LEAF's Adopt-A-Street-Tree program: Impacts on urban tree health and the driving social factors of community-based urban forest stewardship

by

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November 21, 2018

A capstone paper in conformity with the requirements for the degree of

Master of Forest Conservation

Faculty of Forestry

University of Toronto

EXECUTIVE SUMMARY

Trees in the urban environment provide an array of important benefits that are coming to the forefront of urban forest management and municipalities such as the City of Toronto are actively looking to enhance the urban forest for the benefits provided. However, urban trees are susceptible to a wide range of stressors inherent to the challenging conditions of the city, jeopardizing the provision of these benefits and their canopy cover objectives as a result. While recognizing the importance of tree care post-planting in achieving their urban canopy cover objectives, the City of Toronto has identified the need for other actors to engage in urban tree stewardship.

A notable non-profit organization called Local Enhancement and Appreciation of Forests (LEAF) is dedicated to improving Toronto's urban forest and has established an urban tree stewardship program called Adopt-A-Street-Tree that operates in communities around Toronto including Danforth, Bloordale, the Junction and Liberty Village. The main component of the program is to engage community support in their endeavours of urban tree monitoring and maintenance. This program has demonstrated success in neighbourhoods throughout the City of Toronto. However, as a relatively recent program, there remain challenges to address and analyses to be made in order to strengthen its impact as it expands to new locations across the city.

Urban forests can be considered as socio-ecological systems where human and natural factors interact to produce both small-scale (individual tree) and larger-scale (canopy cover) effects and require human intervention for their management. A complex array of biophysical and social factors works to determine the extent and condition of urban forests, and the following research attempts to capture these factors to comprehensively evaluate LEAF's Adopt-A-Street-Tree program. The nature of actors including residents and businesses involved in urban forest stewardship, strategies to increase their engagement, and the outcomes of collaborative efforts are explored to reveal opportunities to strengthen the multi-stakeholder approach and foster further environmental stewardship in communities across Toronto.

A biological evaluation of the program includes building upon previous research to demonstrate the impact of the Adopt-A-Street-Tree program on urban tree health. Using a community-based tree inventory protocol called Neighbourwoods©, statistical analyses demonstrated that not only does tree health improve over the year with adoption through the Adopt-A-Street-Tree program, but tree health is significantly better in adopted trees when compared to trees not apart of the stewardship program. Evaluation of the social factors includes collection of information from existing stewards involved in the Adopt-A-Street-Tree program and review of relevant literature on the topic. Based on the findings of these evaluations, recommendations are provided to LEAF to enhance the Adopt-A-Street-Tree program

for trees and stewards alike. This research aims to improve and demonstrate the effectiveness of LEAF's Adopt-A-Street-Tree program and further establish the program as a successful model of urban forest sustainability to help achieve the City of Toronto's urban forest management objectives.

ACKNOWLEDGEMENTS

I would like to acknowledge several people who have assisted me throughout the completion of this capstone project. Thank you to Erin MacDonald and the rest of LEAF for the internship opportunity over the summer, and for the ongoing support provided in the development of this report. I would also like to thank Kathryn Money for her help over the course of the summer and in outreach with volunteers. Thank you to Dr. Danielja Puric-Mladenovic for her assistance in providing the Neighbourwoods© data essential to the project. Finally, thank you to Dr. Sandy Smith for her guidance and imparting her wealth of knowledge to me throughout the past year.

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INTRODUCTION

In increasingly urbanized landscapes, trees in and around urban communities are gaining precedence in city planning due to recognition as critical components to city infrastructure. Management of urban trees is mainly the responsibility of municipalities, who are looking to develop new policies and strategies to enhance and sustain the urban forest as pressures of urbanization increase (Konijnendijk, Richard, Kenney, & Randrup, 2006). These actions are set out by urban forest management plans, which are nearly ubiquitous among municipalities. These plans often contain tree canopy cover targets, such as Toronto's goal to reach a 40% canopy cover over the next fifty years from its current canopy cover of approximately 27% (City of Toronto, 2013). This paradigm can mainly be attributed to the rise of research quantifying urban forest benefits, and their contributions are many and varied. Trees provide a host of environmental, economic, social and health benefits in urban settings including air pollution mitigation, carbon storage, air temperature regulation, and positive impacts on human cognition and well-being (Song et al., 2018).

Municipal governments are largely interested in increasing urban tree canopy to maximize and sustain the associated benefits (Kendall & McPherson, 2012; Pincetl et al., 2013), and the City of Toronto's Urban Forestry department aims to plant over 100,000 trees annually on public land to help achieve canopy targets (City of Toronto, 2013). However, the extent to which the benefits of trees are provided is dependent on their growth and survival in the challenging urban environment (Mincey and Fischer, 2013). As trees occupy various types of environments, they experience different challenges to their growth and survival. Street trees, which are located within the public right-of-way, grow in the harshest of urban conditions due to the multiple stressors they encounter including, but not limited to, construction, physical damage, salt, soil compaction and insufficient soil volume which inhibits root growth, and causes drought and drainage problems (Lu et al., 2010). These stressors will determine survivorship and put them at risk for insect and disease problems. Despite devoting significant resources toward tree planting initiatives and campaigns which have been on the rise for the past two decades (McPherson and Young, 2010), young urban tree mortality is observed in many cities (Lu et al., 2010). This essentially negates tree planting efforts and creates difficulties for cities in achieving their canopy cover goals and their urban forest management plan objectives as a result. Actions taken post-planting of trees in the first three years are crucial to their survival (Moskell et al., 2016). A shift towards increased maintenance and monitoring of planted urban trees is therefore essential to achieving management goals (Moskell & Allred, 2013). The City of Toronto recognizes the difficulties for street trees to achieve optimal health, as well as the lack of resources for the associated maintenance of urban trees and have

subsequently identified community stewardship programs and residents as key players in ensuring the long-term success of Toronto's urban tree canopy (City of Toronto, 2013).

An exemplary non-profit organization in the City of Toronto is Local Enhancement and Appreciation of Forests (LEAF), which for 22 years has led the way in community-based urban forestry through a variety of programs, workshops and events. In 2015, LEAF launched the Adopt-A-Street-Tree program in partnership with the City of Toronto, to bring together community volunteers to become stewards of street trees within their neighbourhood through duties such as watering, weed and litter removal, and monitoring for damage or serious health decline (LEAF, 2017). Volunteers include both residents and businesses of the respective communities in which the program is operating. The program is currently operating in four neighbourhoods throughout the city; Junction, Bloordale, Danforth, and Liberty Village with plans to expand to new communities in the future. Data for this research was collected from the Junction (Dundas Street West between Quebec Avenue and Indian Grove, Figure 1), Bloordale (Bloor Street West between Landsdowne Street and Dufferin Street, Figure 2) and Liberty Village (Figure 3). Two previous research projects conducted by University of Toronto graduate students have assessed the biological and social aspects of the program for its impact on tree health and the communities. Diakun (2016) and Dowell (2017) conducted biological tree health evaluations and found some significant improvements in health indicators for trees that were adopted by local stewards compared to unadopted trees, however the effectiveness is inconclusive, and more studies are recommended. In the social evaluation through surveying of stewards, Dowell (2017) identified motivators and issues shared amongst tree adopters and suggested areas that could enhance the relationship between LEAF and its volunteers. Diakun (2016) compared LEAF's Adopt-A-Street-Tree program with others across the globe and found similarities in structure and strategies, but found there are opportunities to increase program participation, such as program incentives.

Past research on LEAF's Adopt-A-Street-Tree program and other community-based urban forestry models reveals that stewardship has a positive impact on survivorship and health of urban trees, but more research into the nature of the involvement of various actors, how volunteer relationships function, and opportunities to increase engagement is necessary. Stewards of the urban forest can range from large public agencies operating at the citywide scale, and smaller civil society agents at the community scale (Fisher et al., 2012). Groups or individuals partaking in environmental stewardship are often fragmented or isolated across an expansive city like Toronto (Svendson & Campbell 2008), and LEAF can play a critical role in bringing these groups together to achieve large-scale urban forestry goals. LEAF's vision for the Adopt-A-Street-Tree program is for it to become a model of urban forest sustainability utilizing a diverse and inclusive multi-stakeholder approach. To achieve this, it is

imperative to understand the inherent interconnectedness of both the biological and social aspects at work. An assessment of the community-based urban forestry model and the Adopt-A-Street-Tree program will include both biological and social factors as they interact to define the health and structure of the urban forest.

RESEARCH OBJECTIVES

While the Adopt-A-Street-Tree program has demonstrated initial success in neighbourhoods across the City of Toronto, there remain challenges to address and information to unearth in order to strengthen its impact as it expands to new communities. There are two main objectives of this research to address both the biological and social aspects of the program. One objective of this project is to build upon previous research on LEAF's Adopt-A-Street-Tree program by providing further evidence for the program's impact on street tree heath in neighbourhoods where it is currently operating. Additionally, as a community-oriented urban forestry program, research is not exclusive to the biophysical factors but will explore the socio-ecological system at work in the context of the urban environment to gain a better understanding of the social factors influencing the program's success. To achieve this, the present structure of the program and the role of various actors involved in the program will be discussed in order to identify opportunities to enhance the multi-stakeholder approach to community-based urban forest management. This understanding will be facilitated through a literature review, which will begin with a broad picture of urban forest management and its function as a socio-ecological model with a multi-stakeholder approach, supplemented by social data collected from the program itself.

LITERATURE REVIEW

Urban forest management

Of the total 10.2 million trees in Toronto, 6% of the population are street trees meaning there are approximately 600,000 trees along streets to care for. Generally, the responsibility of caring for these trees lies with the municipal government, but there is a movement to expand and diversify the type of groups involved in urban forest management (City of Toronto, 2013). While initiatives drawn from science and policy are required, exclusively large-scale actions at the municipal level will not benefit cities (Krasny & Tidball, 2012). Kenney et al. (2011) emphasize the importance of collaboration with other stakeholders including landowners, stewardship groups and community members. An array of partnerships between government institutions and civil society organizations can create a governance system that is flexible and resilient (Ostrom, 2010; Krasny & Tidball, 2012). Furthermore, an

organizational network with many types of actors actively engaged in urban forest management can create opportunities to build on local knowledge and assets that can be scaled-up to address overarching challenges of the urban forest (Krasny & Tidball, 2012; Svendsen & Campbell, 2008).

Urban forest stewardship should be stakeholder-inclusive to coordinate land management with the needs of civil society (Svendsen & Campbell, 2008). One of the more prominent actors working alongside municipalities are non-profit organizations, such as LEAF, that work with communities and citizens and are increasingly relied upon by municipalities for stewardship of planted trees (Svendsen & Campbell, 2008). These organizations are institutional structures that support engagement of urban tree stewardship through community involvement in urban forestry activities, and outreach and education on these practices (Moskell & Allred, 2013). They interact with both the biophysical resources and the human social system, which work synergistically to achieve multiples outcomes of environmental improvement, community development, and environmental education (Svendsen & Campbell, 2008; Mincey & Vogt, 2014). As LEAF's primary function is to form connections between urban trees and the communities of Toronto, it is imperative to recognize the social aspects built into the system of urban forest management.

Urban forests as socio-ecological systems

Urban forests can be defined as systems of linked human and natural features that produce various social and environmental outcomes. Complex relationships exist between factors that influence the sustainability of urban forests, which include the biophysical resources themselves (trees and their growing environment), urban communities, and the stakeholders that manage municipal resources (Vogt et al., 2015; Svendsen & Campbell, 2008). These factors interact, contribute to and gain from the survival and growth of urban trees in different ways (Vogt et al., 2015). This perspective builds off existing theories of sustainable resource management in that it does not focus exclusively on trees, the biophysical resources, but also the social processes that influence the urban forest (Clark, Matheny, Cross, & Wake, 1997). For example, Vogt et al. (2015) found that interactions between ecological and social factors depend on community characteristics such as size, social capital, employment rate, home ownership rate, and personal motivations. The urban forest is therefore influenced by larger quality of life factors, which collectively determine stewardship success (Svendsen & Campbell, 2008). Accordingly, LEAF should have an understanding of the specific community they are targeting for Adopt-A-Street-Tree program implementation.

The success of the urban forest is also defined by the social rules, norms and strategies developed by the management institutions of urban forests to structure interactions of groups involved. McDonnell

and Pickett (1990) argue that the social and policy factors bear more of an influence on the composition of the urban forest than biophysical factors. Svendsen and Campbell (2008) identify that these groups; large public agencies, non-profits, community groups and businesses, interact at multiple levels and each group requires different motivators or incentives to undertake environmental stewardship (Fisher, Svendsen & Connolly, 2015). How LEAF structures interactions and incentives between them and their various volunteer groups, and what resources are provided will ultimately determine outcomes of street tree stewardship on tree health.

Though the biophysical environment of urban trees has a direct impact on their health, an understanding of this multi-level interacting social and biophysical framework demonstrates the importance of the various actors and their underlying drivers for engagement in urban forest stewardship. To further this understanding of the socio-ecological system at work in communities of Toronto, both biological and social information collected will be analyzed to reveal more nuances within the Adopt-A-Street-Tree program and to structure recommendations for LEAF.

