The Potential of Urban Agriculture in Guelph

By

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ABSTRACT

THE POTENTIAL OF URBAN AGRICULTURE IN GUELPH

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There is substantial optimism for urban agriculture as a form of alternative agriculture that can enhance the food security of individuals within our food system. However, productivity and efficiency of this form of agriculture are not well understood in the literature. This research is the result of a case study of Guelph where fifty gardeners were selected and asked to complete a garden diary in which they recorded their production and input costs (land, labour and capital). The results indicate that the average vegetable gardener in Guelph is not able to achieve high yields but their inputs of labour and capital are quite high. Further investigation of motivations and barriers found that production was not a major motivation for vegetable gardening, but that there were numerous other benefits involved. This suggests that backyard gardening is not a viable food security strategy.
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CHAPTER 1: INTRODUCTION

“For the first time in the nation’s history, we have the chance to reinvent the American city from the ground up.”
-ecomattersdaily.com discussing the Detroit Urban Farm

Problem and Context

Society has come a long way since the monumental moment in history when humans decided to cultivate their own food instead of gathering it. Today, the global food system is complex, involving transfers of foodstuffs from many corners of the globe (Fraser and Rimas, 2011; Pretty et al., 2005; Lang, 1999; Friedland, 1994). In the haste to provide consumers with edible items, that are exotic and fresh, the food system is primarily concerned with providing cheap and readily available food. However, one in seven people still do not have access to enough food (Godfray et al., 2010). Clearly the global food system is not meeting its primary goal, which is to provide food for everyone.

Today, food is grown so that it can be shipped easily and great distances (Millstone and Lang, 2003). This has been made possible through numerous scientific advances that have changed the way food is harvested, preserved and ultimately how the end consumer perceives their food. This system, however, is taxed with problematic issues, such as the distance required to transport food, the large dependency on fossil fuels, the low incomes for farmers, the susceptibility of the food supply to shocks and the increasing cost of healthy food (Harrison et al., 2010; Bardhan, 2006; Basu, 2006; Pfeiffer, 2006; Fraser et al., 2005; Maxwell and Slater, 2003; Hill, 1999).

While mainstream agriculture is riddled with issues, academics are worried about food security in the future and whether mainstream agriculture will be able to feed the
growing global population (Borlaug and Dowswell, 2003). However, there are alternatives that in many ways circumvent the negative aspects of conventional agriculture. This thesis will concentrate on one of those alternatives: urban agriculture.

Urban agriculture is defined as the growing of food within the city. Unlike conventional agriculture, which follows primarily intensive agriculture models in which mono-crops and economies of scale are sought, urban agriculture can take on various forms and scales. Urban agriculture can be practiced in almost any space within the city. Rooftops, alleyways, parks, parking lots and backyards all present possible avenues upon which urban agriculture can be practiced (SPUR, 2012). Urban agriculture production was not considered in estimates of the level of food security or additional food required in the future (Tomlinson, 2011). However, urban agriculture production has been cited as responsible in some places for a substantial portion of vegetable intake (Smit, 1996). Urban agriculture has been shown to have substantial impacts on food security in Cuba (Altieri et al., 1999; Koont, 2009), Eastern Europe (Seeth et al., 1998) and Africa (Foeken & Mwangi, 2000). Therefore, urban agriculture could represent a way to increase food security in North America.

In North America, private gardens are cultivated by many urbanites. Their primary motivation, however, is not often yields (Clayton, 2007). In fact, there is no clear indication as to how much food is actually being produced in private gardens in North America. While food production may not be the sole goal of these gardeners, a residual benefit is the food being produced. Understanding how much food is being produced will help society decide how this type of production can be incorporated into and help to lift some stress off the global food system.
**Purpose of Research**

The purpose of this research is to quantify and evaluate the potential of urban agriculture in Guelph, Ontario, Canada. While there is much optimism about the potential of urban agriculture as an alternative food security strategy among advocates and academics, there is no current empirical evaluation of the productivity of North American vegetable gardens. Therefore, the primary purpose of this research is to understand empirically how much food (in kilograms) is being produced in private gardens in and near the City of Guelph. While it is insightful to understand how much food is being produced, it is also important to understand the costs associated with this production. To do so, inputs will be recorded empirically in order to understand how much space, time and capital are required to achieve various levels of production. Additionally, this research seeks to evaluate the motivations of gardeners for growing their own food, as well as the barriers encountered in the process. The broader aim of this research is to assess whether urban agriculture has the potential to contribute substantially to food production in the global food system.

