report every four years (B.A. Blackwell 2014b, 2)</td>
<td>• Monitoring Framework (Appendix A) in addition to targets</td>
</tr>
<tr>
<td></td>
<td>• “Active Adaptive Management” defined and described as “embedded in” NHUFS and UFMP in Introduction (Urban Forest Innovations 2014a, 4)</td>
<td>• Plan to be reviewed every 4 years (Urban Forest Innovations 2014a, 5)</td>
</tr>
<tr>
<td><strong>11. Identification of groups responsible for implementation</strong></td>
<td>• Specific responsibilities not yet allocated; implementation team to be chaired by Urban Forestry Section will do this (B.A. Blackwell 2014b, 2)</td>
<td>• Specific responsibilities assigned in separate Implementation Guide (Urban Forest Innovations 2014a, 79)</td>
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<td></td>
<td>• City’s senior leadership team to adapt corporate philosophy to prioritize urban forest as infrastructure (B.A. Blackwell 2014b, 2)</td>
<td>• Timelines and budgetary requirements provided in Implementation Guide, summarized in UFMP (79)</td>
</tr>
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<td></td>
<td>• Urban Forestry Section to lead in several areas (B.A. Blackwell 2014b, 2)</td>
<td>• Monitoring Framework identifies Responsible Parties for each monitoring criterion (Urban Forest Innovations 2014a, 84)</td>
</tr>
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<td></td>
<td>• Timelines and budgets estimated for all actions (B.A. Blackwell 2014b, 3)</td>
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12. Regulatory instruments

- “Protect More” Guiding Principle subsumes actions to strengthen existing by-laws and enforcement, and develop an additional by-law to protect heritage trees (B.A. Blackwell 2014a, 30; B.A. Blackwell 2014b, 5-7)
- Attention to attitudes toward by-laws from public, city staff (B.A. Blackwell 2014a, 15)
- No private tree protection by-law proposed

- Recommendations to review and update existing Public Tree Protection by-law, Erosion Control by-law, Nuisance Weed by-law, Encroachment by-law, and Private Tree Protection by-law (Urban Forest Innovations 2014a, 66-67)

10. Active Adaptive Management Techniques

London considers an adaptive management approach, based on comprehensive inventory data and continuous tree performance research, to be fundamental to the successful implementation of the Urban Forest Strategy (B.A. Blackwell 2014b, 1). This approach is captured in the “Maintain Better” guiding principle, which is summarized as follows: “maintain and monitor the urban forest over time and adjust management practices as needed using current information and research” (B.A. Blackwell 2014a, 8). Recommended actions which exemplify the adaptive management approach include analyzing the tree inventory to identify species that have required high or low levels of maintenance over their life cycles, and reducing or increasing their use in future tree plantings (B.A. Blackwell 2014a, 28); experimenting with innovative methods of accommodating trees in difficult growing conditions; and forming research partnerships with local institutions to study aspects of the urban forest as it changes over time (B.A. Blackwell 2014a, 36). Progress will be monitored through annual performance reviews and a “state of the forest” review every four years (B.A. Blackwell 2014b, 2). Additionally, the UFS will be reviewed every five years (B.A. Blackwell 2014a, 1).
Mississauga provides a definition of the term Active Adaptive Management and describes this concept as being “embedded” in the NHUFS and UFMP (Urban Forest Innovations 2014a, 4). This approach is evident in recommended actions of the UFMP, including the undertaking of species suitability trials to inform more strategic tree establishment practices (Urban Forest Innovations 2014a, 65), and ongoing monitoring of the status of urban forest metrics and regular program reviews (Urban Forest Innovations 2014a, 55).

Progress will be evaluated using Kenney et al.’s 2011 evaluation framework, which provides a performance indicator of “Low”, “Moderate”, “Good”, or “Optimal” for each of twenty-five evaluation criteria (Urban Forest Innovations 2014a, 5). The NHUFS and UFMP will be reviewed using this evaluation framework every four years, although some criteria will only be measured every eight to twelve years (Urban Forest Innovations 2014a, 5). In cases where performance has worsened or not improved according to a particular criterion, an active adaptive management approach will be used to consider alternative measures to improve performance (Urban Forest Innovations 2014a, 83). Evaluation results will inform the creation of four-year management plans and annual operating plans. The UFMP’s Implementation Guide was developed as a separate document from the UFMP to facilitate more irregular updates and revisions to its timelines and budgetary allocations (Urban Forest Innovations 2014a, 4).