METHODS

Biological data collected from the Junction and Bloordale neighbourhoods during an internship involving the Adopt-A-Street-Tree program and previous data collected by Dowell in 2017 in these neighbourhoods, was analyzed in the methodology for biological evaluation of the program. Social data collected from the Liberty Village Adopt-A-Street-Tree program which launched in the summer of 2018 is used in the methodology for social evaluation of the program.

Biological evaluation: Tree health assessments

To build upon the evidence of the positive impact of the Adopt-A-Street-Tree program on tree health, analyses of health of adopted trees over the course of a year in individual neighbourhoods and between adopted and unadopted trees were conducted. Data was collected in summers of 2017 and 2018 from Bloordale and the Junction using the Neighbourwoods© protocol developed by Dr. Kenney and Dr. Puric-Mladenovic from the University of Toronto. The Neighbourwoods© protocol is utilized as a standardized tree inventory method designed to assist communities and professionals in collecting tree health information that can be analyzed to inform urban forest management and stewardship programs (Neighbourwoods©, 2018). The Neighbourwoods© inventory protocol measures 28 different criteria for each tree, including species, size, health indicators, and conflicts with the urban environment and assembles this information into a database to produce an individual health rating of ‘excellent’, ‘good’,

'fair', 'poor', 'very poor', or 'dead' (Table 1). Each tree was individually assessed based on standardized guidelines provided by the protocol reference guide (Appendix 1).

For the Junction and Bloordale neighbourhoods, tree health condition ratings from 2017 to 2018 were compared in adopted trees to see whether tree health improves with adoption. Two methods of evaluation were used to analyze health across the years; the first being the differences in health ratings and the second being direction of change in health from 2017 to 2018. Change in health looks at the number of trees that have improved (rating went up), declined (rating went down), or had no change in health (rating stayed the same). Trees that died in 2017 and trees planted as replacements in 2018 were removed from the data as appropriate.

The 120 adopted trees in 2017 and the 113 adopted trees in 2018 in the Junction were summarized into the six Neighbourwoods© health rating classes (Table 2), and the 113 trees summarized into the three categories for change in health rating from 2017 to 2018 (improved, declined or no change) (Table 3). Differences in health ratings between Junction trees in 2017 (n=120) and Junction trees in 2018 (n=113) were compared using a Wilcoxon rank sum test in the software program R at a 0.05 significance level. This test was chosen for all analyses as the data did not meet the assumptions of normal distributions.

The 44 adopted trees in 2017 and 2018 in Bloordale were also summarized into the six Neighbourwoods© health rating classes (Table 4) and 44 adopted trees summarized into the three categories for change in health rating from 2017 to 2018 (improved, decline or no change) (Table 5). Differences in health ratings between Bloordale (adopted) trees in 2017 (n=44) and Bloordale trees in 2018 (n=44) were compared using a Wilcoxon rank sum test. The same sorting and analysis were performed between Bloorcourt trees in 2017 (n=49) and 2018 (n=46) (Table 6, Table 7). Bloorcourt trees are unadopted trees located in an adjacent block to Bloordale (Bloor Street West between Dufferin Street and Ossington Street). These trees were planted around the same time as those in Bloordale and have been subject to generally the same urban conditions but are not apart of the Adopt-A-Street-Tree program.

Additionally, a biological evaluation of tree health for adopted (Bloordale) and unadopted trees (Bloorcourt) was conducted to observe whether adoption has a positive impact on tree health compared to unadopted trees. In Bloordale, adopted trees, meaning trees belonging to LEAF's program and adopted by volunteers, served as the test group, and unadopted trees, meaning trees not belonging to LEAF's program, served as the control group. Neighbourwoods© health ratings and direction of change in health ratings were compared between the control (unadopted) and test (adopted) groups from 2017 to 2018, and statistically analyzed using Wilcoxon rank sum tests. These analyses were not conducted with Junction

trees as there was no comparable sample size of unadopted trees nearby to use in this study. The data used in the statistical analyses is summarized in Table 8.

Social evaluation: Resident and business adopters

A social evaluation will be conducted using survey data obtained from adopters in Liberty Village including individuals and businesses. Firstly, during the summer of 2018 a 9-question demographics survey was sent to resident adopters of Liberty Village via email, which respondents filled out voluntarily and anonymously. The questions were intended to gauge adopter demographics, lifestyles, motives and incentives for participating in the program (Table 9). Additional to this survey, a stewardship log (using Google Forms) was also provided to adopters to allow them to record their stewardship activities throughout the summer (Table 10). The goal of this was to get insight into the consistency and structure of stewardship efforts and whether providing a tool for this is advantageous. At the end of the adoption season, a 7-question follow-up questionnaire was sent to resident adopters in Liberty Village to get feedback on their experiences and insight into the stewardship log (Table 11). A 4-question questionnaire was also sent to businesses at this time to get a better understanding of this unique stakeholder in the urban forest community stewardship program (Table 12). These questionnaires included both multiple choice questions and Likert scale (5-point scale from strongly disagree to strongly agree) questions to uncover degrees of opinion on the presented topics. Due to the small number of respondents of these surveys, manual qualitative analyses are utilized, which allows for inference and interpretation of raw data to be synthesized into common themes and key concepts and issues.

RESULTS

Biological evaluation: Tree health assessments

The following results of the statistical analyses are summarized in Table 13.

The Junction

In the Junction from 2017 to 2018, the percentage of street trees with an ‘excellent’ health rating increased 24% from 21% to 45% of the total trees. The percentage of street trees with a ‘good’ health rating decreased 12% from 31% to 19% of the total trees. The percentage of street trees with a ‘fair’ health rating increased 11% from 8% to 19% of the total trees. The percentage of ‘poor’, ‘very poor’ and ‘dead’ trees decreased significantly from 2017 to 2018. Trees rated ‘poor’ decreased 5% from 9% to 4% of total trees, trees rated ‘very poor’ decreased 14% from 25% to 11% of total trees, and ‘dead’ trees decreased from 6% to 2% of total trees, representing a 4% decrease (Figure 4, Figure 5). To supplement this understanding of the change in health ratings of adopted trees in the Junction, 53 trees improved in

health (47% of total trees), 15 trees declined in health (13% of total trees), and 46 had no change in health (40% of total trees) (Figure 6). The Wilcoxon rank sum test for differences in distribution of health classes from 2017 to 2018 returned a p-value of <0.001, indicating that there is a significant change in health ratings in the Junction across one year (Figure 15).

Bloordale

In Bloordale, from 2017 to 2018, the percentage of adopted street trees with an 'excellent' health rating increased 2% from 66% to 68% of total trees. The percentage of street trees with a 'good' health rating increased 7% from 9% to 16% of the total trees. The percentage of street trees with a 'fair' health rating decreased 5% from 7% to 2% of total trees. The percentage of trees rated 'poor' reduced to 0% in 2018 from 7% in 2017. Trees rated 'very poor' decreased 4% from 11% to 7% of total trees. Trees with a 'dead' health rating condition went from 0% in 2017 to 7% in 2018, representing a 7% increase (Figure 7, Figure 8). To supplement this understanding of the change in health ratings of adopted trees in Bloordale, 8 trees improved in health (19% of total trees), 9 trees declined in health (19% of total trees), and 27 had no change in health (62% of total trees) (Figure 9). The Wilcoxon rank sum test for differences in distribution of health classes from 2017 to 2018 in adopted Bloordale trees returned a p-value of 0.806, indicating that there is no significant change in health ratings across the one year in Bloordale.

Bloorcourt

In Bloorcourt from 2017 to 2018, the percentage of street trees with an 'excellent' health rating increased 17% from 39% to 56% of total trees. The percentage of street trees with a 'good' health rating decreased 14% from 25% to 11% of total trees. The percentage of 'fair', 'poor', 'very poor' and 'dead' trees did not change significantly from 2017 to 2018. Trees rated 'fair' decreased 8% from 10% to 2% of total trees, 'poor' increased 3% from 4% to 7% of total trees, trees rated 'very poor' decreased 1% from 16% to 15% of total trees, and 'dead' trees increased from 6% to 9% of total trees, representing a 3% increase (Figure 10, Figure 11). To supplement this understanding of the change in health ratings of unadopted trees, 16 trees improved in health (34% of total trees), 14 trees declined in health (30% of total trees), and 17 had no change in health (36% of total trees) (Figure 12). The Wilcoxon rank sum test for differences in distribution of health classes from 2017 to 2018 returned a p-value of 0.259, indicating that there is no significant change in health ratings across the one year in unadopted trees.

Bloordale and Bloorcourt

As discussed, a series of Wilcoxon rank sum tests were conducted between adopted and unadopted trees to determine if significant differences exist between health ratings. The test on adopted

trees and unadopted trees for 2017 produced a p value of 0.018, meaning there is a significant difference between the health ratings of adopted and unadopted trees in 2017 (Figure 16). The second test also produced a p value of 0.018, indicating a significant difference in health classes exists between adopted and unadopted trees for 2018 as well (Figure 17). A third test compared the direction of changes in health ratings (improved, declined, or no change) from 2017 to 2018 between adopted and unadopted trees, producing a p value of 0.009, indicating a significant difference between the two groups in terms of change in health classes over the one-year period (Figure 18).

Social evaluation: Resident and business adopters

The following results of the social surveys are not to be interpreted as statistically significant but are provided for qualitative analysis to produce an evaluation of the themes, issues and concepts of the social aspects of the Adopt-A-Street-Tree program.

Demographics and motivators

In total, 8 adopters from the Adopt-A-Street-Tree program in Liberty Village responded to the demographics survey. These respondents represent nearly 45% of adopters (there was 18 total adopters involved in the first year of the program in Liberty Village). Out of the 8 respondents, 62.5% identified as between the ages of 25-34 years old, 100% identified as female, 50% have completed a bachelor's degree, 50% are employed full-time, and 37.5% have an annual income of $75,000-$99,999. All respondents, apart from one, have not participated in similar environmental stewardship programs previously or have previous experience or education in environmental sciences or urban forestry. In terms of motivators for participation in the program, 43% of responded 'all of the above', which includes feeling connected to the community, personal fulfillment, enjoyment from working outside with nature, exercising environmental values, and opportunities for social interaction. The remaining respondents were divided among three of the motivators provided (Figure 13).

Stewardship log

In total, there were 32 logs of stewardship activities by 8 different adopters from July to October 2018. Watering was the main activity logged, representing 91% of the total logs (Figure 14). Furthermore, 87% of the stewardship activities were undertaken collectively rather than individually, which represented the other 13% of stewardship activities. Only 4 adopters (22%) in Liberty Village responded to the follow-up survey for individuals, in which two adopters responded to the questions proposed about the stewardship log (only those that were provided or made use of the stewardship log were asked to respond to these two questions). On the Likert scale, in response to the statement 'The stewardship log increased

my motivation to complete stewardship activities for my adopted tree', one adopter responded 'neutral' and one adopter responded 'agree' with the statement. In response to the statement 'The stewardship log helped me be more consistent with my stewardship activities', one adopter responded 'neutral' and one adopter responded 'strongly disagree.'

Program feedback: residents

In the questionnaire for individual adopters in which 4 out of 18 adopters responded, adopters were asked if the benefits or rewards of participating in the program (e.g., builds sense of community, personal fulfillment, exercising environmental values, etc.) outweigh the effort involved, in which two adopters responded 'agree' and two adopters responded 'strongly agree.' Adopters were asked if there were enough tree care resources and reminders provided throughout the summer in which 100% of adopters responded, "yes, there was enough." Adopters were asked if they are aware of the Adopt-A-Tree Facebook group and would like to have more ways to connect with other adopters in the neighbourhood. One adopter responded, "No, and I do not care much for connecting with other adopters," and three adopters responded, "Yes, I'd like more ways to connect with adopters in the neighbourhood." The final question asked if adopters have noticed the tree tags around the neighbourhood with the adopter's name and if this type of recognition of their efforts is desirable. Two adopters responded "Yes, I like to be recognized for my efforts," one adopter responded, "No, doesn't interest me," and one adopter chose "other," and wrote they would like to have only their tree's name on the tag.

Program feedback: businesses

In the questionnaire for businesses in which 2 out of 8 businesses responded, they were presented first with a statement that studies have been conducted that conclude the presence of trees in retail and commercial environments can positively impact consumer behaviour in terms of purchasing and visiting stores. They were then asked if this knowledge increases their motivation to participate in the program, where one business responded, 'agree' and one responded, 'strongly agree'. They were then asked that in recognizing the rise of consumer interest in environmentally conscious businesses, does this motivate them to participate in the program, in which both responded, 'agree'. To build upon this question, businesses were asked if public recognition of their involvement in urban forestry stewardship efforts as a 'green business' (e.g., window decals, tree tags with business name, etc.) interests them and would increase their motivation to participate in the program. One business responded, 'agree' and one responded, 'strongly agree' to this question. The final question asked whether participation in the program helps promote a sense of community in their business in which one business responded, 'agree' and one responded, 'strongly agree'.

