

**Urban Food Forestry (UFF), its Role in Canadian Urban Forestry
Management Plans, and Integration into Thunder Bay, Ontario**

by

Jonathan Visentin



FACULTY OF NATURAL RESOURCES MANAGEMENT

LAKEHEAD UNIVERSITY

APRIL 2019

URBAN FOOD FORESTRY (UFF), ITS ROLE IN CANADIAN URBAN FOREST
MANAGEMENT PLANS, AND INTEGRATION INTO THUNDER BAY, ONTARIO

by

Jonathan E. Visentin

An Undergraduate Thesis Submitted in
Partial Fulfillment of the Requirements for the
Degree of Honours Bachelor of Science in Forestry

Faculty of Natural Resources Management

Lakehead University

April 2019

Dr. Leonard J. Hutchison

Major Advisor

Shelley Vescio, R.P.F.

Second Reader

LIBRARY RIGHTS STATEMENT

In presenting this thesis in partial fulfillment of the requirements for the HBScF degree at Lakehead University in Thunder Bay, I agree that the University will make it freely available for inspection.

This thesis is made available by my authority solely for the purpose of private study and research and may not be copied or reproduced in whole or in part (except as permitted by the Copyright Laws) without my written authority.

Signature: _____

Date: _____

A CAUTION TO THE READER

This HBScF thesis has been through a semi-formal process of review and comment by at least two faculty members. It is made available for loan by the Faculty of Natural Resources Management for the purpose of advancing the practice of professional and scientific forestry.

The reader should be aware that opinions and conclusions expressed in this document are those of the student and do not necessarily reflect the opinions of the thesis supervisor, the faculty or Lakehead University.

ABSTRACT

Visentin, J. E. 2019. Urban food forestry (UFF), its role in Canadian urban forestry management plans, and integration into Thunder Bay, Ontario. 31 pp.

Keywords: edible, education, food bank, food security, foraging, fruit, garden, orchard, poverty, urban food forestry, urban forestry, wildlife.

Urban food forests are perennial polycultures of fruit or nut-producing tree species that mimic a natural ecosystem. The concept of urban food forestry within small grassroots campaigns and initiatives is not a new one, but has until recently gained some recognition in Canadian urban forest management plans. Even so, its role in urban forest management plans remains poorly understood. An analysis of 10 contextual search terms and themes related to urban food forestry within 25 Canadian urban forest management plans was conducted to better understand its role. It was determined that the mention of urban food forestry was distributed unevenly and disproportionately with no discernible pattern. Discussions surrounding existing urban food forestry initiatives within Canada were then mentioned to adopt a framework to help address food insecurity in Thunder Bay.

CONTENTS

TABLES	v
FIGURES	vi
ACKNOWLEDGEMENTS	vii
INTRODUCTION	1
Benefits of the Urban Forest	1
Historical Urban Food Forestry	2
Urban Food Forestry Today	4
Organisations Today	5
Thunder Bay Urban Food Forestry	7
MATERIALS AND METHODS	9
RESULTS	10
DISCUSSION	14
Food Security Goals	16
CONCLUSION	21
LITERATURE CITED	22
APPENDIX I: LIST OF URBAN FOREST MANAGEMENT PLANS REVIEWED	28

TABLES

Table	Page
1. Canadian urban forest management plans and count of terms and themes.	11

FIGURES

Figure	Page
1. Concept of the forest garden	4

ACKNOWLEDGEMENTS

I would like to acknowledge and thank the following individuals for their contributions and assistance in the completion of this undergraduate thesis.

My thesis supervisor, Dr. Leonard Hutchison who suggested the topic and provided me with the guidance and support needed to complete this thesis.

Shelley Vescio, former City Forester for Thunder Bay, for agreeing to be my second reader and for providing invaluable information and insight into this thesis.

INTRODUCTION

The historic relationship between people, forests and nature has shaped our cities into the way in which we see them today. Handlin (1963), an American historian who profoundly influenced immigration politics, wrote with great prose that within the modern city, "... the contest between the human will and nature assumed a special form". Today, scientists view the phenomenon of urbanisation as an important tool that has shaped human behaviour as well as attitudes towards the environment. In other words, cities shape people, and people shape cities (Konijnendiik 2008). The phenomenon of urbanisation ignited during the Industrial Era, when cities provided an attractive option for workers to occupy. Today, more than half of all people live in cities and towns. By 2030, more than 60% of all people will live in an urban environment (FAO 2002).

Some of the oldest cities in the world serve as examples of the harmonic relationship between cities and forests. The term 'City Forest' was historically utilized in Europe to describe the forest that is owned or managed by a certain city. The term broadened to encompass many characteristics that link forests to urban society. Today, the term 'urban forest' has come into wider use to include the planning and management of all green resources, both publicly and privately owned, in and near an urban area (Konijnendiik 2008).

Benefits of the Urban Forest

The urban forest can provide both direct and indirect economic benefits. Trees can provide ample protection from winds and can do a good job at controlling wind velocity near

homes, thereby conserving energy. It was discovered that by planting just a few trees around a house, winter and summer electrical costs can be reduced by 25 to 30 percent (Simpson & McPherson 1996; McPherson & Simpson 2003). Whole communities can benefit economically from the urban forest when power companies use less water in cooling towers, reduce fossil fuels in their furnaces, and when few measures are taken to control air pollution. Trees can also have a significant impact on real estate values. Studies have demonstrated that trees can contribute 20 percent to the value of residential properties, and that homebuyers are willing to pay three to seven percent more for a house in a neighbourhood filled with trees (Escobedo *et al.* 2015; Laverne & Winson-Geideman 2003).