As discussed under Criterion 2, both plans were completed in 2014 and have a 20-year scope divided into three time frames, though these time frames are used differently. London’s time frames are used to outline the budgeting and scheduling for various actions, as laid out in the initial 20-year plan: short-term goals should be implemented in 2015-2016, medium-term goals in 2017-2020, and long-term goals in 2021-2035 (B.A. Blackwell 2014b, 2).
By contrast, Mississauga’s time frames reflect three tiers of plans to be developed individually: five 4-year management plans will implement the 20-year strategic direction, and each of the 4-year management plans will be implemented by four 1-year operating plans. Each of these plans will have its own set of goals and timelines to achieve the objectives of the parent 20-year plan, as shown in Figure 3.2.1. The phased development of shorter-term plans to implement stages of Mississauga’s UFMP will ensure that its implementers can adapt and stay on track to achieve the targets of the UFMP by the end of twenty years; whereas London’s plan has scheduled its implementation upfront and will have less flexibility to change over the course of its twenty years.

![Figure 3.1.1: Framework for Implementation of Mississauga’s UFMP](Source: Urban Forest Innovations 2014a, 3)

Both London and Mississauga make a commitment to utilize an adaptive management approach, which both cities identify as an essential component of their urban forest management strategies. Both cities’ plans recommend actions which exemplify this adaptive management approach, including proactive research and experimentation. This experimentation is a necessary
component of developing an urban forest management approach that is proactive rather than reactive (Kenney, personal interview, May 29, 2015).

Mississauga’s plan more clearly defines its concept of active adaptive management, as well as more clearly illustrating how progress will be monitored and evaluated, and how those evaluations will inform plan reviews. The structure of Mississauga’s plan, with a hierarchy of annual, four-year, and twenty-year plans, will ensure regular re-evaluations and promote plan adaptation. In London’s plan, re-evaluation and adaptation opportunities are less formalized and may not occur with as much regularity.

11. Identification of Groups Responsible for Implementation

At the time of completing its Urban Forest Strategy, London had not yet assigned responsibilities for specific actions to individuals or departments within the city. The city will create an implementation team which will include members from multiple city departments and will be chaired by the Urban Forestry section. The team will operate on a consensus-based approach, and will be tasked with allocating responsibilities for the implementation of the various measures of the plan to appropriate individuals and departments (B.A. Blackwell 2014b, 2).

The UFS Implementation Plan provides a priority level, timeline, and budget allocation for each action of the plan. It acknowledges that some timelines and budgets may change subject to changing conditions and specific issues like the EAB or major weather events (B.A. Blackwell 2014b, 2). Budget allocations are categorized as operational or policy items, and are identified as one-time or ongoing expenses. Funding sources have not been identified in all cases (B.A. Blackwell 2014b, 3).
Mississauga’s plan recommends that a multidepartment Urban Forest Working Team be created to ensure forestry policies and standards are applied consistently throughout the city (Urban Forest Innovations 2014a, 56). Responsibilities for the implementation of each of the plan’s recommended actions are allocated to specific groups in a separate Implementation Guide (Urban Forest Innovations 2014a, 79). This Implementation Guide was unfortunately not available for review for this report; however, “responsible parties” are listed in Appendix A of the UFMP for each of the evaluation criteria of the plan’s monitoring framework. These parties are listed at the organizational level, for example “City” and “Credit Valley Conservation Authority” (Urban Forest Innovations 2014a, 83). The UFMP also provides a summary of budgetary requirements to implement the recommended actions of the plan over its twenty-year lifetime, divided into segments of four years (Urban Forest Innovations 2014a, 79). More detailed resource requirements are listed in the Implementation Guide.

London and Mississauga both recommend a collaborative approach to plan implementation, coordinated by a working group consisting of staff from various city departments. Both cities have outlined timelines and budgetary requirements; however, at the time of plan completion, London had not yet allocated responsibilities to specific departments for the implementation of its plan’s recommended actions. Clear allocation of urban forestry responsibilities, such as species selection and planting practices, will contribute to a more organized and efficient approach to realizing UFMP goals (Almas, personal interview, June 16, 2015).