**Rationale of Research**

Recent population projections suggest that the world’s population will peak near nine billion people later this century (Godfray et al., 2010). Food scholars are fearful that feeding nine billion people will be a challenge that industrial agriculture may not be able to tackle (Godfray et al., 2010). Considering six of nine billion people will likely live in the city in 2050, urban agriculture has the potential to provide possible solutions to this issue. However, it is challenging to suggest urban agriculture as a solution due to its unclear potential; thus, it is not often suggested as a possible solution to feeding these six million urbanites.
One of the problems this research seeks to address is that it is currently unknown what percentage of the population actually gardens with food production as their goal (as measured by those with vegetable gardens). The reasons behind backyard food production are also not well understood. However, as mentioned above, there is substantial optimism within various communities and special interest groups claiming that urban agriculture has the potential to assist society in tackling problems like food security for the poor (Zezza and Tasciotti, 2010), increased levels of self-sufficiency for cities (Koc, 1999) and a sustainable food system (Friedmann, 2007). There are also indirect benefits, such as improving nutrition, increasing health through exercise, and counteracting many of the negative environmental issues present within the city (Bradshaw, 2012; Canada News Wire, 2012; SPUR, 2012; Wakefield et al., 2007; Bellows et al., 2003; Twiss et al., 2003).

The current global food system is also incredibly susceptible to shocks, and such shocks could lead to massive increases in food insecurity (Fraser et al., 2005). This susceptibility is largely due to both the long distances that food needs to travel to reach the consumer and the low levels of diversity of different models in the food system (Fraser et al., 2005). Urban agriculture could be one method for decreasing the amount of travel required and improving the much-needed diversity of sources; ultimately reducing the susceptibility of the global food system to shocks such as extreme weather events or terrorist attacks. In this way, it would act as a buffer that could be used if the mainstream food system lapsed temporarily due to a shock. This is a key role for urban agriculture, as it will limit the impact of these shocks.
While it is unlikely that urban agriculture will ever replace mainstream agriculture, it may be helpful in relaxing some of the pressures upon the global food system that urban agriculture is uniquely positioned to fulfill.

**Objectives**

The aim of this research is to discover the role of vegetable garden production in a sample of the City of Guelph to evaluate both the potential, as well as the potential costs, associated with private vegetable gardening. To meet this goal, two two-part questions are explored: How much food is Guelph producing in private gardens and at what cost is the food produced? A second research question is: Why are people motivated to do this and what barriers are they encountering? In order to answer these questions, there are four (4) objectives:

1. To collect preliminary data to estimate current levels of garden food production in Guelph and the associated costs of land, labour and capital.

2. To discover common motivations and barriers and assess whether these have any relation to productivity.

3. To assess how to improve the contribution of gardening to the food supply at the municipal scale.

4. To consider how garden food production could contribute to the global food system.

To this end, the objectives will allow the researcher to estimate how much food is produced and how much input is used to produce the harvest, and to discover some common themes about why citizens are gardening and what prevents or challenges them in their pursuit of food production.
Structure of Thesis

The structure of this thesis is as follows. Chapter One provides an introduction to the topic, the rationale for the research and the key objectives this research sought to explore. Chapter Two explains important scholarly work related to urban agriculture and identifies the gaps present in current knowledge which this thesis fills. Chapter Three discusses the methods used in this thesis, including how data was collected, how the site was selected, a sample characterization and the limitations involved with the methodology. Chapter Four reports results primarily from the garden diary aspect of the project which provides quantifiable results as to the levels of production, and the input costs discovered by this thesis. Chapter Five explores the results from the interview portion of the data collection and reports results about popular motivations and barriers. Chapter Six discusses what gardeners felt their municipality could do to enhance urban agriculture and ends with some policy recommendations. Chapter Seven explores how these results could impact society if expanded to different scales or if specific policies were enacted. Chapter Eight provides a conclusion to the thesis with some potential avenues for future research and a recap of objectives.
CHAPTER TWO: LITERATURE REVIEW

"Gardening is the purest of human pleasures."
- Francis Bacon

Introduction

The following chapter will outline literature that is important in understanding this thesis. In terms of assessing the potential for urban agriculture to address food security needs, there are four critical areas that need to be considered. The first area is the inconsistency and lack of empirical literature on quantifying production of urban agriculture. The second major area covers optimism for urban agriculture. The third section discusses the benefits so as to understand why or why not urban agriculture is worth pursuing. And finally, understanding barriers is important to understanding what is preventing the scaling-up of urban agriculture.