Numerous studies have linked the positive impacts of mental health and wellbeing with the urban forest. Kuo (2003) has demonstrated that greener urban areas result in healthier social dynamics between people, as well as lower levels of crime. Another study by Kuo & Sullivan (2001) has shown that trees growing beside public housing resulted in 25 percent fewer acts of domestic violence, and public housing with high levels of vegetation had 52 percent fewer total crimes, 48 percent fewer property crimes and 56 percent fewer violent crimes than public housing with low vegetation amounts. A much-cited study by Ulrich (1984) demonstrated that patients recovering from surgery who had a view of greenery out of their room window had shorter postoperative hospital stays than patients who had windows facing a brick wall.

Historical Urban Food Forestry

While the many social, economic and environmental benefits that the urban forest provides to society has been studied rigorously, limited research exists on the benefits of

products that can be derived from the urban forest. Today in North America, urban forests are viewed as functioning more as providers of services rather than providers of goods (Mackey 2014). Paradoxically, this gainsays the original intention of the establishment of urban forests as providers of services as well as forest products (McLain *et al.* 2012). One could say this notion reflects a widespread bias that urban foresters and planners possess. In North America, we are just beginning to rediscover the multifunctional benefits the urban forest can provide with a wide range of services and products alike.

The idea of Urban Food Forestry (UFF) is not new. Humans have been cultivating within forest ecosystems for thousands of years in the tropical regions of Africa and South America (Riolo 2018). Levis *et al.* (2017) discovered that the marks of pre-Columbian plant domestication in the tropics can still be detected today. The emergence of the idea of “cultivating like a forest” was first introduced into modern society in the 1970s by Robert Hart in Shropshire, England. Hart is accredited with the concept of the “forest garden”, a branch of agroforestry that divides a natural forest into edible layers consisting of the following seven dimensions: (Figure 1).

1. Tall trees constituting the uppermost canopy (large fruit and nut trees).
2. Smaller trees consisting of lower growing and dwarf fruit trees.
3. Shrub layer consisting of currants and berries.
4. Herbaceous plants such as perennial plants, culinary and medicinal herbs, and other companion plants.
5. Ground cover plants that occupy the ground layer and spread horizontally.
6. A rhizosphere layer consisting of root crops such as potatoes, onions or carrots.
7. A vertical layer of vines that occupy vertical space such as beans, peas or grapes.

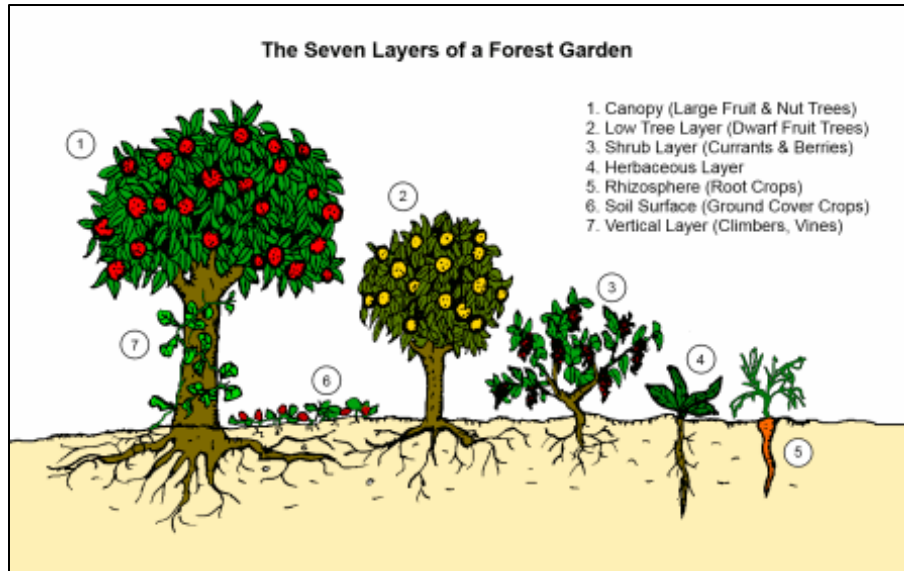


Figure 1: Concept of the forest garden developed by Hart (1996).

Since then, widespread recognition of food forests has spread internationally. Only recently, however, has food forestry been considered a method of managing public land while integrating community stewardship (Riolo 2018). One of the first food forest initiatives on public lands occurred with the opening of the Dr. George Washington Carver Edible Park in Asheville, North Carolina in 1997. Food forests historically spurred out of small grassroot initiatives, but since about 2010, increasing recognition of food forests have been included in policies and municipality plans (Riolo 2018).

Urban Food Forestry Today

Perhaps the first emergence of UFF in a scientific context was introduced by Clark & Nicholas (2013) who incorporated multiple paradigms of urban design and sustainability into their definition: “the intentional and strategic use of woody perennial food-producing species in

urban edible landscapes to improve the sustainability and resilience of urban communities”. Their definition takes into account different levels of organisation, such as street trees, public orchards, allotment gardens, fruit gleaning and informal foraging (Kowalski & Conway 2018). It includes trees situated on private or publically-owned property, single or groups of trees, and typically involves fruits and nuts, but can also include non-timber forest products (NTFPs) such as leaves, bark and sap (Kowalski & Conway 2018; McLain *et al.* 2012). While the benefits the urban forest provides overall has been studied extensively, relatively little research exists on UFF. Perhaps the most obvious benefit surrounding UFF is the ability and intention of an urban food forest to increase food security and resiliency within communities through the provision of food forest products.