12. Regulatory Instruments

At the time that its Urban Forest Strategy was developed, London’s urban forest was protected by the following existing by-laws: Tree Conservation By-law, Parks By-law, Boulevard Tree By-
law, and Site Plan By-law (B.A. Blackwell 2012, 6). The Tree Conservation By-law does not prohibit the removal of trees on private property.

The UFS provides a discussion of public and stakeholder attitudes toward tree-protection by-laws gleaned from the public and stakeholder consultation process. While some groups felt that the lack of a private tree protection by-law was a hindrance to effective urban forest management, most staff preferred education and partnerships over regulation as a means to protect trees on private property (B.A. Blackwell 2014a, 15). There was general support for regulations to protect significant, “heritage or ‘special’” trees, and for upgrading existing by-laws (B.A. Blackwell 2014a, 15).

Enhancing and enforcing municipal policies is a strategic goal of London’s plan. Recommended actions to achieve this goal include strengthening the existing Tree Conservation By-law, Parks By-law, and Boulevard Tree Protection By-law; developing a new by-law to protect heritage trees; and increasing staff’s capacity to enforce these regulations (B.A. Blackwell 2014a, 30). Consistent with feedback from public and stakeholder engagement, the plan does not recommend the creation of a by-law to protect trees on private property.

Prior to developing its plan, Mississauga had already adopted a Street Tree By-law, which regulates injury and destruction of trees located in City-owned rights-of-way and other publicly owned lands; an Encroachment By-law, which prohibits encroachments of private development onto public property, which in many cases is wooded; a Parks By-law which prohibits persons from causing damage to any tree in a municipal park; an Erosion and Sediment Control By-law, which regulates the removal of topsoil; and a Private Tree Protection By-law. The Private Tree Protection By-law prohibits the removal of more than three trees with diameters greater than 15
cm from any privately owned lot within a single calendar year, and requires the planting of tree replacement or cash in lieu for any healthy trees removed (Urban Forest Innovations 2014a, 29).

Mississauga’s UFMP recommends reviewing and updating the city’s Public Tree Protection By-law, Erosion Control By-law, Nuisance Weeds By-law, and Encroachment By-law to better allow the city to protect trees (Urban Forest Innovations 2014a, 66). The plan further recommends that the Private Tree By-law be reviewed and updated within the first four to eight years, based on monitoring of its effectiveness in the interim (Urban Forest Innovations 2014a, 67).

Regulations existed to protect the urban forest in London and Mississauga prior to the development of their urban forest management plans. London’s existing regulatory framework did not include a by-law to regulate the removal of trees on private property, while Mississauga’s included a Private Tree By-law which prohibits the removal of more than three trees of a specified minimum diameter in a single calendar year.

Both cities’ plans call for the strengthening of existing by-laws to improve their effectiveness, but are cautious in their approach to private tree by-laws. London’s plan recommends the development of a new by-law to protect heritage trees, but stops short of recommending a by-law to regulate the removal of all trees from private property. This reflects the input provided by the public and key stakeholders consulted in the development of the plan. Mississauga’s plan recommends that its Private Tree By-law be monitored, and reviewed in four to eight years. This reflects that this by-law was already updated once within the two years prior to plan creation (Urban Forest Innovations 2014a, 29).
London may still have derived benefit from its hypothetical private tree by-law, even though it didn’t adopt it: Dr. Conway points out that the public discussion prompted by a municipality’s consideration of whether to adopt a by-law acts as a public education tool which raises awareness about urban forestry issues and may cause homeowners to place more value on their existing private trees (Conway, personal interview, June 16, 2015).

### 3.2 General Impressions

This case study analysis has evaluated London and Mississauga’s urban forest management plans based on twelve criteria. It has revealed that both plans follow best practices as identified in the literature review and interviews with urban forestry experts. Both plans satisfy all twelve of the evaluation criteria, to differing degrees.

Each plan has its strengths and weaknesses. Both cities conducted extensive data collection in preparing their plans, and placed high priority on continuing to gather and maintain data that will guide better-informed urban forest management decision-making.