Quantifying Production and Inputs

In 1996, the IDRC produced a report in which they estimated that in 1990 14%-20% of food globally was produced in cities and they projected that by 2005 25%-33% would be produced in cities (Smit, 1996). They estimated that a 33% share of vegetables, meat, fish and diary consumed in cities was grown or raised in cities in 1990. They projected that this would increase to 50% by 2005 (Smit, 1996). These estimates were based on a number of assumptions, including technology transfer to make urban yields more competitive with rural yields, lower density cities continuing to provide opportunities for agriculture, and women’s businesses continuing to grow faster than men’s businesses (Smit, 1996).

Quantitative data is the surest way to understand the true productivity of backyard food production. A study on community gardens in Montreal found that production
varied between 0.3kg/m\(^2\) and 5.4kg/m\(^2\) (Duchemin et al., 2009). Agriculture and Agri-Food Canada estimated that vegetables being shipped from market gardens to market would yield 0.6kg/m\(^2\) without being processed (2007, as cited in Duchemin et al., 2009), and De Vries et al. (1997, as cited in Duchemin et al., 2009) estimated that the worldwide rate of urban agricultural production would be between 0.15kg/m\(^2\) and 0.57kg/m\(^2\) for market gardens. This indicates that the sparse literature on yield figures varies widely and no clear consensus can be made. In Cuba, the production rate is 25.8kg/m\(^2\) (Koont, 2008). Productivity in the popular literature is often defined not in terms of produce but in terms of income or value. For instance, a newspaper article from Vancouver’s Tyee cited that urban farmers were able to earn $2000 from a plot they rented for $200 (Zandberg, 2006). A website for S.P.I.N. (Small Plot Intensive) agriculture states that the potential productivity using this model is $24,000-$72,000 per 0.5 acres (SPIN farming, 2012). The issue is that while S.P.I.N agriculture is designed to increase productivity, productivity is not measured in terms of produce but rather in terms of money. Additionally, an undergraduate thesis explored the financial viability of a backyard garden and found that the garden was financially viable over a long period of amortization of costs; however, the amount of food produced was not the focus of the study (Elsadr, 2007). Therefore, one of the aims of this study is to produce a figure that represents the productivity in terms of the amount of produce and also corresponds to the climate in Southwestern Ontario.

Quantifying inputs is the least understood in the literature. Inputs for gardening are often strangely absent from any studies exploring productivity. For example, Koont (2008) explores how much food is produced in Cuba but is totally silent about the inputs
required acquiring that production. Elsadr (2007) did quantify the cost of his garden, which was $16 dollars per m$^2$; however, he calculated his labour cost at $8/hour, which is not realistic in today’s labour market (Elsadr, 2007). Practical gardening books also advertise the large amount of produce that one might harvest; however, the inputs necessary to acquire such great harvests are not often described or even mentioned (SPIN farming 2012; Madigan, 2009; Zandberg, 2006). One exception to the lack of complete information is that the majority of these sources do mention how much space one would require to produce the advertised level of production, but capital and labour figures are absent (SPIN farming, 2012; Madigan, 2009). Additionally, these sources advertise the maximum amount of efficiency, which is not representative of the average gardener’s productivity. Therefore it is important that these inputs be quantified. There has been very little empirical work done in a systematic way to measure the productivity and efficiency of gardens in North America. This is clearly illustrated in this section, with only a couple studies in North America and an unpublished undergraduate thesis. From the popular media on the topic (and the scholarly as well), it is abundantly clear that inputs have not been measured when production is reported. Therefore this study seeks to quantify the land, labour and capital, or inputs, combined with the amount of produce, to have an understanding of the true efficiency of urban agriculture in Guelph.

**Optimism for Urban Agriculture**

In popular literature and media, urban agriculture is often suggested as a solution to the global food crisis or, short of that, a practice that could substantially improve our food situation (Nierenberg, 2013; Schiffman, 2013). Headings such as “Five Reasons Why Urban Farming is the Most Important Movement of Our Time” or “High Demand
for Local Boosts Urban Agriculture” appear in popular media and, from a quick glance, urban agriculture looks to be a very promising phenomenon (Kumar 2012; Karst, 2012). Interestingly, many of these articles do not mention the main output of these endeavors: the food. The benefits instead seem to be social, economic or environmental, but actually feeding ourselves seems to be a topic missing from the basic benefits of growing food within the city. This is an indication of what the literature confirms: the weak understanding of urban agriculture yields. The popular media does not report high yields because there have not been studies to determine what the high yields are. In fact, any yield is relatively unexplored.