Organisations Today

Toronto, Calgary and Seattle are just three notable examples that illustrate this fact. Within Toronto exists the fruit gleaning organisation “Not Far From the Tree”, as well as Ben Nobleman Park Community Orchard, Canada’s oldest urban community orchard. This orchard was established in June 2009 and contains 14 fruit trees, consisting of apple, plum, apricot and sweet cherry trees (Mackey 2014). It is completely run by volunteers and has become one of the mainstays for community development in Toronto. The food grown is donated to volunteers and local groups such as food banks. Within Calgary exists City of Calgary Community Orchards. Established in 2009, it consists of four community orchard pilot projects which are being led by the City as well as community members. The intention of these projects is to gauge the effectiveness of growing fruit and nuts within the city using indicators such as tree survival, vandalism, disease and pest damage, cost and the overall feasibility of the community members’

ability to manage the orchard (City of Calgary 2009). These projects were carried out alongside the ImagineCalgary Plan to augment long-term sustainability and education about the benefits of locally grown food. Seattle, Washington boasts the Beacon Food Forest (BFF) which was started by four permaculture students in 2009 (Golden 2019). The BFF is located on a seven-acre site and is projected to host an edible arboretum, a berry patch, a nut grove and a community garden. Phase 1 of the preparation of the site consisted of soil preparation, the planting of an understory shrub layer, and the construction of many other components, which was all completed in 2013 and 2014. Today, the BFF consists of three sections which are; a P-Patch, where residents can rent out a small parcel of land to utilize at their own leisure; a vegetable garden, where anyone can take what they like; and the food forest itself, which was designed by inspiration of Hart's forest gardening project in 1970.

The emergence of small grassroots initiatives and food-based organisations whose efforts are aimed at increasing food security are perhaps the immediate stimulus for the increasing recognition of UFF. There indeed does seem to be a correlation between gleaning organisations and food policy councils alike with municipal plans that include fruit-bearing trees (Kowalski & Conway 2018). Kowalski & Conway (2018) demonstrated that nine out of fourteen municipal urban forestry plans in Canada that mentioned food trees were associated with a gleaning organisation and nine also had involvement with food policy councils. The current literature aimed at research into UFF is multidisciplinary in nature. For example, gardening and fruit tree-related activities such as foraging can help establish a "sense of place" and can help strengthen social ties among community members as well as increase food security (Hoffman & Doody 2015). Urban food justice and food sovereignty has also been documented and researched and aims to allow local citizens to more freely access wild foods (McLain *et al.* 2012). Conversely,

other literature has focused more on the toxicological side of UFF, examining the amount of accumulation of heavy metals that make its way into urban food (Gallagher *et al.* 2015; Saeumel *et al.* 2012). All of this research can help provide a foundation for research into UFF and food security initiatives in Thunder Bay.

Thunder Bay Urban Food Forestry

Household food security is a significant social and health problem in Canada (Bush 2004). Approximately 1.6 million (12%) of Canadian households experience food insecurity, which affects about one in six children (Bush 2004). Many factors exist that prevent access to a healthy diet: poverty, isolation, housing issues, transportation costs, including many other socioeconomic problems. These factors can leave individuals more vulnerable and at an increased risk to diseases, such as cardiovascular disease, cancer, or diabetes. According to the Lakehead Social Planning Council (2013), 12.8% of residents (about 15,100 people) live below the poverty line, and 10.2% of citizens live with moderate to severe food insecurity in the Thunder Bay District Health region.

Many initiatives have been developed to address food security within Thunder Bay. Community kitchens, gardens and emergency food programs are all available to support individuals who need them. The most obvious effort aimed at increasing social and food security resiliency that incorporates elements of UFF is the Court Street Edible Food Forest. This project was started in 2014 through a collaboration with Roots to Harvest and the City of Thunder Bay to turn a previously underutilized area into a greenspace that hosts a myriad of edible wild foods to consume (Nelson *et al.* 2015). The space includes apples, plums and different species of

berries. The vision and intention of this project is to give citizens an accessible method of consuming wild food while increasing educational awareness of growing fruit in northern climates (Nelson *et al.* 2015).

MATERIALS AND METHODS

An online search of 10 contextual terms and themes within 25 Canadian urban forest management plans was conducted (Table 1, Appendix I). These terms and themes were chosen to reflect a broader context based on its relevance and association with urban food forestry initiatives and topics. The terms and themes included were: “fruit”, ”foraging”, ”orchard”, “edible”, ”education”, ”food security”, ”food bank”, ”wildlife”, ”poverty”, and ”garden”. The 25 urban forest management plans were chosen based on how openly accessible they were using online search engines. The count of each search term and theme was then recorded based on the number of times they were mentioned. Each mention of each search term and theme, as well as the text surrounding them, was examined to establish certainty that the results were not off-topic and were associated and aligned positively with urban food forestry. This included both relevancy to topics associated with human consumption as well as wildlife consumption and habitat. Terms and themes contained within the whole of the urban forest management plans were included, excluding the references sections.

RESULTS

Within 25 Canadian urban forest management plans (Table 1, Appendix I), 10 terms and themes surrounding UFF which include “fruit”, ”foraging”, ”orchard”, “edible”, ”education”, ”food security”, ”food bank”, ”wildlife”, ”poverty”, and ”garden” were distributed with no discernible pattern. The most common term mentioned was “education” which was mentioned in all 25 plans; the highest number of which was included in Halifax’s plan 212 times, while the lowest mentions included were within Peterborough’s, Fredericton’s and St. John’s plans at three times for each. Conversely, “poverty” was the least common term, with only Vancouver mentioning it once in their plan’s open house comments within the appendix.

The terms “food security” and “food bank” which tie closely together were both mentioned by only two plans: Sechelt and Victoria. Sechelt’s plan specifically lists working with local groups to provide food security as one of their goals and objectives to increase the understanding and support for the urban forest. They also mention the production of produce that should be donated to food banks to support food security. Such initiatives include Sechelt’s Fruit Tree Project and the Food Action Network which aim to achieve food security.