London’s plan was somewhat weak on defining key terms and setting effective targets by which to measure success. The plan would benefit from clarifying the definitions of those terms which are essential to understanding the scope of the plan. It could also be improved through the development of additional targets to measure the performance of dimensions of the urban forest other than canopy cover – in particular, species diversity and urban forest health, which are integral to the plan’s vision statement.

A key strength of London’s plan was its strong public consultation process, which succeeded in gathering input from more than 1700 members of the general public, 600 of whom provided written comments. The plan validates the participation of London residents by providing
examples of public feedback that influenced the creation of the plan, such as the “Forest City”
brand which was incorporated into the plan’s vision statement as a priority based on the public’s
desire to retain this as the city’s slogan.

Mississauga’s plan could have been strengthened by a more effective consultation with the
general public as part of plan development. Based on the literature review and interviews, public
participation in the development of a plan is an effective way to generate public buy-in to the
plan’s goals and implementation strategies. The importance of having implementation strategies
supported by the public, who control the vast majority of the urban forest, was a recurring theme
in the literature review and interviews. This is borne out in the priority that both London and
Mississauga place on public engagement as a component of plan implementation.

A strength of Mississauga’s plan development process was the collaboration between the city
and key stakeholder groups, including Peel Region, conservation authorities, First Nations, and
neighbouring municipalities. This is probably due in part to the fact that Mississauga, as a lower-
tier municipality in the heart of the Greater Toronto Area, has close ties and a history of
collaboration on a variety of issues with these other organizations.

The key strengths of Mississauga’s plan are its highly detailed implementation strategy,
characterized by three tiers of management and operational plans, and its emphasis on active
adaptive management. These aspects of the plan will ensure Mississauga’s management
paradigm continues to improve upon itself based on ongoing experimentation, performance
evaluation, and adaptation.

Lessons for other large Ontario municipalities wanting to develop urban forest management
plans of their own are discussed in section 4.
Chapter 4: Recommendations

The analysis of the case study plans, combined with the literature review and interviews with urban forestry experts, has provided lessons for large Ontario municipalities that are considering adopting an urban forest management plan. These lessons are discussed in section 4.1 below.

Additional lessons have been identified for planners, as well as for Ontario provincial policy makers. These lessons are discussed in sections 4.2 and 4.3. Concluding remarks follow in section 4.4.

4.1 Lessons for large municipalities

1. All municipalities with urban forestry programs can benefit from adopting an urban forest management plan.

All three of the experts interviewed for this report agreed that adopting an urban forest management plan is a beneficial practice for any municipality which has the capacity to do so, with one adding that any municipality with a population comparable to that of London or Mississauga should have this capacity (Kenney, personal interview, May 29, 2015). Almas suggested that this does not mean that smaller municipalities should not attempt to create a UFMP – he suggested that every municipality can benefit from a UFMP, but that the scope of the UFMP can be narrowed or broadened to fit the capacity of the municipality (personal interview, June 16, 2015). Even a neighbourhood association or academic institution could benefit from establishing a UFMP for its neighbourhood or campus, although the lack of resources available to neighbourhood associations makes them less well-equipped to fund the development and implementation of a UFMP than governments (Kenney, Conway; personal interviews May 29
and June 16, 2015). Municipal governments, rather than federal, provincial, or regional
governments, or conservation authorities, are most likely to have existing urban forestry
programs which can benefit by being expanded or focused through the adoption of a UFMP.

All three interviewees identified more efficient use of resources as the principal benefit of
adopting a UFMP. Urban forests provide a number of services but also certain costs; a well
thought-out UFMP contemplates both, and will maximize the provision of services while
minimizing the costs of management (Conway, personal interview, June 16, 2015). For
municipalities which already have an urban forestry department and associated budget, the
consequences of not adopting a UFMP are that they will not have a vision or set of codified goals
for what that department is working towards, which will result in inefficient work (Almas,
personal interview, June 16, 2015). Kenney provided the example of planting a tree without
having a plan to ensure it will be maintained until it reaches maturity and becomes a net provider
of ecosystem services: if the tree dies after fifteen years, not having reached maturity, that tree
represents fifteen years’ worth of wasted equity. In sum, an urban forestry department working
without a UFMP is “not spending taxpayers’ money very well” and not addressing the pressures
on the urban forest adequately (Kenney, personal interview, May 29, 2015).