Numbers are not usually mentioned, but when they are, they tend to provide an optimistic but incomplete picture. “14,000 lbs” is a harvest figure noted in one article, with 35 backyard gardeners and up to 80 community gardeners (Hodgins, 2012). What is missing here is how much space was cultivated, how many hours invested or how much money spent to produce this amount of food. This is typical of popular media surrounding urban agriculture and leaves us unclear whether the amount of food being produced actually represents a useful investment of labour, land and money. Thus, while it is clear that there is optimism, it is unclear how much real potential urban agriculture actually represents, as solid quantitative studies on the level of production are still elusive in the North American context.

There is substantial optimism for urban agriculture in scholarship, but this differs between the developed and developing world. The topic of urban agriculture generally is much more prominent in literature focusing on the global south rather than the global north. Literature in the developing context often focuses on urban agriculture as a
livelihood strategy for the poor (Bryld, 2003). This is due to opportunities for people to grow food in a subsistence context, but also to sell extra produce as entrepreneurs (Hovorka, 2004), experience female empowerment (Slater, 2001), and benefit from nutrient recycling in cities without adequate plans to deal with organic wastes (Bryld, 2003). Additionally, there is some additional evidence that urban agriculture in the developing world could have the potential to alleviate poverty as it has been shown to lower food prices and provide employment (De Bon et al., 2009).

While there is less literature focusing on the developed world, there are still distinct themes which emerge. One of the major themes is optimism surrounding the ability of urban agriculture to facilitate positive community development (Wakefield et al., 2007; Roubanis and Landis, 2007; Glover et al., 2005; Saldivar-Tanaka and Krasny, 2004; Glover, 2004). There is also some employment optimism for urban agriculture in the developed world (Smit and Nasr, 1992), as well as economic benefits including the cost savings on groceries or the value earned from selling the food (Ferris et al., 2001; Hannah and Oh, 2000). Generally, however, the focus of North American literature on urban agriculture is about the environmental benefits including the productive use and preservation of open space (Hess and Winner, 2007; Mougeot, 2006; Saldivar-Tanaka and Krasny, 2004; Armstrong, 2000; Smit and Nasr, 1992). A final reason for optimism is the potential health benefits of urban agriculture, which include leisure activities and improved diet and exercise (Alaimo et al., 2008; Pudup, 2008; Armstrong, 2000).

A smaller group of scholars have optimism for vertical farming that is a variation of urban agriculture (Despommier, 2010). This theme is not limited to North America, but due to the projected cost of these projects they are ideally suited to a developed
society (Despommier, 2010). The vertical farm concept provides optimism for urban agriculture because it is proposed as a solution to the pressures of current agriculture which would move agriculture into a vertical building within the city (Despommier, 2011). While this idea is rather futuristic, there is optimism that it is possible should current agricultural methods become no longer viable. It should be noted that there are many skeptics to this idea.

As is clear, urban agriculture seems to have lots of potential for good in the food system. This optimism was a large portion of the inspiration for this project, because while all these potential benefits are great, it is important to understand the yields and input costs of such an enterprise.

When Has Urban Agriculture Flourished in the Past?

During the Second World War, food was being sent from North America to Europe to support the Allied Forces, which created a shortage at home. Citizens were encouraged to keep their own gardens, called ‘victory gardens’ to help ensure victory in Europe (Miller, 2003). Efficiency was promoted by the use of garden journals and production was a major focus, which was illustrated by asking questions about which vegetables were needed most for the war effort and which might produce the highest yields per row (Miller, 2003). The Science Newsletter in 1943 suggested tomatoes be planted because they are: “agreeable to eat, easy to feed to children, easy to put up for winter [and] rich in vitamins and minerals” (Thone, 1943,186). From these articles, it is clear that in the past vegetable gardening has been concerned with production and efficiency, but only in times of need.
Literature on Benefits of Urban Food Production

The reasons that people cite for gardening can be very diverse. A study done in Thailand in 2002 found that benefits might include increased property value, more aesthetically pleasing landscapes, and better air quality (Fraser, 2002). However, another paper stated that the major factor in pursuing gardening was rooted in the ethnic tradition in which the homeowner had grown up (Fraser and Kenney, 2002). A newspaper article in the Vancouver-based Tyee states that it is for the potential income, the vegetables they can grow, and the popularity that accompanies successful gardening (Zandberg, 2006).