Wildlife was most commonly mentioned in Banff’s plan 58 times which cited objectives that aim to increase wildlife habitat outside of the urban forest and to reduce major human-wildlife conflict by removing tree species that attract wildlife from out of town, which Banff’s plan strongly emphasized. Halifax mentions wildlife 40 times which associates the same issues outlined in Banff’s plan, which includes wildlife conflict and the provision of habitat. Conversely, Devon and Fredericton were the only two plans to not include the mention of wildlife at all.

Table 1: Canadian urban forest management plans and count of terms and themes

Province	City	Publication Date	Fruit	Foraging	Orchard	Edible	Education	Food security	Food bank	Wildlife	Poverty	Garden
Alberta	Banff	2008	8	2	0	2	8	0	0	58	0	10
	Devon	2015	0	0	0	0	4	0	0	0	0	0
	Edmonton	2012	0	0	0	0	22	0	0	4	0	6
	St. Albert	2017	7	0	0	1	6	1	0	8	0	8
British Columbia	Campbell River	2015	0	0	0	0	8	0	0	3	0	1
	Comox	2012	13	0	0	3	11	0	0	19	0	5
	Kamloops	2016	26	0	0	3	24	2	0	12	0	7
	New Westminister	2016	1	0	0	4	26	0	0	10	0	13
	Sechelt	2010	10	1	2	0	22	22	3	27	0	11
	Vancouver	2007	1	0	0	0	42	0	0	16	1	7
	Victoria	2013	18	0	0	10	19	2	2	12	0	54
	Morden	2017	1	0	0	0	10	0	0	4	0	1
Ontario	Barrie	2013	11	0	0	1	18	1	0	1	0	2
	Brampton	2011	3	1	1	0	21	0	0	7	0	6
	Burlington	2010	0	0	0	0	11	0	0	7	0	9
	Guelph	2012	0	0	0	0	27	0	0	2	0	8
	Mississauga	2014	1	0	0	1	73	0	0	7	0	13
	Ottawa	2017	16	0	0	1	65	0	1	10	0	5
	Peterborough	2011	0	0	0	0	3	0	0	5	0	2
	St. Catherines	2011	0	0	0	0	23	0	0	12	0	5
	Thunder Bay	2011	8	0	0	0	41	0	0	8	0	9
	Toronto	2013	0	0	0	0	28	0	0	8	0	2
Nova Scotia	Halifax	2013	40	0	5	14	212	1	0	40	0	46
New Brunswick	Fredericton	2015	2	0	0	0	3	0	0	0	0	2
Newfoundland and Labrador	St. John's	2006	0	0	0	0	3	0	0	2	0	3

The term “forage” or “foraging” was mentioned two times in Banff’s plan, but makes reference to this in the context of food and habitat for wildlife. The same scenario is shared with both Sechelt’s and Brampton’s plans, each utilizing the term just one time. The term “orchard” was used nine times overall, mostly in Halifax’s plan which makes reference to their efforts aimed at increasing food security through the planting of fruit. Sechelt uses the term two times in the context of increasing urban orchard numbers, while Brampton makes reference to the term in an agricultural sense to plant nut orchards.

The most common occurrence of the term “fruit” was used by Halifax’s and Kamloop’s plans, 40 and 26 times, respectively. Kamloops makes reference to the strengths and challenges encountered with the inclusion of fruit trees; notably, the strengths outlined include the contribution to food security and enjoyment of residents, while the challenges include fruit trees as an attractant for wildlife, contamination from pests, and overall litter and decreased aesthetics. Nine out of the 25 plans make no reference to fruit at all. Halifax makes reference to the term “edible” 14 times, which is the highest number of mentions out of all 25 plans. Fifteen out of 25 plans make no reference or mention of this term.

Gardens were heavily mentioned in Victoria’s and Halifax’s plan, 54 times and 46 times, respectively. Victoria emphasized urban forestry initiatives aimed at increasing green infrastructure such as rooftop gardens, rain gardens, vertical gardens, even privately and publicly owned spaces intended to cultivate fruit and vegetables in a community-driven environment. Halifax’s plan includes the provision of gardens in a more traditional sense within an urban environment, and makes many references to the historical upbringing of the urban forestry program under the influence of the “garden city” movement. Only one plan, Devon, contained no

mention of gardens at all. Interestingly, Devon was also the least embracing of UFF initiatives overall and did not mention anything relating to UFF except four instances of “education”.

DISCUSSION

Many of the Canadian urban forest management plans examined and analyzed did not contain any discussion related to urban food forestry. The results obtained, which displayed a disproportionate and dispersed count of search terms and themes associated with urban food forestry, indicates that as far as Canadian cities are concerned, municipal urban forestry management plans do not view urban food forestry's presence as central to urban forestry goals and objectives (Kowalski & Conway 2018). This could be related to the fact that urban forestry management plans prioritize the ecological services that the urban forest provides to the city rather than the ecological products and goods that can be derived from the urban forest. The overwhelming emphasis put on ecological services rather than ecological goods associated with urban food forestry indicates and reflects a widespread bias that urban foresters possess (Mackey 2014). This fact also marginalizes individuals who are engaged with foraging and gleaning within urban landscapes that are part of decision-making process in management plans (Poe *et al.* 2013).

Another explanation for the lack of mention of urban food forestry in municipal forestry management plans stems from the fact that urban forestry is typically not concerned with community or economic development (Kowalski & Conway 2018). While community and economic developmental goals are recognized, such as trees contributing to increases in property and house values, fruit or nut-bearing trees are barely part of the discussion. If and when discussion is mentioned, the establishment of links made between community enhancement and food trees are not substantiated, and are nuanced at best (Kowalski & Conway 2018).