2. Clearly define the terms of reference and scope of the plan.

The literature review illustrated that the definition of the term ‘urban forest’ has evolved over
time (van Wassenaer et al 2000, 242), and the scope of a UFMP will vary between municipalities
depending on their capacity (Almas, personal interview, June 16, 2015). The case study UFMPs
differed in how they defined the urban forest (for London all trees in the municipal boundary, for
Mississauga all trees, shrubs, understory plants, and the soils that sustain them), and what scope
their policies applied to. This reflects the unique context and management capacity of the two different cities. London’s scope was less clearly defined, and this could lead to confusion or controversy in implementing the UFMP, especially later in the plan’s 20-year lifespan, at which point it is possible that none of the staff involved in creating the plan will remain to help interpret it. Other municipalities creating UFMPs should ensure that all terms of reference and assumptions are clearly and explicitly defined, to allow for straightforward interpretation and implementation in the long term.

3. Conduct a thorough inventory of the urban forest to provide data on which to base the plan.

The more information a municipality collects on its existing urban forest and the pressures it faces, the more informed its decisions will be in setting targets and taking actions to address those pressures (Almas, personal interview, June 16, 2015). There are multiple inventory methods to choose from, such as the UFORE and i-Tree Eco models, which provide data on multiple aspects of the urban forest. Despite having already conducted inventories using these two models, both London and Mississauga prioritized additional inventory work as being an urgent and important step in the early stages of implementing their UFMPs (B.A. Blackwell 2014a, 34, Urban Forest Innovations 2014a, 57). This highlights the significance of having a comprehensive understanding of current urban forest conditions and trends, which thorough and recurring inventories can provide.

4. Set targets that will be effective in achieving the vision for the urban forest.

As noted above, modern inventory techniques provide data on multiple aspects of the urban forest. Despite having data on such aspects, and citing several of them in its vision statement,
London’s UFMP sets targets for only one aspect of the urban forest: canopy cover (B.A. Blackwell 2014a, 20). By contrast, Mississauga’s UFMP outlines six sets of targets for various urban forest aspects (Urban Forest Innovations 2014a, 19).

All three interviewees recognized that canopy cover targets had value but were not sufficiently comprehensive to stand alone as the basis of a UFMP. Interviewees cited numerous other metrics for which municipalities can set targets, which convey different information about the urban forest that canopy cover overlooks. Species diversity and age class distribution were most frequently mentioned, each of them providing valuable insight into the urban forest’s health and vulnerability.

Less frequently discussed was stem density, conveying the number of trees present in a given area; however, Dr. Conway advocated for the value of this metric, noting that it considers the contribution of young trees. She also explained that this metric is the most relatable and easiest to visualize for the general public, who can be asked to help achieve stem density targets by planting another tree on their property more easily than they can be asked to help achieve targets which only consider forest-wide factors such as canopy cover or species diversity (personal interview, June 16, 2015).

Leaf area density was recognized as being the metric most indicative of ecosystem services, but all interviewees conceded that it is the most difficult to measure. Canopy cover was seen as more easily measurable and reasonably reflective of ecosystem services (Conway, personal interview, June 16, 2015).

When municipalities do set targets for canopy cover, these targets should reflect the unique geographic, historical, and ecological context of the municipality (Almas, personal interview,
June 16, 2015), as is the case for the targets set by London (B.A. Blackwell 2014a, 20). Above all, the targets should be realistic based on the available plantable space in the municipality (Conway, personal interview, June 16, 2015). For this reason, Andy Kenney recommends setting targets for canopy cover relative to potential canopy cover (Kenney, personal interview, May 29, 2015).

It is clear from the interview results that no one metric can provide a comprehensive picture of the urban forest. When developing UFMPs, municipalities should utilize the range of data provided by inventories to set targets for multiple aspects of the urban forest, as Mississauga did. This will help to ensure that plan implementation does not become skewed in favour of prioritizing only those actions which will help achieve a target (such as planting trees to meet canopy cover targets) at the expense of actions which would contribute to improving other factors that are equally important to urban forest health but are not subject to targets.