The motivations to urban food production in societal terms are numerous. Benefits include the following: increased economic stability due to decreasing food costs, resulting in more income being left over instead of being devoted to food purchasing; community development from community gardens that fosters a tighter sense of community especially surrounding their food; diets with increased nutritional content because gardeners are eating the vegetables out of their garden which promotes increased levels of healthy, fresh vegetables; and a reduction in the problems associated with urbanization including more green space, increased air quality, and a more beautiful landscape (Mougeot, 2006; Saldivar-Tanaka and Krasny, 2004). The following will summarize the current understanding of these issues in academic literature.

One of the most important potential benefits is that urban agriculture solves many distribution problems, as the food is grown where it is consumed. Logistics in the current food system are responsible for providing food to those who consume it, though this distribution is not equitable across the globe (Kendall and Pimentel, 1994). A major problem with the global food system is that it is vulnerable to major threats, even if they seem remote, such as health outbreaks or terrorist attacks (Fraser et al., 2005). This
system is responsible for feeding cities while being dependent on weather conditions, energy, the global market functionality and trade (Fraser et al., 2005). Major disruptions are possible, and the system would not be functional during major crisis events. This has the potential to lead to massive food insecurity globally. Urban agriculture is a possible alternative to relieve the pressure of this problem, especially if it were possible to scale this form of food production up. While urban agriculture is still dependent on affordable energy and weather consistency, it is almost entirely independent of the logistical systems that characterize the global food system. This logistical system is the portion most vulnerable to shocks from major events. Therefore, urban agriculture presents a possible solution that contributes to food security in the urban setting during a crisis situation.

Urban agriculture is important because the proportion of people living in cities is climbing and further population growth will take place in cities, not in the country (Weis, 2007).

Another significant potential advantage to the urban farmer is the amount of money that can be earned. One study claimed that for every dollar invested in a community garden plot there would be six dollars of vegetables produced (Bellows et al., 2004). The benefit is obvious. Due to the low input from the farmer, the amount to be made may be significant. Continuing with economic benefits, a community garden has been shown to significantly lower food bills of the participants or to create extra income (Saldivar-Tanaka and Krasny, 2004, Fraser, 2002; Ferris et al., 2001; Hanna and Oh, 2000). Gardens that focus on production have been popular in the past when there were economic reasons to pursue production. Victory gardens were popular during WWII as an effort to lower the domestic impact on the war effort (Miller, 2003). In the 1970s, the
prevalence of vegetable gardens increased due to an increase in the price of food and increasing environmental awareness (Lawson, 2005). A new phenomenon called ‘Recession Gardens’ increased by 19% during the recent recession in an effort to decrease household grocery bills (Sutter, 2009). While none of these lead directly to economic gain or income generation, they do allow less of the participant’s monthly budget to be spent on food, which is likely why these all became popular when there was a financial downturn or crisis. While there is some preliminary evidence that urban farming can be profitable, there has not been research on the labour required to earn that profit.

One of the key challenges of urban agriculture is acquiring the land needed to grow food on. In the case of Backyard Bounty in Guelph, an innovative solution is being used where people who do not use their backyard were in many cases willing to donate it for the production of food. Backyard Bounty is a company that grows food in the resident’s backyard and then sells it to consumers (Backyard Bounty, 2013). The possibility of inexpensive land is an important advantage that the urban farmer has over the rural farmer. A similar program operates in Vancouver, but it is not marketed at companies but simply to those who wish to garden but do not have a space (Sharing Backyards, n.d.)

Another major advantage of urban agriculture is through community gardens, as they foster a sense of community development (Roubanis and Landis, 2007; Glover et al., 2005; Saldivar-Tanaka and Krasny, 2004; Glover, 2004). The visible signs of community development are varied but can take shape in the form of community activism or political activism. In Latino gardens in New York City, 20% were politically
active as a gardening community (Saldivar-Tanaka and Krasny, 2004). The fact that they were politically active as a gardening group illustrates how the community garden acts as a focus for a sense of community to be developed. Political activism is an example of that community. A campus garden at Meredith College in North Carolina developed to encourage sustainability has developed an increase in community on campus that transcends disciplines (Roubanis and Landis, 2007).

However, a study by Glover indicated that while the garden did bring some members of the community together, it also divided certain members who were not included, leading to increasing alienation (Glover, 2004). Additionally, even within the gardening group there was tension over what was planted (Glover, 2004). However, the concept of the project itself was useful in bringing the community together to accomplish a task (Glover, 2004).