Concerns over wildlife provide another reason why the idea of urban food forestry is not seen as a key urban management goal. Fruit-bearing trees provide an attractive option for many species of wildlife to consume. With dense areas of fruit located within the city, wildlife are incentivised to wander into town with the intention of obtaining an easy snack. Because of this, food-bearing trees located within cities present a major human-wildlife conflict which poses great risk to human safety. A great example can be seen in the Town of Banff, where bears frequently tend to wander into the city in search of food to consume before hibernation. Banff's urban forest management plan emphasizes the need to reduce and eliminate the use of non-native tree and shrub species and reduce the species that act as an attractant to wildlife in the town (Tesera Systems Inc 2008). Banff already has a program that incentivises homeowners to replace their fruit trees for free with different tree species that do not produce fruit (Rieger 2019). Additionally, legislation is being considered to outright ban the planting of fruit, which would be a major success in efforts aimed at reducing human-wildlife conflict within the Town.

Many other issues surrounding urban food forestry initiatives can detract from its potential implementation within cities. A major problem stems from the planting of fruit trees along and within the vicinity of sidewalks and roads, which presents major concerns for urban foresters and citizens. For example, is it very unlikely that the majority of fruit grown on street-lined fruit trees would be picked or harvested. Fruits that go unpicked would spoil, fall onto the surrounding street and sidewalks below which would create a mess and would attract insects such as wasps (Stapleton 2015). Health and safety issues could arise, such as the issue of slippery sidewalks which could consequently cause citizens to slip and injure themselves. Associated with this presents concerns of legality and financial cost; that is, the costs associated with

maintaining and cleaning the mess posed by falling fruit, as well as the potential for citizens to sue the City for health and safety issues such as slipping.

Additionally, the toxicological profiles of fruit grown along streets could also present a health hazard. Pollution from automobiles and soil could potentially lead to the bioaccumulation of heavy metals and carcinogens in fruit trees. However, Gallagher *et al.* (2015) in Baltimore, Maryland determined that concentrations of lead and arsenic did not present immediate health concern, and the micronutrient levels of fruit lining city streets were higher than commercially grown fruits. Other studies have determined that airborne toxins making their way into vegetables grown in gardens located near busy roads tested positive for heavy metals such as lead, zinc, and polycyclic aromatic hydrocarbons (PAHs), but these metals wash right off (Saeumel *et al.* 2012; Vermeulen 2013). Despite the limited mention of discussion related to food security goals in the 25 Canadian urban forestry management plans examined, no mention of health concerns related to heavy metal contamination was addressed. This indicates that further research on optimal siting and species selection is needed, and these health concerns should be incorporated into urban food forestry discussion in urban forestry management plans (Kowalski & Conway 2018).

Food Security Goals

Food security is defined as, "...a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life." (FAO 2002). Although food security goals are sparsely acknowledged in the urban forestry management plans examined,

urban food forestry initiatives as a whole can improve and facilitate food security in several respects (Clark & Nicholas 2013). Urban food forestry can help improve the availability of accessible food through plantings in areas that are underutilized, such as on public lands. Similarly, it can also increase access to free or low-cost foods from local sources, thus contributing to the local economy. One example that illustrates this fact is Toronto's fruit-picking project "Not Far From The Tree" which operates in 14 of Toronto's 44 city wards and consists of 1600 registered fruit trees to pick, and just last year had over 1600 volunteers and over 20,000 pounds of fruit picked (Not Far From the Tree 2018).

Urban food forestry can also provide nutrient-dense foods that can help alleviate malnutrition or obesity. According to Rao *et al.* (2013), eating a healthy diet consisting of fruits, vegetables, fish and nuts, versus an unhealthy one such as fast food, costs about \$1.50 more a day per person, or more than \$550 a year. This difference in price may not seem significant for the individual, but it may impose an economic burden on families who are below the poverty line, costing a family of four about \$2000 more per year to eat healthily (Rehel 2013). This situation holds especially true for the 8400 households that receive social assistance in Thunder Bay (Thunder Bay and Area Food Strategy 2015). To illustrate this, the fixed monthly income for a family of four in Thunder Bay from Ontario Works is about \$2200. After rent (on average \$1045/month) and groceries (on average \$875/month), families of four are left with just under \$300 to pay for other basic needs such as utilities, transportation, clothing and medical costs. Given this economic situation, families on social assistance are more likely to choose unhealthy foods over healthy ones. Prioritizing unhealthy eating choices over healthy ones puts individuals at an increased risk to diet-related illnesses. This unfortunate circumstance reflects what families living on social assistance face every day.

Perhaps one of the best ways to alleviate food insecurity in Thunder Bay comes from food banks. There are a total of 19 food banks located within the Thunder Bay census metropolitan area (CMA), with about 3400 residents accessing these food banks each month (Thunder Bay and Area Food Strategy 2015). These food banks have become vital and necessary to help individuals and families meet their dietary needs. There already exist many food-related initiatives in Thunder Bay that allow an accessible means to consume fruit and vegetables. The Thunder Bay District Health Unit and Food Action Network's Gleaning Program has been running since 2000 and allows individuals and families free transportation to farms and parks to collect fresh produce (Thunder Bay and Area Food Strategy 2015). This program has fed over 1000 people each year who do not have access to fresh fruits and vegetables (Thunder Bay and Area Food Strategy 2015). Thunder Bay already has 20 other fruit gleaning programs like this, allowing volunteers to come to homeowners' properties and pick their own fruit from fruit trees (Thunder Bay and Area Food Strategy 2015).