5. Utilize regulatory instruments as one of many means to protect trees.

Neither the literature review nor the interviews nor the case study analysis provided a conclusive argument for or against the use of regulatory instruments such as private tree by-laws. Interviewees generally felt that by-laws restricting the removal of trees on private property have value in providing a disincentive to remove healthy trees, but need to be combined with a parallel effort to persuade the public that healthy trees are worth maintaining and/or provide incentives for maintaining them. Private tree by-laws are difficult to enforce, and enforcement cannot bring back a tree that has already been illegally removed; however, the existence of a private tree by-law may save some trees by causing property owners to give removal a second
thought. For this reason, Tenley Conway concluded that such by-laws are ultimately worthwhile (personal interview, June 16, 2015).

The City of London did not reach the same conclusion: consultation with stakeholders and the general public revealed that many considered private tree by-laws to be too expensive and difficult to enforce. This led to the decision not to adopt a private tree by-law as part of London’s UFS (B.A. Blackwell 2014a, 15).

Notwithstanding the discussion of private tree by-laws, both London and Mississauga found ways to protect trees through other types of regulatory instruments: the UFMPs of both cities recommend strengthening existing by-laws to protect public trees (B.A. Blackwell 2014b, 5-7, Urban Forest Innovations 2014a, 66-67), and London’s plan recommends the adoption of a by-law to restrict the removal of identified “heritage trees” (B.A. Blackwell 2014b, 6). Other municipalities should take note that there are varying levels of regulation that can be used to protect trees, and that the public conversation surrounding what level of regulation is appropriate in each municipality may prove to be valuable regardless of whether a by-law is ultimately adopted (Conway, personal interview, June 16, 2015).

6. Include the public and key stakeholder groups in the development and implementation of the plan.

A recurring theme in all three interviews as well as in the case study documents was the importance of public and key stakeholder engagement in the development and implementation of a UFMP.

A municipality would be unwise to ignore the public in developing its UFMP, because they own the entirety of the urban forest either individually as private property owners or as a combined
citizenry who collectively own public property (Kenney, personal interview, May 29, 2015). Because a large proportion of the urban forest is located on private property, the public exerts the greatest amount of control over the urban forest through their household-level decisions (Conway, personal interview, June 16, 2015).

Conway advised municipalities to recognize that members of the public have widely varying opinions and attitudes toward trees. Listening to these varying opinions and incorporating them into the plan can create a stronger plan with greater public buy-in. While municipalities may not persuade every property owner to plant the large-stature trees that provide the greatest ecosystem services on their property, they can increase the general public’s awareness and appreciation of trees, and garner public support for urban forest management initiatives (Conway, personal interview, June 16, 2015). An effective way to educate the public is to include them in plan development and implementation (Almas, personal interview, June 16, 2015).

All three experts interviewed agreed that public engagement and education are essential in the development and implementation of a UFMP. This is evident in the priority placed on public and key stakeholder engagement and education by London and Mississauga in every stage of their UFMPs. Other municipalities may look to these two plans for numerous examples of methods to involve the public in their urban forestry programs.

**7. Adopt an “active adaptive management” approach to maximize plan effectiveness.**

London and Mississauga both identified adaptive management as a fundamental component of their UFMPs (B.A. Blackwell 2014b, 1, Urban Forest Innovations 2014a, 4). This is borne out through a commitment to experimentation, monitoring of results, and consequent adaptation of plans to continuously refine their methods and improve their effectiveness. Monitoring and
adaptation should occur continuously and at regularly scheduled intervals to ensure the lessons learned from experimentation are applied to improve practices. In Mississauga’s plan, these opportunities to monitor and adapt are built into the plan’s hierarchical structure, which requires the creation of subordinate plans at annual and four-year intervals (Urban Forest Innovations 2014a, 5).

The importance of this approach was echoed by Andy Kenney, who offered the further distinction that the term active adaptive management better conveys an emphasis on the experimental component of plans adhering to this approach (Kenney, personal interview, May 29, 2015). All three interviewees identified species suitability trials (and adapting planting practices based on their results) as an example of an active adaptive management technique that can contribute greatly to efforts to improve tree health and species diversity in tree plantings. Species suitability trials are a component of both London and Mississauga’s UFMPs.