It seems that the literature on community development indicates that gardens are an effective way to bring a community together but, as Glover points out, it is possible that the garden can represent an exclusive activity that has potential to lead to increasing alienation. While the Glover article discussed how race and crop selection were major points of contention, it is unclear exactly why gardens may not provide the sense of community that is often expected.

Another residual benefit to the community is increased safety upon the implementation of a community garden. Participants of community gardens have perceived crime rates as lower; however, this is simply an aspect of other studies and not the sole focus of the studies that report these findings (Pudup, 2008; Hess and Winner, 2007; Kurtz, 2001). There have yet to be concrete before and after comparisons.
Urban agriculture has also been shown to increase nutrition and food security (Mougeot, 2006; Armstrong, 2000; Memon and Lee-Smith, 1993). This is especially important in poorer households in which the ability to afford the proper food to constitute a healthy diet is not a reality. One study found that adults participating in a community garden project consumed fruits or vegetable 1.4 times more per day than non-participants (Alaimo et al., 2008). This indicates an improvement in diet. Growing the food on their own property allows poorer households to experience greater food security, especially in the developing world (Mougeot, 2006). In Kenya, 40% of urban farmers stated that they would starve without the produce they cultivated in the city (Memon and Lee-Smith, 1993). Furthermore evidence from another study in Malawi indicated that urban agriculture was beneficial for low-income families as they would grow food for profit and then reinvest that profit in grains to feed their families (Mkwambisi et al., 2011). In North American communities, many community gardens give at least a portion of their produce away to others, which improves the food security of the entire neighbourhood (Teig et al., 2009; Macias, 2008; Shinew et al., 2004). This expands the food security benefit beyond the immediate community of gardeners to their surrounding community.

There are also environmental impacts that increase the health of the city landscape. For example, urban agriculture has been shown to improve air quality, use waste products as fertilizer and reverse the damage the city has inflicted upon the natural environment (Mougeot, 2006). In addition, more urban farmers use organic inputs because they are more economical and therefore more accessible, especially in the Global South (Memon and Lee-Smith, 1993).
A major problem in all cities, whether in the developed or developing world, is how to deal with the massive amount of physical waste. Biowaste, which includes food waste, is often shipped out of the city, even though the food itself had to be shipped into the city (Smit and Nasr, 1992). Converting this waste into compost within the city and subsequently using that compost to grow food results in less food having to be imported; this is a natural benefit of urban agricultural production (Smit and Nasr, 1992). Another benefit is that gardens have the ability to absorb rainwater instead of creating runoff which, depending on the sewer system present, could have significant impacts on the alleviation of stress on the sewage system (SPUR, 2012). It is unclear from this literature how much of an impact this type of closed system could have in quantified terms, but there is certainly optimism for it.

While there is sparse literature on the motivations for vegetable gardening, there is some literature on the motivations of gardeners generally. Clayton (2007) surveyed 126 people at a garden center about their motivations and found that spending time outdoors, observing nature and relaxation were the most common benefits to gardening. Clayton (2007) also found that producing food was a motivation but not a significant one. This could be based on which gardening stores Clayton surveyed and the amount of actual vegetable gardening supplies they sold. Another study by Ashton-Shaeffer and Constant (2005) looked at the motivations of older adults and found that physical fitness and creativity were the most important motivations, while social interaction and friendship-building were the least important. A historical study by Kaplan in 1973 found that vegetable gardeners were more concerned with the tangible benefits of their garden, such as food, while other gardeners were most concerned with mental benefits (Kaplan,
This indicates that food may not be a significant motivation for gardening generally, but it is suggested that it is important to those who are actually growing food, and Kaplan was not primarily focused on vegetable gardeners. It may also indicate a shift over time from the vegetables being a major benefit to other benefits being paramount. This probably indicates that vegetable gardeners are simply a minority among gardeners. Armstrong (2000) indicated that the food is a popular reason to join community gardens, further illustrating that food may be a significant motivation for vegetable gardening.

**Literature on Barriers to Urban Food Production**

The barriers to urban food production are also numerous and suffer from a lack of understanding in the North American context. Barriers include local by-laws that prevent urban food production, land tenure stability, pressure to develop land, and soil contamination (de la Salle and Holland, 2010; Mougeot, 2006; Saldivar-Tanaka and Krasny, 2004; Howe and Wheeler, 1999).