DISCUSSION

Biological evaluation: Tree health assessments

Based on the results of the data analysis of tree ratings in the Junction, Bloordale and Bloorcourt neighbourhoods, it can be concluded that adoption through the Adopt-A-Street-Tree program has a positive impact on urban tree health, demonstrated by some of the analyses conducted.

The Junction

In the Junction, the statistical analysis confirms there were significant differences in tree health ratings from 2017 to 2018. In 2018 there was a larger proportion of trees rated 'excellent' than in 2017, and less trees rated 'good', however many of these trees improved in health to 'excellent'. There are also more trees rated 'fair' in 2018, however significantly less trees rated 'poor' and 'very poor' in 2018, as many of these trees improved to 'fair', 'good' or 'excellent' ratings. There is also a smaller proportion of 'dead' trees in 2018 than in 2017. Overall, considering 87% of trees improved or had no change in health rating and only 13% of trees declined in health, the statistical analysis indicates the difference produced is due to the positive impact of adoption over the one-year period.

Bloordale and Bloorcourt

There were no significant differences between Bloordale (adopted) trees in 2017 and 2018, and similarly between Bloorcourt (unadopted) trees in 2017 and 2018. However, no significant differences between these trees in a one-year period is not surprising, as small positive changes may not be captured by a statistical analysis. It is interesting that no significant differences over the year were observed for adopted trees in Bloordale when there was a significant change in the Junction. However, 66% of trees in Bloordale were at an 'excellent' health rating in 2017, meaning only 33% of the trees had the capacity to improve on the Neighbourwoods© scale. Seeing the small positive changes and overall steady healthy canopy in the Bloordale is just as valuable as the significant improvements in tree health seen in the Junction.

Nonetheless, significant differences were produced when comparing adopted and unadopted trees in 2017 and in 2018. In both 2017 and 2018, there is a significantly larger proportion of trees rated 'excellent' in the adopted group. While there is a higher proportion of 'good' trees in the unadopted group in 2017 and a similar proportion of 'good' trees in unadopted and adopted groups in 2018, there is also a higher proportion of unadopted 'poor', 'very poor' and 'dead' trees compared to adopted trees in both years. When comparing change in health from 2017 to 2018 (improved, declined, or no change in health), a significant difference between adopted and unadopted trees was also observed. While unadopted trees saw a higher proportion of trees improve in health than adopted trees, the unadopted group also had a

higher proportion of trees that declined in health. As discussed, adopted trees had a significant proportion of trees with no change health from the previous year, however a majority of the trees (66%) were already at an 'excellent' health rating in 2017, with no room for improvement on the Neighbourwoods© scale. Considering the adopted and unadopted trees were planted around the same time and are likely subject to the same urban conditions, the results of this analysis support the notion that adoption through the Adopt-A-Street-Tree program has a positive impact on urban tree health, when compared to 'unadopted' trees or ones not apart of the LEAF program.

These significant differences observed are likely because unadopted trees in Bloorcourt are assumingly not watered regularly like the trees adopted by stewards. Water can be a significant limiting factor for trees in urban environments and a lack of supplemental water in planted trees can result in poor health and early mortality (Clark & Kjelgren, 1990; Koeser, Gilman, Paz & Harchick, 2014). Stewardship of adopted trees through watering and mulching can reduce drought stress and improve overall tree health. Nonetheless, some adopted trees declined in health over the year, meaning watering is not the only potential limiting factor of tree health. There are many other factors such as insufficient rooting soil volumes, poor soil structure, or injuries from vehicles or machinery that could be contributing to health decline and are factors beyond the adopter's control. For example, the 2018 Neighbourwoods© inventory would take into consideration a new injury to an adopted tree's trunk, which would negatively impact the tree rating, but this is not a reflection of the adopter's care or stewardship efforts. On the other hand, there is a possibility that while volunteers have 'adopted' a tree they may not be following through on their care duties. It is hard to define what an 'adopted' tree truly means without knowledge of the specific actions stewards are taking, potentially reducing the significance of the analyses as the differences may be due to a 'year effect' rather than an 'adoption effect'.

Social evaluation: Resident and business adopters

Which specific factors of the urban forest stewardship model contribute to survival and growth of trees in the urban environment? The various surveys and questionnaires provided to adopters were used to gauge which factors are potentially influencing adopters to engage in the Adopt-A-Street-Tree program and discover potential tools to sustain this engagement. Interpretation of the results are discussed through common themes supported by relevant literature on the social aspects of community environmental stewardship.

Demographics and motivators

There is a gap in understanding the differences among demographic groups engaged in environmental stewardship (Mincey & Vogt, 2014). More research is needed on the type of incentives

effective for various populations taking part in environmental stewardship. The demographic information collected in Liberty Village can help to develop strategies effective for this group of people.

Urban environmental stewardship by community-based urban land managers is on the rise (Svendsen & Campbell, 2008), and this emergence is attributed to a demographic shift of increased civic ecology interest at the personal level and nested within community groups (Krasny & Tidball, 2012). These groups and individuals represent local assets with specific expertise and knowledge that could be better utilized (Svendsen & Campbell, 2008; Krasny & Tidball, 2012). The influence of local actors on urban forest conditions through participation in community stewardship actions depends on individual behavior, which has begun to be explored (Perkins et al., 2004; Wall et al., 2006; Conway et al., 2011).

Individual residents are a unique group due to their daily interactions with trees in proximity to where they live and work (Moskell & Allred, 2013). Various studies have investigated the outcomes of urban tree stewardship or related activities that motivate community members to participate and perceptions of such programs. While environmental improvement is often a primary motivator for stewardship, the social benefits are just as important (Wolf et al., 2003). These include opportunity for social interaction, connecting to their community, personal fulfillment, enjoyment from working outside and with nature, educational aspects, and exercising emotional or spiritual values of the environment (Dowell, 2017; Austin, 2002; Boyce, 2010; Moskell & Allred, 2013). These motivators present in literature are consistent with responses from the survey of adopters in Liberty Village, and the previous survey by Dowell (2017). These factors differ extensively from utilitarian approaches utilized by government institutions for urban forestry engagement and provide a more holistic understanding of the public's perceptions of and preferences for the urban forest (Austin, 2002). Cities often use economic and environmental benefits to advocate for trees, but on an individual level people hold cultural value towards trees that are an underrepresented aspect of urban forest management. There is an inherent interest of nature in humans, who seek connections to nature, which is not understood by the modern-day view of trees as ways for reducing energy costs or for curbing climate change. Residents want to adopt a tree for reasons beyond the tree itself, and motivators are the direct outcomes from participating in stewardship of the tree. Indirect social outcomes that arise from active and passive encounters with city nature generate include social ecology (Krasney & Tidball, 2012), community resilience (Svdenson, 2009; Tidball & Krasny, 2012), ecological democracy (Hester, 2006) and improving social ties (Kuo, 2003). While it is unclear whether adopters are aware of these other outcomes, there seems to be an interest in improving social ties through the program as some adopters in Liberty Village are interested in connecting with other tree adopters in their community, beyond social media platforms.

Business adopters

While the Adopt-A-Street-Tree program facilitates community member participation, business groups also play a role in stewardship of trees in their respective communities. In neighbourhoods where Adopt-A-Street-Tree has been implemented, LEAF recognizes the challenges of engaging businesses in the program (E. MacDonald, personal communication, February 13, 2018). Involving businesses is important as they represent more permanent entities within neighborhoods, however there is a void in the literature about the role of the business sector in environmental stewardship. As LEAF continues to expand the Adopt-A-Street-Tree program into new neighbourhoods across Toronto, a better understanding this group's role in the process and strategies to enhance their engagement is necessary. The questionnaire sent to businesses in Liberty Village was intended to get some initial insight into their motivators for participation and potential incentives to increase business involvement.

The business community operates differently from non-profit groups in its involvement in stewardship of the local environment (Svendsen & Campbell, 2008). Often, businesses take an "arm's length" approach by acting as a source of funding or participating in large scale environmental events, however participation in long-term environmental stewardship is rarely fulfilled by these entities (Svendsen & Campbell, 2008). Furthermore, urban tree benefits are generally indirect and there is a lack of an effective market for trees and their ecosystem services to provide direct returns to businesses (Wolf, 2003). The environmental and social benefits that accrue from urban forests may not be particularly incentivizing for business audiences, or they may be overlooked. While trees are not always a priority for them, businesses should be interested in urban trees as they can play an important role in creating appealing retail and commercial environments (Wolf, 2003). Trees alter people's perceptions of commercial areas, and their behavior of purchasing and visiting stores is positively related to streetscape greening (Wolf, 2003). Maintaining trees in the vicinity of business areas can improve the overall outdoor environment and thereby positively impact consumer choice and behavior to encourage more frequent visits, more time spent shopping and more spending by consumers (Wolf, 2003). Businesses in Liberty Village that responded to the questionnaire agreed that knowledge of the positive outcomes of trees in consumer environments increases their motivation to participate.

The business sector represents for-profit actors, and therefore require creative economic incentives to engage them in urban tree stewardship. Another angle for engaging businesses is using the rise of consumer interest in environmentally supportive businesses to LEAF's advantage. Portraying a 'green' image by involvement in urban forestry practices may help to bring in customers and remain competitive (Conway et al., 2011), and LEAF can provide tools to create a 'green' image for businesses that are involved in their program.

Collective action

Community-based urban forest management involves engaging residents and businesses in stewardship efforts to achieve the city's vision of a sustainable urban forest and collectively these groups can contribute significantly to the co-production of urban forest resources (Mincey & Vogt, 2014). Collective action is an important concept, and it is defined as groups who work together towards a shared interest or goal, "whose realization depends on the coordinated actions of those groups" (Meinzen-Dick et al., 2004), and participation in assisting the public good is to "contribute to its preservation and continuation" (Marschall, 2004). Studies have demonstrated that collective action leads to enhanced outcomes of social projects and these actions will transcend into additional forms of collaboration for the greater good (Mincey & Vogt, 2014).

The success of such projects involving collective action depends on the rules, norms, strategies that the host institutions, such as LEAF, use to encourage ongoing behavior (Ostrom, 2009). In Liberty Village, it was determined that a majority of adopters are already using a collective method during their stewardship activities. Mechanisms can be implemented to ensure individuals are contributing to the collective goal, such as clearly defined rules and shared responsibilities, monitoring of their actions, or imposing sanctions (Mincey & Vogt, 2014). Mincey and Vogt (2014) argue that these mechanisms could lead to higher accountability. Formal or written agreements could be used to solidify commitment of participants.

Furthermore, Mincey and Vogt (2014) suggest that regular meetings and opportunities for interaction among stewards could act as a form of social sanctioning and motivation could come simply from this social network that can form between stewards. Some adopters who responded to the questionnaire for individuals agreed that more ways to connect with other adopters is desirable. The Facebook group for Liberty Village adopters is a good initial step in forming these social ties, but more ways to connect may help strengthen the community network and thereby the mechanisms underpinning collective action.

RECOMMENDATIONS

The purpose of this research was to review and evaluate the biological and social aspects of LEAF's Adopt-a-Street-Tree program to identify successes, areas for improvement and tools to enhance the adopter experience. The following recommendations are based on the research conducted and literature on similar environmental stewardship studies, however it is recognized that potential limitations of staff, resources, and funding available ultimately determine the feasibility of these suggestions.

Biological evaluation: Tree health assessments

The Neighbourwoods© inventory data from 2017 to 2018 is valuable and can be used as a benchmark for the Adopt-A-Street-Tree program's impact on urban street tree health. It is recommended that LEAF continue to collect data on a yearly basis to monitor impacts in the long-term. An accumulation of biological health data can be used in future longitudinal data analyses that allow for studying changes over time in urban tree health where the program is operating, and to observe whether the significant outcomes produced by research in the past two years will become a trend over the next 5 or 10 years, for example. This will help to justify the program's expansion across the City of Toronto, while communicating to volunteers that their help is effective, thereby potentially sustaining volunteer engagement over the long-term.

A challenge LEAF faces related to evaluation of the Adopt-A-Street-Tree program's impact on street tree health, is the inability to define exactly what a tree being 'adopted' or 'unadopted' signifies as there a lack of data on the stewardship actions of adopters. LEAF has an adoption tracking spreadsheet for the Junction that some adopters utilize to log their stewardship activities and observations, but implementing this on a wider scale may help to alleviate the issue of uncertainty surrounding what an 'adopted' tree means and strengthen the arguments for adoption. This also supports the recommendation to continue monitoring shifts in tree health beyond this first year in order to improve the legitimacy that the significant differences produced are due to adoption and not a year effect.