Other large municipalities should follow the example of London and Mississauga by taking an active adaptive management approach when designing their UFMPs.

8. Adopt a collaborative approach to urban forest management, internally and externally.

Municipal urban forestry departments should collaborate with other municipal departments, as well as collaborating at a municipal level with external agencies such as conservation authorities, higher levels of government, and neighbouring municipalities, in both the development and implementation of their UFMPs. As Andrew Almas points out, forest ecosystems do not adhere to municipal boundaries, and ultimately municipalities should co-ordinate their efforts in order to improve urban forest quality and maximize the provision of ecosystem services at a regional level, for the benefit of all (Almas, personal interview, June 16, 2015).
All interviewees agreed that within a municipality, the establishment of an interdepartmental committee is an effective mechanism to address forestry issues from different perspectives and to ensure a consistent approach to UFMP implementation across departments. This can also help to resolve the frequently-cited problem of forestry staff not being included early enough in the projects of other departments – particularly planning departments. Ongoing communication through a committee or other venues will allow staff to benefit from each other’s expertise and avoid missed opportunities to collaborate.

Both London and Mississauga conducted extensive consultation with internal departments and external agencies in the development of their plans (B.A. Blackwell 2012, 5-7, Urban Forest Innovations 2014a, 2); both cities also recommend ongoing collaboration between departments, including the creation of an interdepartmental committee, as part of UFMP implementation (B.A. Blackwell 2014b, 5-7, Urban Forest Innovations 2014a, 56, 65). Mississauga’s relationship with Peel Region and proximity to numerous other large municipalities likely explains its advanced level of collaboration with other levels of government. Other municipalities in a similar context may find Mississauga’s approach to be a particularly relevant example; likewise, London’s plan may be more relatable to other single-tier municipalities with few comparably-sized neighbours.

4.2 Lessons for planners

1. Become educated in the basics of urban forestry, and consider forestry concerns early in the planning process.

Planners are responsible for designing and implementing the policies which shape the urban environment. It is therefore important that planners have knowledge of the environmental conditions that are needed for trees and green infrastructure to successfully grow, and awareness
of the pressures placed on the urban forest by development and grey infrastructure. Simply by ensuring that every plan includes dedicated places for tree growth, planners can make a significant positive difference for the urban forest (Conway, personal interview, June 16, 2015). To do this, the urban forest and green infrastructure in general must be considered early in the planning process, and given equal importance compared with grey infrastructure and the built form.

This is especially critical now, given the recent trend toward intensification as the dominant form of development in many Ontario jurisdictions. Low-density residential neighbourhoods are currently home to a large proportion of most urban forests; as these environments become redeveloped at higher densities, it will become increasingly difficult to provide sufficient room for the large-stature trees which are the lead providers of ecosystem services (Conway, personal interview, June 16, 2015). Planners who are ignorant of urban forestry concerns or who consider trees only as an afterthought in the planning process can therefore have a negative impact on urban forest viability (Almas, personal interview, June 16, 2015).

To avoid these negative outcomes, the Canadian Urban Forest Strategy advocates for training planners in the basics of urban forestry (Canadian Urban Forest Network 5). In addition to learning about the urban forest, planners should maintain open lines of communication with urban foresters, and ensure that urban forestry concerns are addressed early in the planning process – rather than leaving the provision of spaces for trees as an afterthought, which interviewees complained is currently too often the case (Conway, personal interview, June 16, 2015).
As intensification overtakes greenfield development as the dominant form of development, it is imperative that planners educate themselves on urban forestry issues, prioritize the urban forest as a primary concern in planning, and ensure that urban forestry staff are included in the planning process.

2. Explore how planning tools, such as zoning by-laws, can support urban forestry efforts.

In addition to consulting with urban foresters in development review planning, planners should consider what tools may be available to them that can be used to advance urban forestry, which are not available to foresters. Zoning by-laws were cited as one of the single most influential mechanisms to ensure space is provided for trees, due to their role in regulating the amount of a property which may be built on or left as impervious surface (Kenney, personal interview, May 29, 2015). Other planning tools that can ensure space for trees may include Official Plan policies, secondary plans, site plan control, development permit systems, and urban design guidelines. Future research could explore how these and other tools may be utilized to support urban forestry efforts.