More relevant to urban food forestry initiatives, however, is the Court Street Edible Food Forest, which was established in 2014 by Roots to Harvest and the City of Thunder Bay. This urban food forest hosts fruit trees and berries including apples, plums, saskatoons, and other edible species (Nelson *et al.* 2015). While the food forest provides individuals with an accessible means of obtaining fruit, it has lately not received much landscaping or horticultural care, and maintenance has fallen by the wayside. While in theory, this food forest is a great idea to promote food security initiatives, in practice, the area is rather underutilized. Nevertheless, urban food forestry has the great potential to augment sustainability initiatives within the city with food security goals.

To further increase the recognition and embracement of urban food forestry initiatives and further incorporate these paradigms of urban food forestry, Thunder Bay can borrow inspiration from other projects previously mentioned. For private lands in Thunder Bay, volunteering organisations can be sent to harvest fruit, resulting in harvesting possibly being divided between the tree owner, volunteers and food banks. This would allow harvesting initiatives to add to the food supply that would otherwise be wasted. Another great example is Village Harvest in California, which has donated 100,000 kilograms of fruit from backyards and small orchards to community food banks and charities in 2012 (Village Harvest 2012). Public parks within the city also present a great opportunity to host the establishment of urban food forests. Perhaps the city can look at what, for example, the City of Calgary has already implemented, and run trials of fruit and nut-bearing species in community gardens, public parks, regional orchards, along pedestrian routes, and in urban domestic gardens (City of Calgary 2009; Clark & Nicholas 2013).

One factor that has caused urban food forestry initiatives to go fairly unacknowledged is unfavourable climate. Climate in Thunder Bay plays a major factor in the abundance of fruit and vegetables that can be successfully grown. Because Thunder Bay is located in Hardiness zone 3a to 2a, fruit should be planted and grown that can survive the harsh growing conditions in the city. For example, cold-hardy and disease resistant apple trees are two important characteristics to consider to ensure the successful production of apples (Hardy Fruit Tree 2019). Pear trees are also fairly easy to grow and maintain, given when the right variety is chosen. Other edible species can include cherry trees, plum trees, berries and grapes. Additionally, climate change model projections indicate that the growing season in Thunder Bay will gradually increase over

the next 100 years, resulting in further growing opportunities for the region (Harry Cummings and Associates Inc 2009).

CONCLUSION

In North America, urban forests are seen more as providers of ecological services rather than ecological goods. The incorporation of urban food forestry in Canadian urban forestry management plans is still beginning, but remains relatively unacknowledged. The results obtained of contextual terms and themes surrounding urban food forestry suggests that urban food forestry is not seen as central to Canadian urban forestry goals and objectives. Still, urban food forestry can be an important strategy in efforts aimed at alleviating food security, malnutrition and poverty. With this being said, the multifunctional benefits of the urban forest are just being re-discovered in North America.

Thunder Bay's incorporation of urban food forestry in its urban forestry management plan does not seem to have a presence. This is partly due to the many challenges the city faces, such as unfavourable climate and issues with wildlife. Still, grassroots movements within the city are gaining momentum, which means that incorporating elements of urban food forestry in the City's management plan still has great potential. Finally, Thunder Bay can borrow inspiration from what other cities are doing related to urban food forestry and food security in order to increase these elements and recognition into our municipality plan.

LITERATURE CITED

- Bush, M. 2004. Canadian Community Health Survey Cycle 2.2, Nutrition (2004) Income-Related Household Food Security in Canada. Health Canada. Ottawa, Ontario. 124 pp.
- City of Calgary. 2009. Community orchards. City of Calgary.
<http://www.calgary.ca/CSPS/Parks/Pages/Programs/Community-orchards.aspx>. April 21, 2019.
- Clark, K.H. & K.A. Nicholas. 2013. Introducing urban food forestry: a multifunctional approach to increase food security and provide ecosystem services. *Landscape Ecol.* 28: 1649 - 1669.
- Escobedo, F., D.C. Adams, & N. Timilsina. 2015. Urban Forest Structure Effects on Property Value. *Ecosystem Services* 12:209 – 217
- [FAO] Food and Agriculture Organization. 2002. Chapter 2. Food security: concepts and measurement. <http://www.fao.org/3/y4671e/y4671e06.htm#fn31>. April 21, 2019.
- Gallagher, C. L., H. L. Oettgen, D. C. Okhai & and D. J. Brabander. 2015. Assessing Risks and Potential Benefits of Harvesting Urban Fruit. p. 244 *in* Geological Society of America Abstracts Nov. 7, 2015 244 pp. (abstract).
- Golden, H. 2019. The Beacon Food Forest grows community agriculture in South Seattle. Curbed Seattle. <https://seattle.curbed.com/2019/1/28/18196269/beacon-food-forest-urban-agriculture>. April 21, 2019.

- Handlin, O. 1963. The modern city as a field of historical study. In: O. Handlin, & J. Burchard (Eds.), *The Historian and the City*. The MIT Press. Cambridge/London. pp. 1–26
- Hardy Fruit Tree Nursery. 2019. Apple trees. <http://www.hardyfruittrees.ca/catalog/apple-trees>. April 21, 2019.
- Harry Cummings and Associates Inc. 2009. *Thunder Bay District Agricultural Economic Impact Study*. Ontario Federation of Agriculture. 136 pp.
- Hart, R. 1996. *Forest Gardening: Cultivating an Edible Landscape*. Chelsea Green Publishing. Shropshire, England. 256 pp.
- Hoffman, A. J. & S. Doody. 2015. Build a fruit tree orchard and they will come: creating an identity via community gardening activities. *Community Development Journal*. 50(1): 104 – 120.
- Konijnendijk, C. 2008. *The Forest and the City. The Cultural Landscape of Urban Woodland*. Springer. Dragoer, Denmark. 246 pp.
- Kowalski, J. & T. M. Conway. 2018. Branching out: The Inclusion of Urban Food Trees in Canadian Urban Forest Management Plans. *Urban Forestry & Urban Greening* (in press).
- Kuo, F. E. 2003. The Role of Arboriculture in a Healthy Social Ecology. *Journal of Arboriculture*. 29(3): 148-155.
- Kuo, F. E. & W. C. Sullivan. 2001. Aggression and Violence in the Inner City: Effects of Environment via Mental Fatigue. *Environment and Behavior*. 33(4): 543-571.