Social evaluation: Structure of the Adopt-A-Street-Tree model

The City of Toronto has qualities of community composition that lends itself to co-management of public biophysical resources at nested neighbourhood scales and is a city of rapid development and ongoing revitalization. LEAF has capitalized on these characteristics by targeting established neighbourhoods and developing relationships with support from local BIAs to create community-based urban forest stewardship. The program provides training to "core volunteers" to solicit tree adopters to water trees and maintain their rooting zone to augment maintenance efforts by the municipality. LEAF offers support to the adopters via tree care resources (watering cans, tree care manuals), guidance on aspects of tree care and acts as a point of contact for questions and concerns. Adoption recognition decals and tree gate signs are also provided in some programs as a form of recognition. What other strategies or mechanisms could improve participation in the program and generate excitement?

Motivators for engagement

Engaging residents on a wider scale remains a significant challenge, however insight into motivators for participation and other positive social dynamics that arise can help to develop appropriate

strategies for improved interactions between organizations and local citizens (McPherson & Young, 2010). The benefits of tree stewardship extend beyond the trees and a better understanding and appreciation for the human dimension can further efforts of developing effective and inclusive partnerships between actors (Austin, 2002; Wolf et al., 2003). Individuals want to adopt a tree for reasons beyond the tree itself and scaling up the individual motivators for participation, such as building a sense of community, personal fulfillment, and connecting with nature is a difficult but worthwhile task. Building off Dowell's (2017) research into the social aspect of urban tree stewardship and the feedback received from Liberty Village adopters, when recruiting new tree stewards, LEAF should communicate these positive aspects and outcomes of participation, such as how it can improve their daily lives, to existing and potential stewards. Reinforcing the values of the urban forest to communities through direct communication, marketing tools, or resources sent out to volunteers is essential to facilitating continued engagement.

In terms of utilizing demographic information, strategies can be developed for LEAF to connect with the target community. For example, Liberty Village is the latest neighbourhood where the Adopt-A-Street-Tree program has been implemented, and is a community combining residential and commercial uses that attracts a crowd of young professionals and families. The program for this neighbourhood should therefore be tailored to this group of people by understanding what may influence them to participate in community programs. The results from the demographic survey in Liberty Village, while a small sample size, indicate that the majority of current adopters are females between the ages of 25 and 34 years old. This information can be used for strategies to approach new volunteers, such as social events or family-oriented volunteer training events. Nonetheless, it is recommended that LEAF also consider ways to attract more of the underrepresented groups involved in environmental stewardship. This is beyond the scope of this paper, however a general recommendation is to increase presence on social media and participating in a variety of community events to publicize the Adopt-A-Street-Tree program.

Program impact and education

As discussed, LEAF should continue to collect data and build compelling information about the effectiveness of the program. Survey respondents indicated that knowledge and evidence that the Adopt-A-Street-Tree program is having a positive impact, increases their motivation to partake in the program. Recognizing the productivity of the program in terms of tree health and the overall community is a good method of attracting new adopters and sustaining engagement of existing adopters. Furthermore, education is a critical aspect to raise awareness about trees and engage citizens in urban forest stewardship, as Moskell and Allred (2013) and Austin (2002) found in their studies, that there is already a strong education interest among residents in learning about trees. Outreach and education about the urban

forest and providing an understanding of the values of their actions will strengthen interest and increase involvement in the program. In the Liberty Village questionnaire, the majority of individuals did not have previous experience or education in the realm of urban forestry, which demonstrates the importance of educating the public to garner more participation in environmental community programs. General outreach and education by LEAF could be done through informational sessions in existing or prospective neighbourhoods for the Adopt-A-Street-Tree program, such as 'tree tours' to educate residents about the program, and participation in other community events. Combining the popular tree identification walk with Adopt-A-Street-Tree orientation could be way to attract more people through education.

Watering strategies, collective action and stewardship log

Watering of young urban trees is critical to their growth and survival and long-term water stress can decrease growth and lead to mortality (Mincey & Vogt, 2014). Watering by stewards is especially important given the lack of municipal management and resources available and the high levels of water stress in urban environments (Moskell et al., 2016). Tree growth and survival may therefore be impacted by the watering strategies that community groups utilize in their stewardship programs. Mincey and Vogt (2014) examined the variety of strategies used by community groups in neighborhood tree management and how tree growth and survival relate. Generally, two types of watering strategies exist: collective – where participants gather at a specified time to water trees, and individual – where participants are individually responsible to water trees on their own time. The study found that survival was higher in neighbourhoods that utilized a collective watering strategy, however a lack of data on the consistency of watering weakens this relationship (Mincey & Vogt 2014). Coupling this knowledge with the concept of social sanctioning, LEAF could encourage the collective watering strategy where appropriate to enhance commitments. Partnerships (coupling two residents together to maintain a tree with the potential to alternate weekly duties) and teamwork could enhance the consistency of stewardship actions and accountability. This would also serve as a means to strengthen community social ties with reoccurring interaction among LEAF and its stewards. Furthermore, issues with stewards having to source their own water and the physical challenges associated with transporting water from the source to the tree could be alleviated through a collective watering strategy. Coordination of watering by providing a source for everyone at once may ease the challenges of the individual watering strategy.

Collective watering strategy could also include signed agreements between stewards, monitoring of one another and verbal reminders for encouragement (Moskell et al., 2016). Furthermore, as Dowell (2017) found in the volunteer feedback that a lack of responsibility by other adopters was frustrating, a collective strategy may remediate this issue. A majority of respondents to the questionnaire in Liberty

Village recorded they did their stewardship actions collectively, and LEAF could expand on this by offering more support in organizing collaboration among adopters.

The stewardship log provided in the beginning of the season was developed as a mechanism to potentially increase adopters' motivation and consistency of stewardship activities through reinforcement that adoption is a collective effort. The aim was that if adopters knew LEAF or the community organizers of the program were aware of when and how often they were performing stewardship activities, that it would increase motivation and consistency of their actions. Due to the small number of respondents to the questionnaire about the stewardship log, it is unclear whether it had that effect, but respondents did somewhat agree that it increased their motivation. More research is required to see if it is an effective tool, however monitoring of people's actions, such as watering, to encourage repeated behaviour could be utilized and has shown to have positive outcomes on survival and growth of trees (Mincey & Vogt, 2014). Furthermore, the format of the stewardship log provided did not allow adopters to view each other's logged stewardship activities. Considering the literature that commitment of participants in stewardship programs can depend on trust and the actions of others involved and that reciprocal mechanisms are at work, providing a way for adopters to view each other's efforts in the program through the stewardship log may increase participation and consistency of efforts. As discussed, the physical design and provision of physical resources in the program play a big role in determining the degree of stewardship commitment (Moskell et al., 2016).

Monitoring and informational strategies

Currently, LEAF has relatively limited contact with its adopters in the Adopt-A-Street-Tree program and no consensus on how often stewardship duties are fulfilled. Informational strategies to provide tree care tips and information on tree stewardship responsibilities can be used by organizations to enhance awareness and education and promote desired behaviour of the stewards (Steg & Vlek, 2009). LEAF sends Adopt-A-Street-Tree stewards tree care tips every 2-3 weeks in the summer and provides tree care manuals, however respondents in the social evaluation survey by Dowell (2017) want to see more tree care material, and resources to guide them in fulfilling their responsibilities. Reminders to complete responsibilities have been studied as effective, especially if they are noticeable, have strong visuals, are self-explanatory and occur near the time of when the behaviour should be carried out (McKenzie-Mohr, 2011; Tetlow et al., 2014). This strategy is relatively low cost if postcards in the mail or emails are used (Lehman & Geller, 2004). In one study, outreach intervention seemed to have a positive impact on watering behavior as soil moisture was higher for trees adopted by the group receiving these reminders (Moskell et al., 2016). The study also aimed to use soil moisture data to validate residents' self-reported watering behaviour, which would require further research to determine if this is an

effective method of monitoring stewardship actions (Moskell et al., 2016). Monitoring of soil moisture and other stewardship duties may encourage more consistent behaviour from the stewards knowing that their actions were being tracked by LEAF. Stewards recording their own actions could also give them a sense of fulfillment from seeing the positive results of their efforts add up over the long-term. As discussed, the stewardship log provided to Liberty Village adopters could be developed further to become a tool to gain more insight into fulfillment of stewardship activities, while simultaneously encouraging consistency, developing accountability, and increasing communication between LEAF and its volunteers.

Online platform

To expand on the idea of the stewardship log, an online platform could be a valuable way to combine all previous recommendations. As an example, New York City has developed an online street tree map with a comprehensive inventory of their urban trees that allows residents to access the information and record and share caretaking and tree stewardship activities of individual trees (NYC Parks, n.d.). Tree information such as species, DBH, ecological benefits and a log of these stewardship activities is kept for each tree. Furthermore, information on active community groups undertaking tree care and ways to join is provided. Creating a platform to connect with other volunteers and to view the ongoing stewardship activities may increase engagement, as this builds off the idea of collective action. This platform could also allow LEAF to send reminders for tree care, highlight trees in need of care, show contributions of tree care over time to adopters, and ultimately become a platform to establish a network of volunteers, thereby increasing social ties which was said to be desirable by adopters in Liberty Village. This platform would likely require further partnership with the City of Toronto to develop but is in the city's best interest as this can elevate their basic urban tree inventory to include detailed information on tree health thereby helping them to effectively manage the urban forest.

Incentives for businesses

Attracting engagement from businesses represents a unique issue for LEAF and requires using an approach different from that of residents as businesses generally operate on economic incentives. Using existing studies on the positive relationship between consumerism and presence of trees is one way to communicate the importance of having a healthy tree canopy near their business and that they can play a role in this through stewardship of these trees. This information may be important to communicate to potential businesses and to incentivise them to engage in the program. As well, many consumers are drawn to businesses that give back to their community and are committed to the environment. LEAF should offer this public recognition to provide the image of a 'green business', which was discussed as being desirable by businesses in Liberty Village, and that display of this through decals or signage is

appealing. In some neighbourhoods these decals have been provided, and more creative ways of providing this recognition through social media or being included in the BIA's marketing and promotional materials, which could also attract new businesses, could be explored by LEAF. Another angle on it could be to create a carbon neutral program by presenting the program as a way of offset carbon emissions of the businesses involved. Certificates, awards, plaques, recognition in a public newsletter or magazine, or social media promotion could capture the attention of the public and raise the public profile of LEAF and the businesses who get involved, simultaneously attracting more customers to the businesses and participants to the Adopt-A-Street-Tree program. More research into specific forms of incentives effective for this group is necessary but integrating economic incentives into the program is key in forming environmentally effective partnerships between LEAF and businesses.

In Liberty Village, the BIA currently organizes many community events and block parties that allow businesses to showcase their products or services. These events are great networking opportunities for LEAF to attract new stewards to the program, while also communicating with businesses that are present. In the future, these types of events could be angled as a celebration of the Adopt-A-Street-Tree program. Furthermore, the businesses who responded to the questionnaire are interested in participating for the sense of community it promotes. This means that businesses that partake in such community events are likely to recognize this positive aspect of participating in the program and if not, this can be communicated. Furthermore, LEAF could create tree care walks oriented to businesses, which may be popular among businesses looking for team-building events. It is recommended that LEAF create a brochure specific to businesses to include the information discussed.

Mobile application for both businesses and residents

Based on the idea of an online platform, a mobile app could be developed that has the Adopt-A-Street-Tree inventories built in, and where adopters can also log and track their tree care efforts (which be a source of data for research), report issues with their stewarded trees, and take photos for visual assessments. However, the app would incorporate both resident and business interests and reconcile the challenges associated with addressing resident and business incentives separately. Businesses could be involved in the app by offering coupons, deals or advertising to the stewards that are registered, and could also offer a points or rewards system with continued use of the app that can be redeemed in the participating local businesses. Businesses could also contribute to a prize and award it to a community group or members that have made significant contributions to the program. This would motivate stewards to continue engagement in the program while connecting them to participating businesses, increasing business exposure and potentially driving their sales. LEAF's database of stewards could be contained in the app, potentially acting as an online place for stewards to connect with one another and form

partnerships in efforts to maintain trees in their neighbourhood. Communication between LEAF and stewards is also possible, with reminders and information being sent directly to users' phones. Online presence and mobile options are an important part of organizations' and businesses' success and will improve chances of generating additional revenue, building steward loyalty, and is an easy way to engage interested parties everyday. Furthermore, this app could help to streamline Neighbourwoods© data collection in the field as a mobile data collection tool. This type of software has already been created and LEAF could partner with these developers.

As this was the first year of collecting social data from the program in Liberty Village, there was limited feedback in the short amount of time in which the program had been operating. As participation increases, LEAF can assess the social factors influencing the success of the program more thoroughly or begin to collect data across all Adopt-A-Street-Tree communities.

CONCLUSION

LEAF is actively integrating biophysical and social objectives into their Adopt-A-Street-Tree program and their attempt to straddle the divide between environmental enhancement and community engagement has proved fruitful over the past couple years. However, there is always room for improvement especially in the context of urban forestry, which faces many multilayered challenges in a city with complex public and private interests. Conducting an assessment of opportunities to enhance urban forest stewardship and providing direction for future action can increase diversity of involved stewards, elevate relationships between stakeholders, and thereby positively impact communities in a variety of ways. Shifting focus from a government-based approach to a model that supports community involvement leads to strengthened neighbourhood connections and increased awareness and education of trees and the benefits they provide (Fisher et al. 2015; van Wassanaer et al. 2012). Stewards involved will develop deeper attachment to their communities and environmental values that will transcend to other forms of civic engagement and activities (Fisher et al. 2015).