There are some limitations and barriers that must be addressed for very large-scale urban agriculture to be possible. The first major problem to be overcome, which has not been explored in the literature, is whether it is economical in terms of land use, financial input and the time invested in food production for the majority of citizens. The determination of whether urban agriculture is worth society’s time and investment must be determined before other aspects of feasibility are examined. Thus far, this has not been the case in the realm of urban agriculture research. Much of the literature has considered the environmental barriers of urban agriculture and some have considered the social barriers, but few have addressed the general feasibility problems directly. If it is in
fact determined that a substantial amount of produce could be realistically cultivated within the city, the next major concern is whether people are willing to participate in such a project or not and, if they are not, why are they not willing to do it?

One of the major limitations to urban agriculture is that in many cities, especially in the developing world, urban farming is considered illegal; this leads urban farmers to be opportunistic planters (Mougeot, 2006; Bryld, 2003). The problem with unplanned urban farming is that it can be obstructive and actually enforce the policy maker’s belief that urban agriculture is not beneficial to the city. This presents many public policy issues that a municipal council must consider. Furthermore, the illegality of urban agriculture forces money to be diverted from helping people to have enough to eat to enforcing the ban on urban agriculture. A policy of acceptance could very easily realize a substantial decrease in food insecurity should urban agriculture become accepted by an increasing number of city councils.

If urban agriculture is being practiced on undeveloped land, either within the city or near the edges, then there is always pressure to have that land developed (de la Salle and Holland, 2010). This pressure is often unbeneficial to urban production because the parties involved in disputes over the land are usually unfunded urban agriculture groups against major real estate development firms. This drives the price of land up and results in the land being unaffordable for practicing agriculture. This happens in both the developed world and the developing world (de la Salle and Holland, 2010; Mougeot, 2006). One group, the SOLEfood project in Vancouver, has 2 acres on pallets so that their farm can be mobile if required (Webb, 2012). This solidifies how significant the constant pressure on land can be.
One of the most problematic issues associated with urban agriculture is land tenure (Saldivar-Tanaka and Krasny, 2004, Fraser, 2002; Howe and Wheeler, 1999). Often in urban farming, the owner of the land is not the farmer and therefore the urban farmer requires permission or rent to gain access to land within the city. This is often difficult and is a major limitation to expanding the scale of urban agriculture. While initial agreement can be achieved, if the owner changes their mind, all the investment of the urban farmers is lost and they must begin searching for land again (Fraser, 2002). In heavily developed areas, urban farming is also subject to somewhat vulnerable or marginal plots and therefore another limitation is theft and vandalism (Howe and Wheeler, 1999). This is problematic because often the community gardens are unfunded or marginally funded, so when their equipment is stolen or their crops are destroyed, it leads to the failure of these gardens.

Soil contamination is a limitation that is very prevalent within the media and is widely conceived as a limitation to urban agriculture, especially in the developed world where industrialization occurred in many urban areas (Lamprey, 2013). Howe and Wheeler (1999), however, noted that this is a limited barrier and solutions are possible, most notably of which is raised beds (Rockland-Miller, 2010). Raised bed present another obstacle however, as they generally require soil to be brought into the site. Raised beds are practiced usually for functionality or for aesthetics.

Summary

In summary, this chapter has examined the literature that inspires and informs this research. It is clear that there is a lack of understanding about yields and the associated input costs, as well as motivations and barriers specific to vegetable gardening. This
research provides preliminary evidence to fill these gaps in the hopes of providing a base to assess the potential of urban agriculture to address problems in the global food system.
CHAPTER THREE: METHODOLOGY

“Quantifying this sort of thing is difficult as it’s not something you normally think of when gardening unless you are doing it for money rather than love.”
-Garden Diary Research Participant

Introduction
The first goal of this thesis was to assess the quantity of food produced, as well as the inputs in terms of land, labour and capital invested in a sample of vegetable gardens in Guelph in the summer of 2012. The second goal was to determine why the gardeners were interested in producing their own food and what kinds of barriers they encountered during the process. To this end, the research took a mixed methods approach which included garden diaries and semi-structured interviews. This chapter will discuss study design, site selection, ethical implications, recruitment strategies, sample characterization, data collection methods and the limitations of the research project.

Study Design
This study uses a case study design. Case studies are used to select a small sample and study them in-depth within their social contexts and to understand what is happening within the case (Adler and Clark, 2008). This research design was chosen because it was decided that the data would be collected over one summer, as is normal for a geography Master’s project. Additionally, only a small number of participants were selected, therefore allowing more in-depth coverage of their gardening experiences. It was also only possible to study one location in this time period, which limited the study design to that of a case study. The methods to conduct the project used both a
quantitative approach (garden diaries) combined with a qualitative approach (semi-structured interviews).