- Lakehead Social Planning Council. 2013. Building a Better Thunder Bay for All: A Community Action Strategy to Reduce Poverty. 39 pp.
- Laverne, R. & K. Winson-Geideman. 2003. The Influence of Trees and Landscaping on Rental Rates at Office Buildings. *Journal of Arborticulture*. 29(5):281 – 290.
- Levis, C & Costa, Flavia & Bongers, Frans & Peña-Claros, M & R. Clement, C & Junqueira, André & G. Neves, E & Tamanaha, Eduardo & Figueiredo, Fernando & P. Salomão, R & Castilho, Carolina & Magnusson, William & Phillips, Oliver & Guevara, Juan & Sabatier, Daniel & Molino, Jean-François & Cárdenas López, D & M. Mendoza, A & Pitman, Nigel & ter Steege, Hans. 2017. Persistent effects of pre-Columbian plant domestication on Amazonian forest composition. *Science*. 355. 925-931.
- Mackey 2014. An Urban Food Forest for Peterborough: Planting for Our Future. Peterborough GreenUp. 45 pp.
- McLain, R., M. Poe, P. T. Hurley, J. Lecompte-Mastenbrook, & M. R. Emery. 2012. Producing edible landscapes in Seattle's urban forest. *Urban Forestry & Urban Greening* 11: 187– 194.
- McPherson, G. & J. Simpson. 2003. Potential energy savings in buildings by an urban tree planting programme in California. *Urban Forestry & Urban Greening*. 2(2):73 – 86.
- Nelson, C. H., M. Stroink & K. Kerk. 2015. Case Study: Roots to Harvest. Contributions to the emergence of the Northern Ontario resilient and connected food hub. Lakehead Food Security Research Network. 10 pp.

Not Far From the Tree. 2018. 2018 Impact Report. https://notfarfromthetree.org/nfftt_2015/wp-content/uploads/2019/03/NFFTT-2018-Impact-Report-s.pdf. April 21, 2019.

Poe, M. R., R.J. McLain, M. Emery, & P. T. Hurley. 2013. Urban forest justice and the rights to wild foods, medicines, and materials in the city. *Human Ecology* 41(3): 409– 422.

Rao, M., A. Afshin, G. Singh & D. Mozaffarian. 2013. Do healthier foods and diet patterns cost more than less healthy options? A systematic review and meta-analysis. *BMJ Open*: 3

Rehel, J. 2013. A healthy diet costs \$2,000 a year more than an unhealthy one for average family of four: Harvard study. *National Post*. <https://nationalpost.com/health/a-healthy-diet-costs-2000-a-year-more-than-an-unhealthy-one-for-average-family-of-four-harvard-study>. April 21, 2019.

Rieger, S. 2019. Banff eyes legislation that would force residents to chop fruit trees. *CBC News*. <https://www.cbc.ca/news/canada/calgary/banff-fruit-tree-ban-1.4964205>. April 21, 2019.

Riolo, F. 2018. The social and environmental value of public urban food forests: the case study of the Picasso Food Forest in Parma, Italy. *Urban Forestry & Urban Greening* (in press).

Saeumel, I., I. Kotsyuk & M. Hoelscher. 2012. How healthy is urban horticulture in high traffic areas? Trace metal concentrations in vegetable crops from plantings within inner city neighbourhoods in Berlin, Germany. *Environmental Pollution*. 165: 124-132

- Simpson, J. R. & E. G. McPherson. 1996. Potential of tree shade for reducing residential energy use in California. *Journal of Arboriculture* 22(1):10 – 18.
- Stapleton, T. 2015. 5 Reasons Why Planting Fruit Trees Along Sidewalks is a Terrible Idea. Land8: Landscape Architects Network. <https://land8.com/5-reasons-why-planting-fruit-trees-along-sidewalks-is-a-terrible-idea>. April 21, 2019.
- Thunder Bay Area Food Strategy. 2015. Community Food Security Report Card. Thunder Bay Area Food Strategy. 48 pp.
- Tesera Systems Inc., Trees Consulting Inc., HAB-TECH Environment Ltd. & For Trees Company Ltd. 2008. Town of Banff Urban Forest Management Plan. 121 pp
- Ulrich, R. S. 1984. View through a window may influence recovery from surgery. *Science*. 224 (4647): 420-421
- Vermeulen, T. 2013. Urban Farming unhindered by air pollution. Wageningen University & Research. <https://www.wur.nl/en/show/Urban-Farming-unhindered-by-air-pollution.htm>. April 21, 2019.
- Village Harvest. 2012. <https://www.villageharvest.org/>. April 21, 2019.

APPENDIX

APPENDIX I: LIST OF URBAN FOREST MANAGEMENT PLANS REVIEWED

Boeur, C. 2010. District of Sechelt Urban Forest Plan.

<https://www.sechelt.ca/Portals/0/public%20document%20library/Studies%20and%20Reports/Urban%20Forest%20Plan%202010.pdf>. 56 pp.

City of Barrie. 2013. City of Barrie Urban Forest Strategy.

<https://www.barrie.ca/Living/Environment/Documents/URBAN%20FOREST%20STRATEGY%20DOCUMENT.pdf>. 31 pp.

City of Brampton. 2011. City of Brampton Urban Forest Study.

<https://www.peelregion.ca/planning/climatechange/reports/pdf/bramp-urb-forest-study-july14-2011.pdf>. 124 pp.