Toronto's communities and residents can play a crucial role in the monitoring and management of existing street trees, improving their chance to survive in the city environment. Managing the urban forest towards a canopy cover goal necessitates finding new, innovative strategies to create an inclusive multi-stakeholder system with a shared sense of responsibility for stewardship of the urban forest. The goal of this research was to narrow down these opportunities and provide recommendations for the future of the Adopt-A-Street-Tree program. An extension of this research could include more rigorous research into the strategies used to engage adopters and how this transcends into improved urban street tree health. The

program is a unique and valuable tool that faces many challenges, however, its initial success demonstrates the power of collaboration in achieving a collective goal. Incrementally, the impact of LEAF's Adopt-A-Street-Tree program across different neighbourhoods will demonstrate how community-based urban forest management plays a significant role in achieving Toronto's vision of a healthy, sustainable urban tree canopy.

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TABLES

Table 1: Neighbourwoods© criteria, definitions, and associated measurement scale for data collection

	Criteria	Definition	Measurement Scale
1	Species	Standard 6 letter species code	N/A
2	Number of stems	The number of tree stems present at 1.3m	Numeric
3	Diameter at breast height (DBH)	The diameter of the tree trunk at 1.3m	Centimetres
4	Percent of hard surface	The proportion of ground surface under the canopy dripline that is hard surface	Percentage
5	Crown width	The width of the tree crown	Metres
6	Height to base of crown	The distance from ground to the base of the crown	Metres
7	Total height	The distance from the ground to top of the tree	Metres
8	Reduced crown	The proportion of the tree's crown that is missing or removed	Neighbourwoods scale (0-3)
9	Unbalanced crown	The proportion of the tree's crown that is asymmetrical or lopsided	Neighbourwoods scale (0-3)
10	Crown defoliation	The proportion of the tree's crown that is defoliated	Neighbourwoods scale (0-3)
11	Weak oy yellowing foliage	The proportion of the tree's crown that has irregularly small or discoloured foliage	Neighbourwoods scale (0-3)
12	Large dead or broken branches	The amount of major dead or broken branches	Neighbourwoods scale (0-3)
13	Lean	The degree of lean of the tree's main stem	Neighbourwoods scale (0-3)
14	Poor branch attachment	The severity of a poor branch attachment between the tree's main stem and a branch	Neighbourwoods scale (0-3)
15	Branch scar	The amount and severity of scars on the branches	Neighbourwoods scale (0-3)
16	Trunk scar	The amount and severity of scars on the trunk	Neighbourwoods scale (0-3)
17	Conks	The presence of a fungal conk on the tree's stem	Neighbourwoods scale (0-3)
18	Rot or cavity – major branch	The presence and severity of rot or cavities on the tree's major branches	Neighbourwoods scale (0-3)
19	Rot or cavity – trunk	The presence and severity of rot or cavities on the tree's trunk	Neighbourwoods scale (0-3)
20	Confined rooting space	The proportion of rooting space under the canopy dripline that is constricted by an obstruction or conflict	Neighbourwoods scale (0-3)
21	Cracks	The presence and severity of cracks on the trunk or major branches	Neighbourwoods scale (0-3)
22	Girdling roots	The presence and severity of girdling roots at base of trunk	Neighbourwoods scale (0-3)
23	Root trenching	The presence and severity of root trenching or cutting within the rooting area	Neighbourwoods scale (0-3)

24	Overhead wires	The presence of a conflict between the tree and overhead wires	Neighbourwoods scale (N-No, E-Existing, P-Potential)
25	Conflict with structure	The presence of a conflict between the tree and a structure	Neighbourwoods scale (N-No, E-Existing, P-Potential)
26	Conflict with sidewalk	The presence of a conflict between the tree and a sidewalk	Neighbourwoods scale (N-No, E-Existing, P-Potential)
27	Conflict with trees	The presence of a conflict between the trees and another tree crown	Neighbourwoods scale (N-No, E-Existing, P-Potential)
28	Conflict with traffic signs	The presence of a conflict between the tree and a traffic sign	Neighbourwoods scale (N-No, E-Existing, P-Potential)

Table 2: The Junction: Neighbourwoods health ratings for trees in LEAF's Adopt-A-Street-Tree program

Neighbourwoods health rating	**2017**	**2018**
Excellent (6)	25	51
Good (5)	37	22
Fair (4)	10	22
Poor (3)	11	4
Very poor (2)	30	12
Dead (1)	7	2
Total # of trees	120	113

Number of trees in each category of health rating in 2017 and 2018 for trees apart of LEAF's Adopt-A-Street-Tree program in the Junction.

Table 3: The Junction: Change in category of Neighbourwoods tree health ratings from 2017 to 2018

Change in health category	# of trees
Improved (+1)	53
Declined (-1)	15
No change (0)	45
Total # of trees	113

Number of trees that have improved in health (health rating went up), declined in health (health rating went down), and had no change in health (health rating stayed the same) from 2017 to 2018 in the Junction Adopt-A-Street-Tree program.

Table 4: Bloordale: Neighbourwoods health ratings for trees in LEAF's Adopt-A-Street-Tree program

Neighbourwoods health rating	2017	2018
Excellent (6)	29	30
Good (5)	4	7
Fair (4)	3	1
Poor (3)	3	0
Very poor (2)	5	3
Dead (1)	0	3
Total # of trees	44	44

Number of trees in each category of health rating in 2017 and 2018 for trees apart of LEAF's Adopt-A-Street-Tree program in Bloordale

Table 5: Bloordale: Change in category of Neighbourwoods tree health ratings from 2017 to 2018

Change in health category	# of trees
Improved (+1)	8
Declined (-1)	9
No change (0)	27
Total # of trees	44

Number of trees that have improved in health (health rating went up), declined in health (health rating went down), and had no change in health (health rating stayed the same) from 2017 to 2018 in the Bloordale Adopt-A-Street-Tree program

Table 6: Bloorcourt: Neighbourwoods health ratings for trees not belonging to LEAF's Adopt-A-Street-Tree program

Neighbourwoods health rating	2017	2018
Excellent (6)	19	26
Good (5)	12	5
Fair (4)	5	1
Poor (3)	2	3
Very poor (2)	8	7
Dead (1)	3	4
Total # of trees	49	46

Number of trees in each category of health rating in 2017 and 2018 for trees not apart of LEAF's Adopt-A-Street-Tree program in Bloorcourt, a block adjacent to Bloordale trees (adopted trees).

Table 7: Bloorcourt: Change in category of Neighbourwoods tree health ratings in Bloorcourt from 2017 to 2018

Change in health in category	# of trees
Improved (+1)	8
Declined (-1)	9
No change (0)	27
Total # of trees	44

Number of trees that have improved in health (health rating went up), declined in health (health rating went down), and had no change in health (health rating stayed the same) from 2017 to 2018 in Bloorcourt (trees are unadopted, or not apart of LEAF's Adopt-A-Street-Tree program).

Table 8: Data used in statistical analyses to understand the effect of adoption on tree health in LEAF's Adopt-A-Street-Tree programs

Site	Location	# of trees		Mean health rating (1-6)			Mean direction of change in category of health rating (-1/0/+1)
		2017	2018	2017	2018	Between years	
1	Bloordale (adopted)	44	44	5.2	5.3	5.15	-0.02
	Bloorcourt (unadopted)	49	46	3.5	4.6	4.55	0.04
2	The Junction	120	113	3.9	4.8	4.35	0.35

Table 9: Demographics and motivators survey given to adopters in LEAF's Adopt-A-Street-Tree program in Liberty Village

1. What is your age?
    a) Under 18 years old
    b) 18-24 years old
    c) 25-34 years old
    d) 35-44 years old
    e) 45-54 years old
    f) 55-64 years old
    g) 65-74 years old
    h) 75 years old or older

2. What is your gender?
    a) Female
    b) Male
    c) Prefer not to say
    d) Other…

3. What is the highest degree or level of school you have completed?
    a) Less than a high school diploma
    b) High school graduate, diploma or equivalent
    c) Some college, no degree
    d) Associate degree
    e) Bachelor's degree
    f) Master's degree
    g) Professional degree
    h) Other…

4. What is your current employment status?
    a) Employed full-time (40 or more hours per week)
    b) Employed part-time (up to 39 hours per week)
    c) Self-employed
    d) Unemployed
    e) Student
    f) Retired

5. What is your annual income?
    a) Less than $20,000
    b) $20,000 to $34,999
    c) $35,000 to $49,999
    d) $50,000 to $74,999
    e) $75,000 to $99,000
    f) Over $100,000
    g) Prefer not to say
    h) Other…

6. Have you previously participated in similar environmental stewardship programs? If yes, please explain.
    a) Yes
    b) No

7. Do you have previous experience/education in environmental sciences or urban forestry? If yes, please explain.
    a) Yes
    b) No

8. What motivates you to participate in the Adopt-A-Tree program?
    a) Feeling connected to your community
    b) Personal fulfillment
    c) Enjoyment from working outside
    d) Exercising environmental values
    e) Opportunities for social interaction
    f) All of the above
    g) Other…

Table 10: Stewardship log given to adopters in LEAF's Adopt-A-Street-Tree program in Liberty Village in 2018

1. What is your name or business name?
2. What tree have you adopted?
3. What activity did you complete?
    a) Watered
    b) Cleared litter/waste
    c) Landscaped/planted flowers
    d) Managed soil
    e) Mulched
    f) Weeded
    g) Other…

4. What day did you complete the activity?
5. Did you care for the tree individually or collectively (with others)?
    a) Individually
    b) Collectively
    c) Other…

Table 11: Follow-up questionnaire given to adopters in LEAF's Adopt-A-Street-Tree program in Liberty Village in 2018

1. The Stewardship Log increased my motivation to complete stewardship activities for my adopted tree:

Strongly disagree 1 2 3 4 5 Strongly agree

2. The Stewardship Log helped me to be more consistent with my stewardship activities:

Strongly disagree 1 2 3 4 5 Strongly agree

3. There is evidence in other neighbourhoods where the Adopt-A-Street-Tree program is operating (Junction, Bloordale) that stewardship of the trees by adopters is having a positive impact on tree health. Does knowing this increase your motivation to continue to participate in the program?

Strongly disagree 1 2 3 4 5 Strongly agree

4. Do you believe the benefits/rewards of participating in the program (sense of community, personal fulfillment, exercising environmental values, etc.) outweigh the effort involved?

Strongly disagree 1 2 3 4 5 Strongly agree

5. Were enough tree care resources and reminders provided to you throughout the summer?

a) Yes, there was enough.
b) No, I'd like to see more.

6. Are you aware of the Adopt-a-Tree Facebook group? Would you like to have more ways to connect with other adopters in the neighbourhood?

a) Yes, and I'd like more ways to connect with adopters in the neighbourhood.
b) No, and I do not care much for connecting with other adopters.
c) Other…

7. Have you noticed the tree tags around the neighbourhood with adopter's names? Is this type of recognition for your efforts desirable?

a) Yes, I like to be recognized for my efforts.
b) No, that doesn't interest me.
c) Other…

Table 12: Follow-up questionnaire given to businesses in LEAF's Adopt-A-Street-Tree program in Liberty Village in 2018

1. Studies have been conducted that conclude the presence of trees in retail and commercial environments can positively impact consumer behaviour in terms of purchasing and visiting stores. This knowledge increases your motivation to participate in the program:
Strongly disagree 1 2 3 4 5 Strongly agree

2. In recognizing the rise of consumer interest in environmentally conscious businesses, this motivates you to participate in the program:
Strongly disagree 1 2 3 4 5 Strongly agree

3. Furthermore, public recognition of your involvement in urban forestry efforts as a 'green business' (window decals, tree tags with business name etc.) interests you and would increase your motivation to participate in the program:
Strongly disagree 1 2 3 4 5 Strongly agree

4. Participation in the program helps promote a sense of community in your business:
Strongly disagree 1 2 3 4 5 Strongly agree

Table 13: Results of Wilcoxon rank sum tests on trees in Toronto unadopted and adopted in LEAF's Adopt-A-Street-Tree program from 2017-2018

Data	Location	Year	Analysis	p-value	# of trees
Health ratings					
	Junction	2017-2018	By year	<0.001*	233
	Bloordale	2017-2018	By year	0.806	88
	Bloorcourt	2017-2018	By year	0.259	97
	Bloordale and Bloorcourt	2017	By adoption	0.018*	94
	Bloordale and Bloorcourt	2018	By adoption	0.018*	91
Change in category of health rating					
	Bloordale and Bloorcourt	2017-2018	By adoption	0.009*	91

Analysis by year looks at difference between tree health ratings from 2017 to 2018. Analysis by adoption looks at the effect of adoption on differences in health ratings between adopted and unadopted trees. (*=statistically significant)