4.3 Lessons for Ontario provincial policy makers
1. Develop policies to guide municipal urban forest management.

The province of Ontario has taken an active role in the last decade in guiding municipal land-use planning practices, adopting policies such as the Provincial Policy Statement, the Greenbelt Act, and the Places to Grow Act, which require municipalities to conform to provincial directives about where and how to develop their built form. The same level of provincial oversight is not present in the realm of urban forestry.
Because the province is responsible for the protection of public health and the environment, both of which benefit from the ecosystem services provided by urban forests, it would be in the province’s interest to ensure the protection of healthy urban forests. Recognizing that a minority of large Ontario municipalities have adopted UFMPs, the province should consider passing legislation to require a minimum level of urban forest management planning for all municipalities which meet certain criteria such as a minimum population size or proportion of developed land. This could be accomplished by passing legislation which builds upon or is modeled after the land-use planning legislation described above, in particular the Provincial Policy Statement (Kenney, Conway, personal interviews, May 29 and June 16, 2015).

Currently, the Municipal Act, the Planning Act, the Provincial Policy Statement, and the Forestry Act all have an impact on the urban forest and green infrastructure (Kenney, personal interview, May 29, 2015), but do not, for example, require municipalities to adopt urban forest management plans, or establish minimum standards of canopy cover distribution or species diversity to which all municipalities must conform. The lack of province-wide quantitative standards for urban forest characteristics reflects the fact that every municipality’s urban forest has a unique ecological context; however, the province could adopt qualitative policies which are universally applicable without disregarding the uniqueness of each municipal context. For example, policies could require that species diversity be maximized (Almas, personal interview, June 16, 2015) or that urban forestry initiatives have regard for the equitable distribution of canopy cover across all the residential communities of a municipality.

Future research is warranted to explore how the provincial government could play a more active role in guiding and supporting the management of urban forests in Ontario municipalities.
2. Support municipal urban forest management by taking a lead role in research to inform active adaptive management practices.

Multiple interviewees remarked that it is challenging for municipalities to adequately fund research such as species suitability trials, which are an important component of active adaptive management practices (Conway, Almas, personal interviews, June 16, 2015). Interviewees pointed to the role played by upper-level governments in the United States in funding research that provides data which is utilized by municipalities in the United States and Canada to improve their urban forest management practices, and advocated for the Ontario (or Canadian federal) government to fill a similar role (Kenney, Conway, personal interviews, May 29 and June 16, 2015). A particularly useful endeavour would be to conduct species suitability trials for ecological contexts that are found in Ontario (or Canadian) municipalities but not in the U.S. This would provide knowledge that is currently lacking and could be applied by numerous Ontario municipalities to improve their practices and benefit their urban forests (Conway, personal interview, June 16, 2015).

The province of Ontario (and/or the federal government of Canada) should explore how it could provide support for municipal urban forest management efforts by conducting or funding research to inform active adaptive management practices.

4.4 Conclusion
This report analysed a literature review, a comparative case study, and interviews with experts in the field of urban forestry to derive lessons for large Ontario municipalities wishing to adopt an urban forest management plan. The report found that urban forest management plans can be
beneficial for municipalities of any size that have the capacity to implement them, and that large municipalities in particular should have this capacity and stand to benefit from UFMP adoption.

In the process of developing and implementing a UFMP, municipalities should engage key stakeholders and the general public, as well as collaborating with internal departments and external agencies. A thorough inventory of the urban forest should be conducted as the basis of setting goals and designing actions to achieve them. In order to be effective, the choice of goals and targets should be comprehensive in reflecting the variety of important indicators of urban forest health. An active adaptive management approach should be adopted to ensure that continuous trial and error results in improved practices for the best possible results.

London and Mississauga are the only municipalities of the eight in Ontario with populations between 200,000 and 750,000 that have adopted UFMPs. As intensification, climate change, invasive pests, and other factors place increasing pressures on urban forests, other large municipalities can look to the example set by London and Mississauga for lessons in how to develop their own urban forest management plans. By implementing such plans, these municipalities can address the pressures facing their urban forests and work towards securing a healthier urban forest ecosystem in the future.
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