City of Burlington. 2010. City of Burlington Urban Forest Management Plan 2011–2030.

https://www.burlington.ca/en/services-for-you/resources/Forestry%20Operations/Urban_Forestry_Master_Plan.pdf. 60 pp.

City of Edmonton. 2012. Urban Forest Management Plan.

https://www.edmonton.ca/residential_neighbourhoods/PDF/Urban_Forest_Management_Plan.pdf. 38 pp.

City of Halifax. 2013. Halifax Regional Municipality Urban Forest Master Plan.

https://www.halifax.ca/sites/default/files/documents/transportation/streets-sidewalks/HALREG%201246%20UrbanForestReport_HighRes_SINGLEPAGE_Mon20_Combined.pdf. 460 pp.

City of Kamloops. 2016. City of Kamloops Urban Forest Management Strategy.

<https://www.kamloops.ca/sites/default/files/docs/our-community/urbanforestmanagementplan.pdf>. 92 pp.

City of New Westminster. 2016. Urban Forest Management Strategy.

https://www.newwestcity.ca/database/files/library/Urban_forest_management_strategy_FINALreduced_size.pdf. 66 pp.

City of Peterborough. 2011. Urban Forest Strategic Plan.

<https://www.peterborough.ca/Assets/City+Assets/Public+Works/Documents/Final+Urban+Forestry+Plan.pdf?method=1>. 64 pp.

City of St. Albert. 2017. Urban Forest Management Plan. [https://stalbert.ca/uploads/PDF-](https://stalbert.ca/uploads/PDF-infosheets/StAlbert-Urban-Forest-Management-Plan_June-26-2017.pdf)

[infosheets/StAlbert-Urban-Forest-Management-Plan_June-26-2017.pdf](https://stalbert.ca/uploads/PDF-infosheets/StAlbert-Urban-Forest-Management-Plan_June-26-2017.pdf). 66 pp.

City of Toronto, Parks, Forestry and Recreation, Urban Forestry. 2013. Sustaining & Expanding the Urban Forest: Toronto's Strategic Forest Management Plan.

<https://www.toronto.ca/data/parks/pdf/trees/sustaining-expanding-urban-forest-management-plan.pdf>. 76 pp.

City of Vancouver. 2007. City of Vancouver Urban Forest Strategy.

<https://vancouver.ca/files/cov/Urban-Forest-Strategy-Draft.pdf>. 96 pp.

Davey Resource Group. 2011. Urban Forest Management Plan: City of Thunder Bay, Ontario.

<https://www.thunderbay.ca/en/city-hall/resources/Documents/Urban-Forest-Management-Plan.pdf>. 217 pp.

Davey Resources Group. 2017. Urban Forest Management Plan: City of Morden, Manitoba.

<http://www.mordenmb.com/wp-content/uploads/2012/05/City-of-Morden-Urban-Forest-Management-Plan-.pdf>. 73 pp.

Environmental Design and Management Ltd. 2006. St. John's Urban Forest Management Master Plan.

<http://www.stjohns.ca/sites/default/files/files/publication/St.John%27%20Urban%20Forest%20Master%20Plan.pdf>. 71 pp.

Gye & Associates Ltd. 2013. City of Victoria Urban Forest Management Plan.

<https://www.victoria.ca/assets/Departments/Parks~Rec~Culture/Parks/Documents/Urban%20Forest%20Master%20Plan%202013%20Final%20Approved.pdf>. 116 pp.

Mumby's Arboriculture Consulting. 2012. Town of Comox: Urban Forest Management Plan.

<https://comox.ca/modx/urban-forest-management.pdf>. 107 pp.

Penner, Irv., City of Campbell River & Greenways Land Trust. 2015. Urban Forest Management Plan for Campbell River Phase I: Urban Forest Inventory.

<http://www.campbellriver.ca/docs/default-source/parks-recreation-culture/parks/phase-1-urban-forest-inventory.pdf?sfvrsn=4>. 85 pp.

Recreation and Community Services Department. 2011. City of St. Catharines Urban Forestry Management Plan.

<https://www.stcatharines.ca/en/livein/resources/UFMPFinalDraft.pdf>. 69 pp.

Tesera Systems Inc., Trees Consulting Inc., HAB-TECH Environment Ltd. & For Trees Company Ltd. 2008. Town of Banff Urban Forest Management Plan.

<http://www.banff.ca/DocumentCenter/View/1638>. 121 pp.

Town of Devon. 2015. Urban Forest Management Plan.

http://www.devon.ca/Portals/0/Documents/Plans-Reports/2015-03-17-APPROVED-Urban-Forest-Management-Plan_v1.pdf. 16 pp.

University of New Brunswick – Faculty of Forestry and Environmental Management. 2015.

Fredericton’s Street Tree Management Plan- Phase 2.

<http://www.fredericton.ca/sites/default/files/pdf/2016jun02forestrymanagementplan.pdf>. 130 pp.

Urban Forest Innovations Inc. and Beacon Environmental Ltd. 2012. City of Guelph Urban

Forest Management Plan 2013–2032. <https://guelph.ca/plans-and-strategies/urban-forest-management-plan>. 131 pp.

Urban Forest Innovations Inc., Beacon Environmental Ltd & Dr. W. A. Kenney. 2017. Putting

Down Roots for the Future: City of Ottawa Urban Forest Management Plan 2018–2037. http://capitalward.ca/PDFs/UFMP_2017.pdf. 262 pp.

Van Wassenaer, P., Ursic, M., Satel, A. & A. Kenney. 2014. Urban Forest Management Plan.

http://www7.mississauga.ca/Departments/Rec/parks/nhufs/pdf/FINAL_ufmp.pdf. 124 pp.