FIGURES

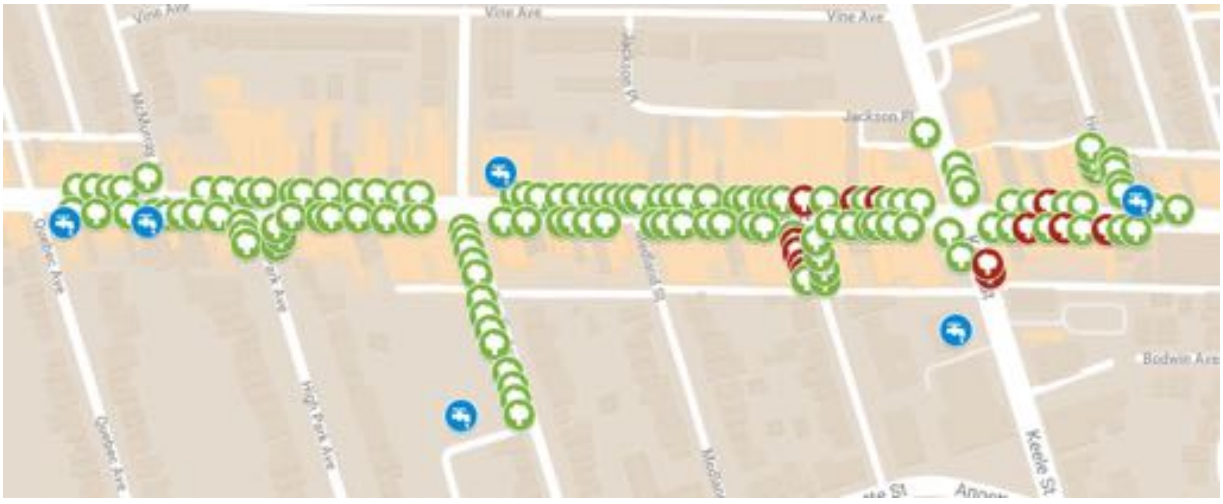


Figure 1: Map of the Junction's Adopt-A-Street-Tree project area. Tree symbols indicate the location of trees included in the Adopt-A-Street-Tree program.

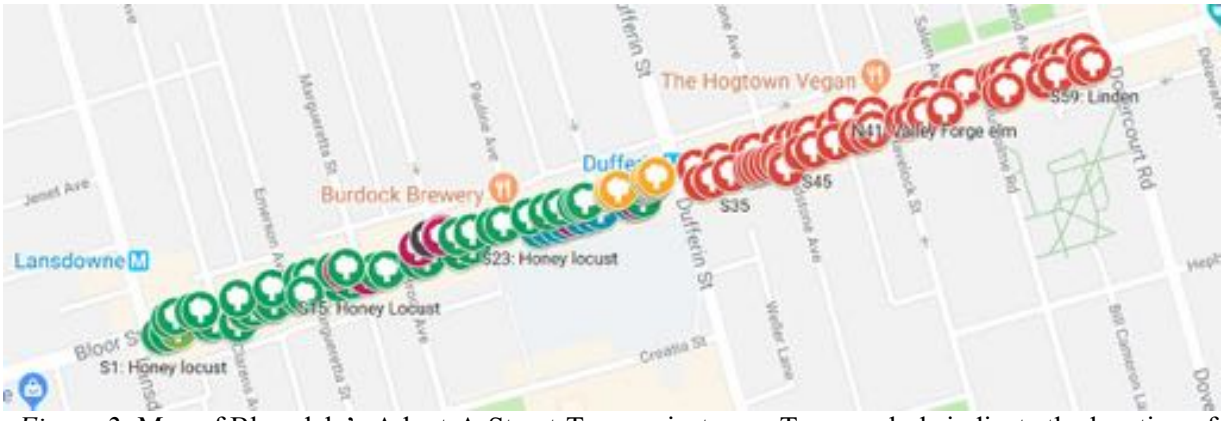


Figure 2: Map of Bloordale's Adopt-A-Street-Tree project area. Tree symbols indicate the location of trees included in the Adopt-A-Street-Tree program.

Figure 3: Map of Liberty Village's Adopt-A-Street-Tree project area. Tree symbols indicate the location of trees included in the Adopt-A-Street-Tree program.

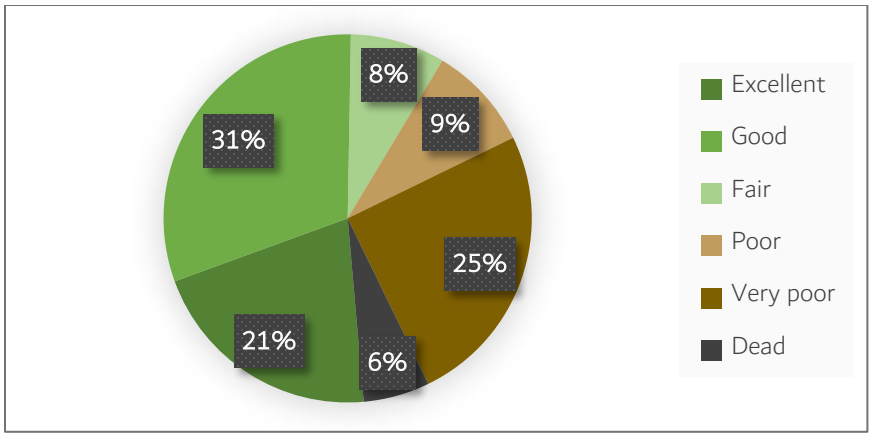


Figure 4: Neighbourwoods health ratings for trees in the Junction's Adopt-A-Street-Tree program in 2017 (n=120).

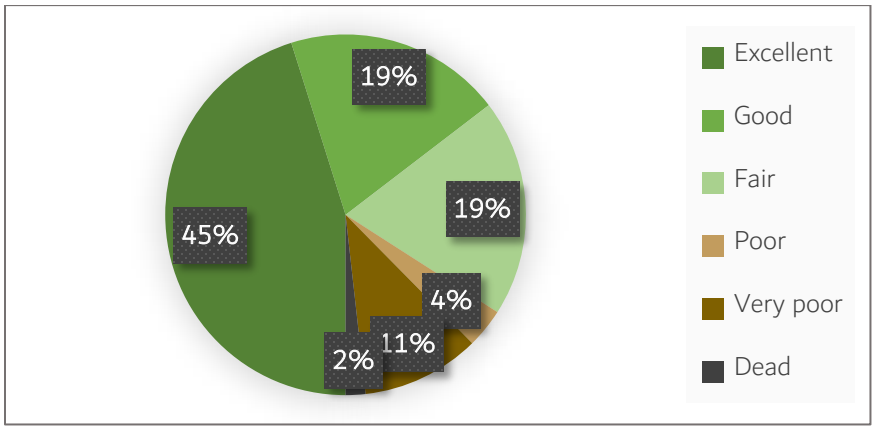


Figure 5: Neighbourwoods health ratings for trees in the Junction's Adopt-A-Street-Tree program in 2018 (n=113).

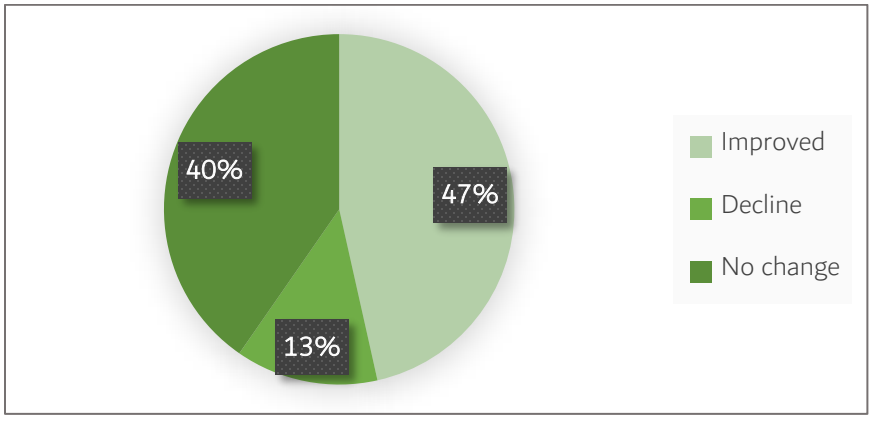


Figure 6: Change in category of Neighbourwoods health ratings for trees in the Junction's Adopt-A-Street-Tree program from 2017 to 2018 (n=114).

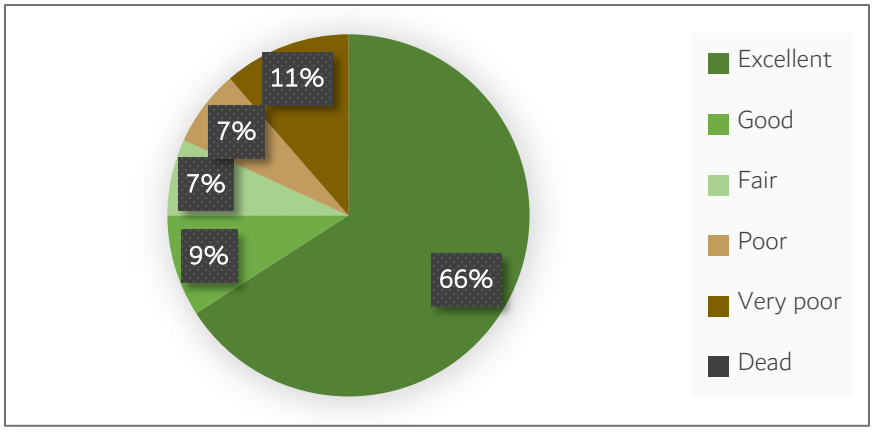


Figure 7: Neighbourwoods health ratings for trees in the Bloordale's Adopt-A-Street-Tree program in 2017 (n=44).

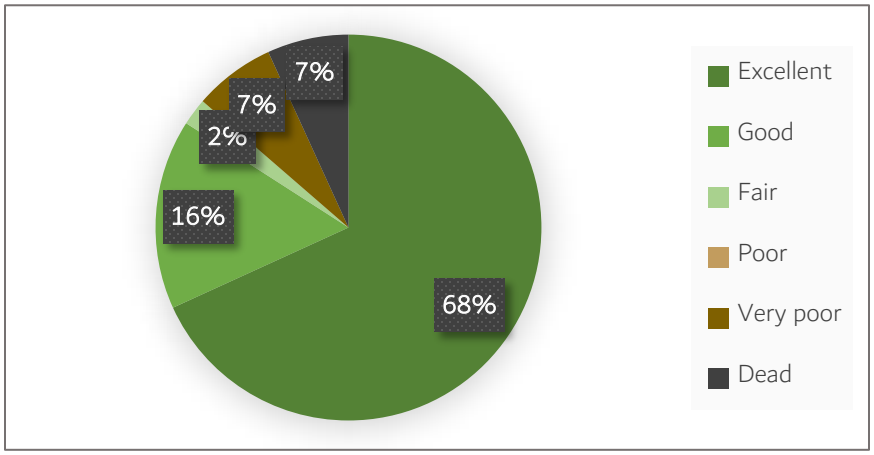


Figure 8: Neighbourwoods health ratings for trees in the Bloordale's Adopt-A-Street-Tree program in 2018 (n=44).

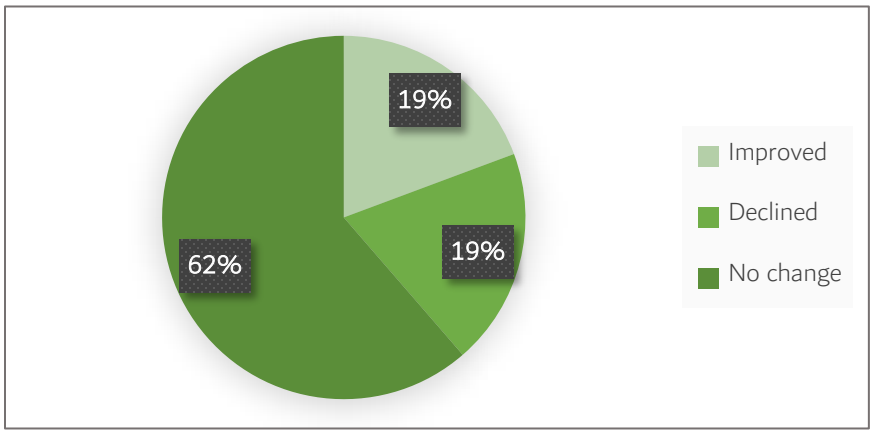


Figure 9: Change in category of Neighbourwoods health ratings for trees in Bloordale's Adopt-A-Street-Tree program from 2017 to 2018 (n=44).

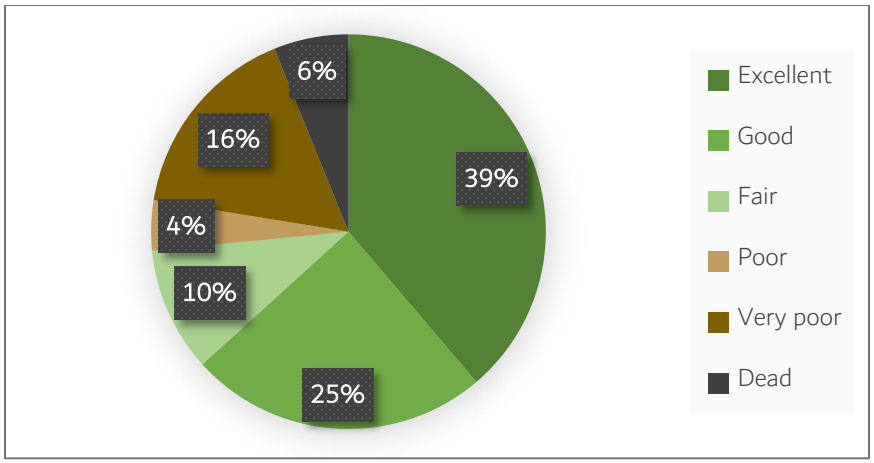


Figure 10: Neighbourwoods health ratings for Bloorcourt (unadopted) trees in 2017 (n=49).

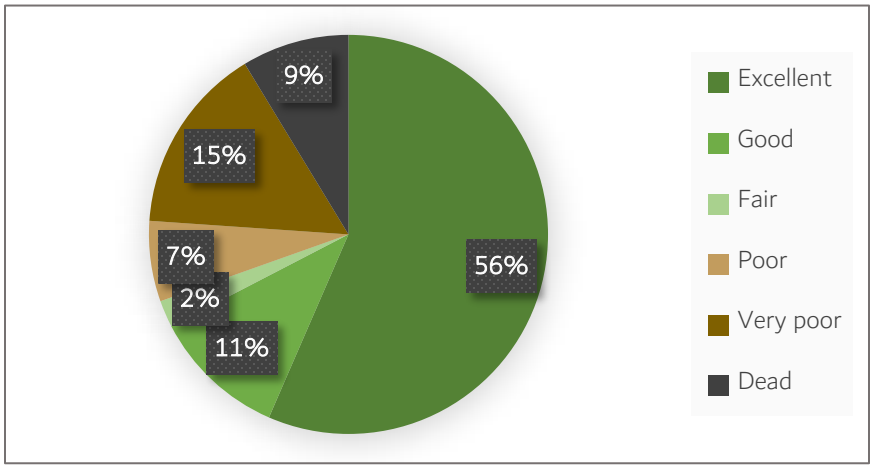


Figure 11: Neighbourwoods health ratings for Bloorcourt (unadopted) trees in 2018 (n=46).

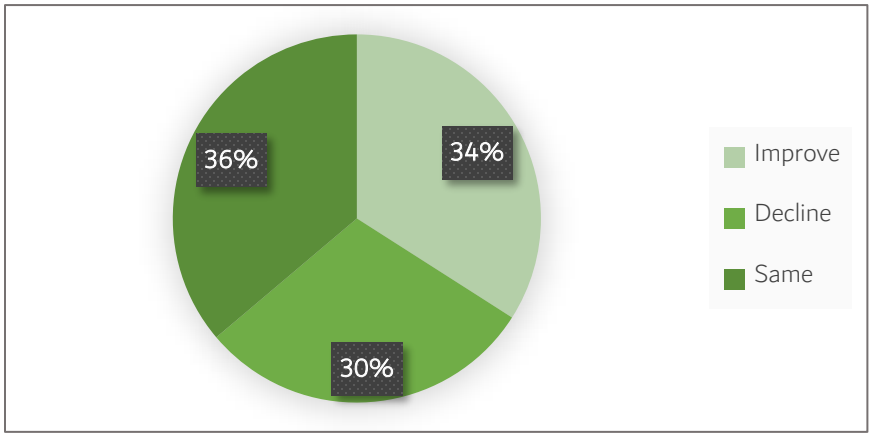


Figure 12: Change in category of Neighbourwoods health ratings for Bloorcourt (unadopted) trees from 2017 to 2018 (n=46).

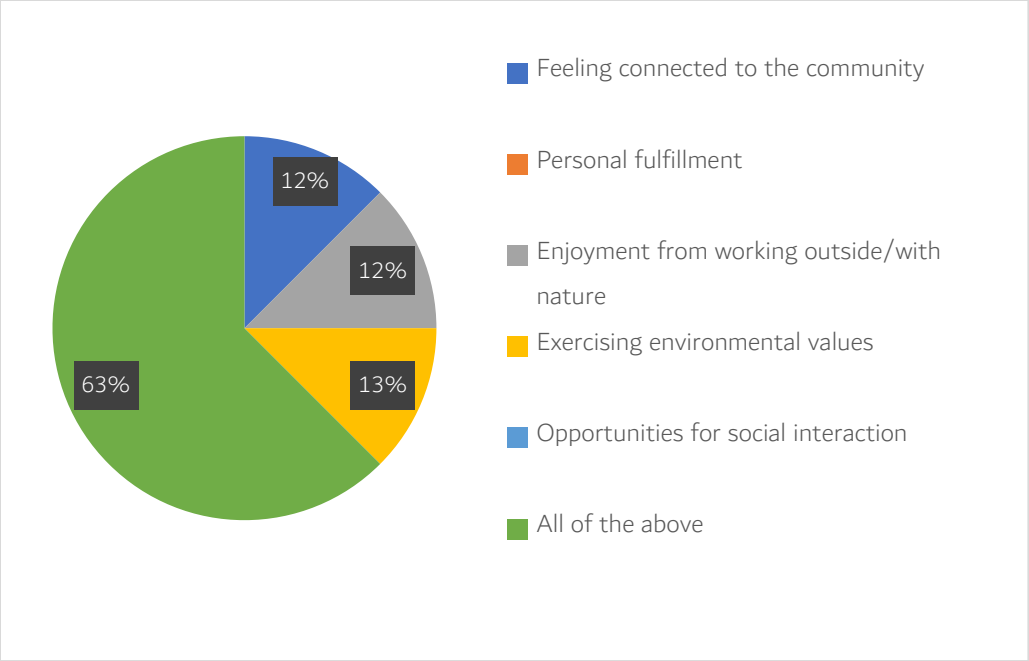


Figure 13: Adopters' motivators for participating in LEAF's Adopt-A-Street-Tree program in Liberty Village.

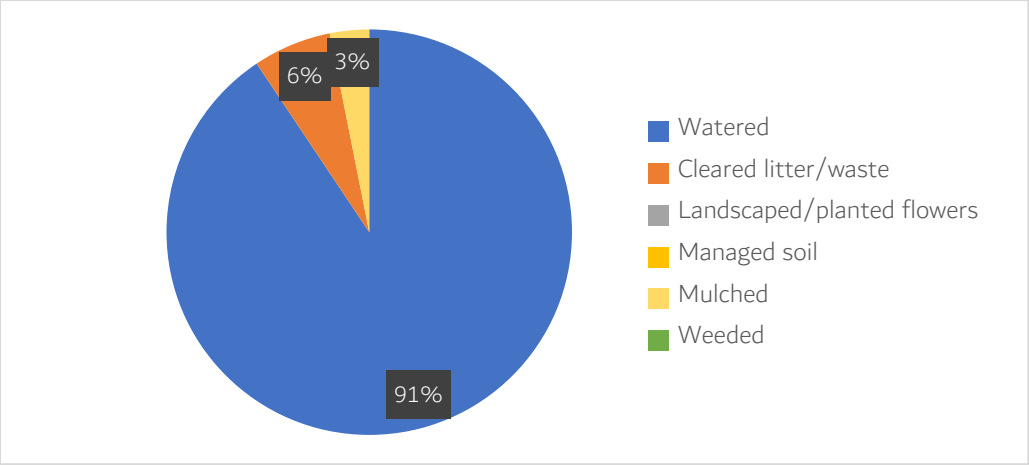


Figure 14: Logged street tree stewardship activities of adopters in Liberty Village over the 2018 season.

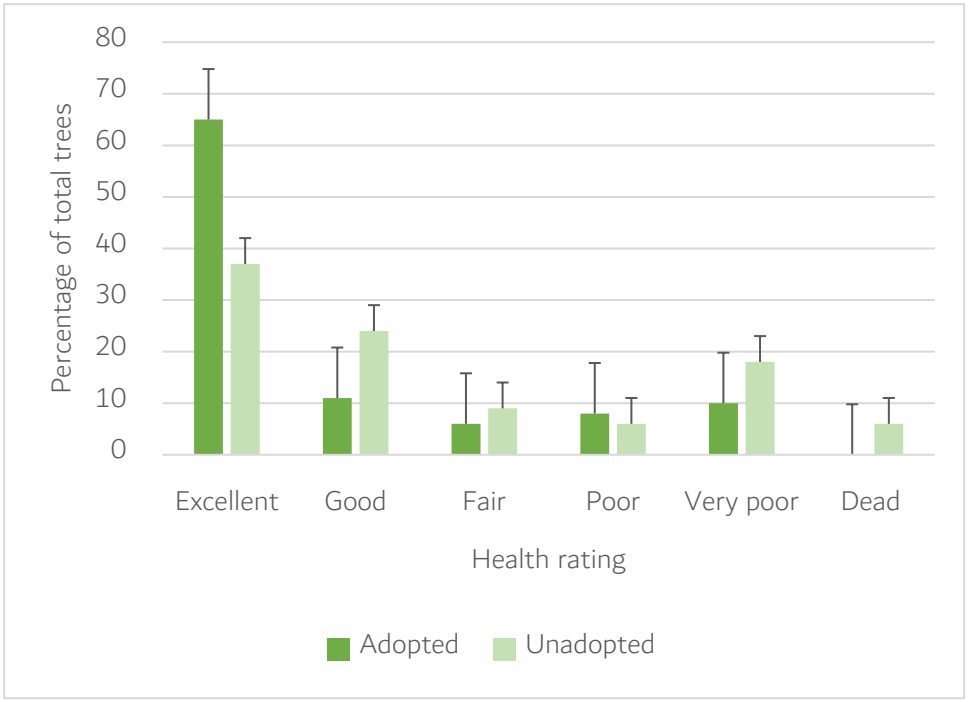


Figure 15: Proportion of Neighbourwoods health ratings for trees in the Junction between 2017 (n=120) to 2018 (n=113). P value = <0.001.

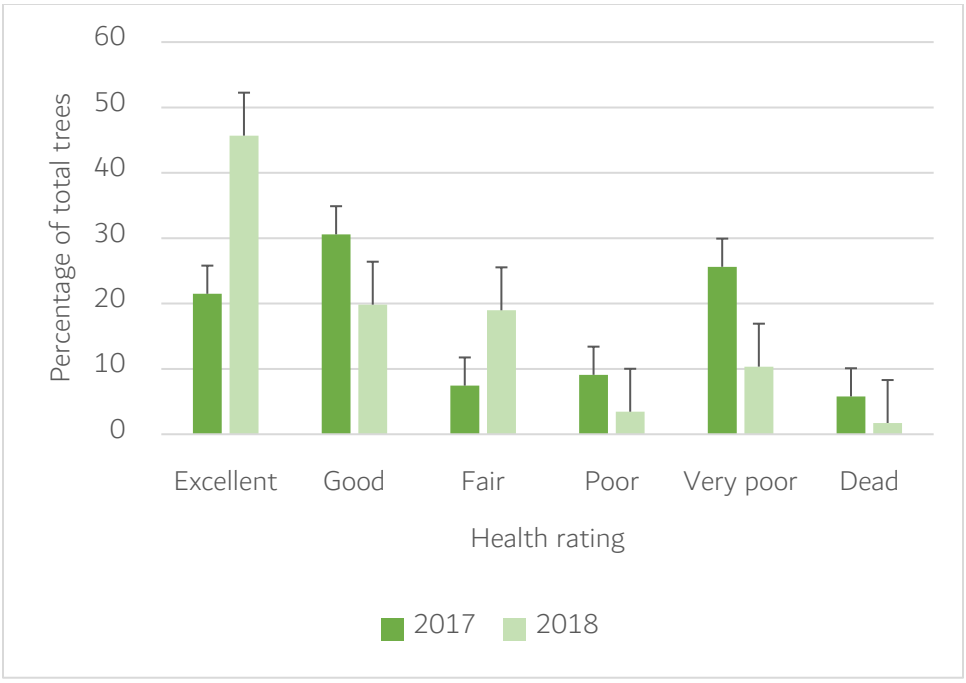


Figure 16: Proportion of Neighbourwoods health ratings for trees in 2017 between Bloordale (adopted, n=44) and Bloorcourt (unadopted, n=49). P value = 0.018.

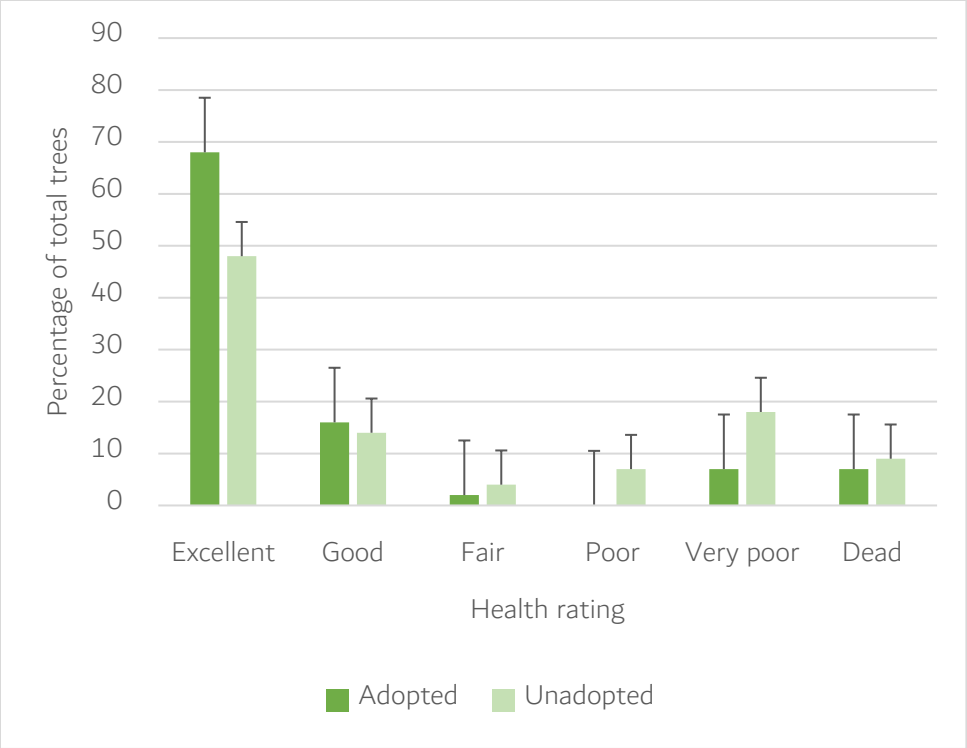


Figure 17: Proportion of Neighbourwoods health ratings for trees in 2018 between Bloordale (adopted, n=44) and Bloorcourt (unadopted, n=46). P value = 0.018.

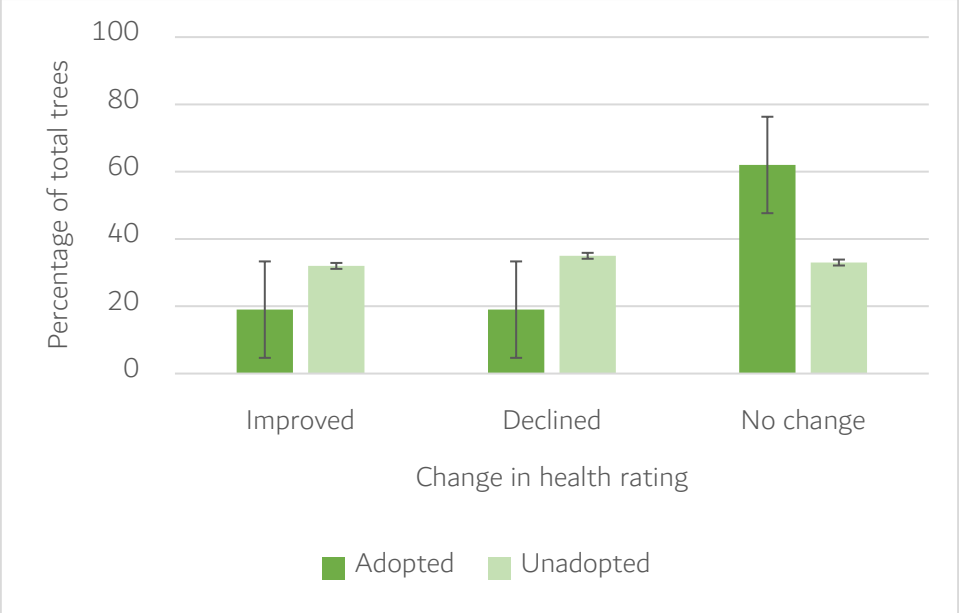


Figure 18: Proportion of change in Neighbourwoods health ratings from 2017 to 2018 between Bloordale (adopted, n=44) and Bloorcourt (unadopted, n=46). P value = 0.009.

APPENDIX

Appendix 1: Neighbourwoods© reference guide with standardized criteria guidelines

Neighbourwoods© Quick Reference Guide

Reduced Crown

0	No major sections of the crown are missing (consider the general outline defined by tree ht. width and crown ht.
1	Less than 1/4 of the crown volume is missing.
2	1/4 to 1/2 of the crown volume is missing.
3	More than 1/2 of the crown volume is missing

Unbalanced Crown

0	There are no signs that the crown is unbalanced or lopsided; crown normally developed.	
1	Crown slightly asymmetrical due to restricted growing space or lack of light.	
2	Crown is asymmetrical, unbalanced or lopsided. Between 75% and 90% of the crown volume is on one side of the stem.	
3	Crown is severely asymmetrical to the point where it clearly places damaging stress on the main stem and/or root system. Greater than 90% of the crown volume is on one side of the stem.	

Crown Defoliation

0	Tree crown not defoliated except for minor twig defoliation, which is normal in a healthy tree.
1	Between trace amounts of defoliation (twigs and fine branches are present but leaves are not) and less than 1/4 of the crown having lost its leaves - crown slightly defoliated.
2	1/4 to 1/2 of the crown has lost its leaves - crown moderately defoliated.
3	More than 1/2 of the crown without leaves - crown severely defoliated.

Weak or Yellowing Foliage	
0	Leaves normal size, color, and texture.
1	Leaves appear to be somewhat smaller than normal and/or pale in colour ("yellowish green".
2	Leaves are significantly smaller than what is normal and /or pale foliage ("greenish yellow"; thinning of foliage; the crown is significantly more transparent than typical for the species.
3	Leaves are dramatically smaller than normal and/or leaf colour is best described as yellow; the crown is very transparent; the tree appears to be in a serious state of decline.

Large Dead or Broken Branches	
0	Tree does not have major dead branches; small branches within the inner crown should not be considered.
1	At least one dead or broken branch or stub greater than 7cm in diameter is present. Its diameter is less than 1/4 of the diameter of the next order branch or main stem at the point of attachment.
2	The tree has one or more dead or broken branches or stubs BUT its diameter is 1/4 to 1/2 of the diameter of the next order branch or main stem at the point of attachment.
3	The tree has one or more dead or broken branches or stubs which is (or was) a main branch (a scaffold branch. i.e. the diameter is more than 1/2 of the diameter of the main stem at the point of attachment).

Lean	
0	The tree is virtually vertically positioned over the base of the stem.
1	Slight or minor lean (< 15° from vertical) but no apparent danger.
2	Slight or minor lean (< 15° from vertical) with some evidence of root mounding or soil cracking on the side of the tree away from the lean.
3	Serious lean (>15° from vertical) with some evidence of root mounding or soil cracking on the side of the tree away from the lean.

Poor Branch Attachment (V-shaped Fork)	
0	Branches properly attached, there are no signs of poor attachment.
1	A V-shaped union between a minor branch and the main stem (the diameter of the branch is 1/2 of the diameter, or less, than the branch or main stem where it is attached). There is no evidence of included bark, but the angle of the fork is such that there is a potential for this to appear as the tree grows. This category also includes epicormic shoots following topping, pruning or storm damage, etc.
2	As in 1, but the branch is more than 1/2 of the diameter of the branch or main stem where it is attached, and there is evidence of included bark but no breakage. This category also includes trees with epicormic shoots resulting from poor pruning or breakage, and multiple trunks or co-dominant stems. Multiple stems are trunks of equal size and/or relative importance arising from the base of the tree, co-dominant stems are major branches of similar diameter arising in the crown of the tree.
3	As in 2, but with evidence of a split or failure between the stems.

Branch Scar	
0	No major (first order) branches have scars
1	One or more major branch (es) has a scar(s) with a width totaling 1/8 to 1/4 the circumference, OR a scar less than 1/8 but more than 50 cm in length.
2	One or more major branch has a scar(s) with a width totaling 1/4 to 1/2 the circumference, OR 1/8 to1/4 the circumference but more than 50 cm in length.
3	One or more major branch has a scar(s) with a width totaling more than 1/2 the circumference of the stem, OR it is between 1/4 to1/2 the circumference but more than 50 cm in length.

Trunk Scar	
0	The main stem or trunk does not have any scars.
1	One or more scars with a width totaling 1/8 to 1/4 of the circumference, OR a scar less than 1/8 but more than 50 cm in length.
2	One or more scars with a width totaling 1/4 to 1/2 of circumference, OR 1/8 to1/4 the circumference but more than 50 cm in length.
3	One or more scars with a width totaling more than 1/2 of circumference of the stem, OR it is between 1/4 to1/2 the circumference but more than 50 cm in length.

Conks

0	The absence of conks
1	One or more conks are present on the main stem or at the base of the stem.

Rot or Cavity – Major Branch

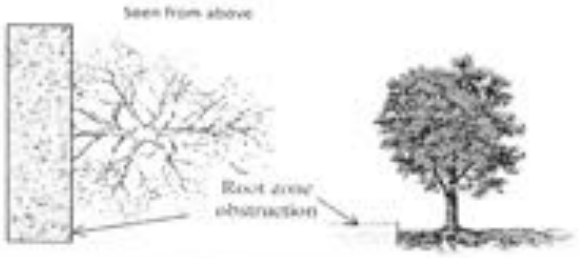
0	Tree does not have any sign of rot or cavity in any of the major (first order) branches
1	Rot/cavity is 1/8 to 1/4 of the diameter of the major branch.
2	Rot or cavity is 1/4 to 1/2 of diameter of the major branch.
3	Rot or cavity is more than 1/2 of diameter of the major branch.

Rot or Cavity – Trunk

0	Tree does not have any sign of rot or cavity in the trunk
1	Rot/cavity is 1/8 to 1/4 of the diameter of the trunk.
2	Rot or cavity is 1/4 to 1/2 of diameter of the trunk.
3	Rot or cavity is more than 1/2 of diameter of the trunk.

Confined rooting space

0	No obstruction or conflicts are apparent in the area within the dripline of the tree.
1	An obstruction exists which would eliminate root development in an area less than 1/4 of the area within the dripline of the tree.
2	An obstruction exists which would eliminate root development in an area between 1/4 and 1/2 of the area within the dripline of the tree.
3	An obstruction exists which would eliminate root development in an area more than 1/2 of the area within the dripline of the tree.



Cracks

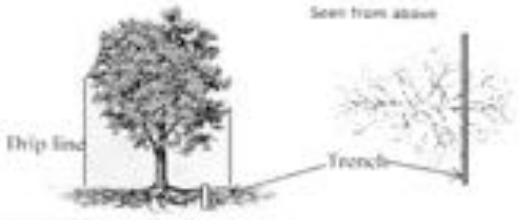
0	Tree does not have major cracks either on trunk or major branches.
1	One minor crack extends into the stem, major stubs or a branch of significant size. A minor crack is one that enters the wood (not just in the bark) but does not extend more than ½ of the distance to the centre of the stem.
2	Two or more minor cracks occur in the same general area of the stem (on opposite sides of the stem), but the crack is NOT in contact with rot or poor branch attachment, and the tree is NOT leaning;
3	A crack(s) is in contact with rot or poor branch attachment, or the tree is also leaning; Tree has one deep crack where one-half or more of the tree diameter is structurally compromised; Crack(s) in the tangential (horizontal) plane.

Girdling roots

0	There are no signs of girdling roots.
1	1/8 to 1/4 of the diameter of the base of the trunk is restricted by girdling roots.
2	1/4 to 1/2 of the diameter of the base of the trunk is restricted by girdling roots.
3	More than 1/2 of the diameter of the base of the trunk is restricted by girdling roots.

Root trenching

0	There are no signs of root trenching or cutting within the rooting area.
1	Up to 1/4 of the root system has been cut during trenching or excavation.
2	Between 1/4 and 1/2 of the root system has been cut during trenching or excavation.
3	More than 1/2 of the root system has been cut during trenching or excavation.



Overhead Wires

N	There are no conflicts.
E	The branches of a tree are currently within 0.5 meters of electrical, telephone, or other wires.
P	At some point (within the inspection cycle), as the tree grows, such a conflict could occur.

Conflict with Sidewalk

N	There are no conflicts.
E	The sidewalk already shows signs of being lifted by stem or root growth.
P	A tree's stem, at some point in its life, would be within 0.3 m of a sidewalk

Conflict with Structure

N	There are no conflicts
E	Tree is already touching the structure.
P	There is potential for the tree to come into contact with the structure within the next inspection cycle.

Conflict with Trees

N	There are no conflicts.
E	The tree in question is currently touching the crown of another tree.
P	There is potential for existing conflict (E) to occur within the inspection cycle.

Conflict with Traffic Signs

N	There are no conflicts.
E	The tree in question is currently screening or touching the sign.
P	There is potential for existing conflict (E) to occur within the inspection cycle.