Usually, a research study can fit into one of three categories: exploratory, descriptive or explanatory. This research project was primarily explanatory but also had elements of descriptive research. Explanatory research seeks to ask the question “why?” and looks for causes and reasons (Adler and Clark, 2008). The researchers wanted to gain an understanding as to whether there are specific reasons and causes for vegetable gardening that differ from those of general gardening. This research is also descriptive because it describes, in great detail, what was happening in the participants’ gardens in Guelph in the summer of 2012.

However, the bulk of this thesis is devoted to answering the linked questions: How much food was grown in Guelph’s backyards and how much did it cost (in land, labour and capital) to produce this food? To this end, data have been collected that allow the researcher to estimate how many people are gardening in Guelph, how large their gardens were and what levels of production they were able to get from their gardens. Additionally, the researcher estimated how much food could be produced if, instead of backyard production by private homeowners, professional urban farmers of various scales were to grow food within the city. These data were analyzed to assess what role urban agriculture could play in positively changing food security in Guelph and other mid-latitude cities.

**Site Selection**

The study site for this project was the City of Guelph. This area was chosen for a number of reasons. First, the City of Guelph, at least generally, has a greater food
awareness compared to many municipalities, as illustrated in the success of various local food initiatives, such as the Guelph Farmers Market, Ignatius Community Shared Agriculture Program, various community gardens on municipal and private land and Backyard Bounty. Guelph also has a food charter which was developed by the Guelph-Wellington Food Round Table; this document illustrates that Guelph is committed to and aware of the need for improvements to their food system. One item in the food charter, under environment reads: “The growth of food production methods that sustain and enhance the natural environment in both rural and urban settings” (Guelph-Wellington Food Round Table, 2011). When this is combined with the following item under sustainable economic development: “[p]rioritizing production, processing, distribution and consumption of local food” (Guelph-Wellington Food Round Table, 2011), it is clear that within Guelph there is an awareness and interest in their food system and how that might apply to urban food production. This may not represent every citizen’s thoughts on the food system, but it does illustrate that there are interested parties in Guelph. This makes Guelph a good location to study urban agriculture, because we can assume that Guelph is ahead of the curve in terms of food awareness and, therefore, may represent the potential of urban food production in cities of a similar size and composition. Secondly, the size of Guelph is also beneficial because it is a medium-sized city (approximately 120,000) and there has been little urban agricultural research in the North American context in medium-sized cities; instead, the research has favoured larger urban centers such as Toronto, Montreal or Vancouver (Nasr et al., 2010; Newman, 2008; Bhatt, 2005). Thirdly, due to the location of Guelph, the climate represents similar gardening potential to many other Southwestern Ontario cities. Collecting local research was beneficial
because the gardening season ended for participants anywhere between mid-July to early October.

It was in the best interest of the researcher to divide Guelph into more specific regions in order to effectively target areas that most represented Guelph as a whole. Census tracts (each with a population of somewhere between 2500-8000 (Statistics Canada, 2010)) were selected as a useful way to divide the city into neighbourhoods. There are 27 census tracts in the urban portion of Guelph with the final Guelph census tract representing the surrounding countryside and therefore was excluded. The census tracts were evaluated to choose which two were most representative of Guelph as a whole.

The study site selection process made use of remote sensing and Canadian census data to form neighbourhood typologies and to ensure that the areas most representative of Guelph were chosen to study urban food production. The remote sensing portion used aerial photographs to sort the census tracts into proper typologies and using ArcGIS, the corresponding census data was matched with the location. Census tracts were chosen to represent areas representative of Guelph as a whole. To this end, census tracts were evaluated based on the characteristics listed in Table 3.1.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Method of Acquirement or Data Sources</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Population</td>
<td>Statistics Canada Data (2006)¹</td>
<td>Most recent data at the census tract level accessible at time required. Chosen to represent Guelph demographically.</td>
</tr>
<tr>
<td>Median Age</td>
<td>Statistics Canada Data (2006)¹</td>
<td>Most recent data at the census tract level accessible at time required. Chosen to represent Guelph demographically.</td>
</tr>
<tr>
<td>Median Household Income</td>
<td>Statistics Canada Data (2005)¹</td>
<td>Most recent data at the census tract level accessible at time required. Chosen to represent Guelph demographically.</td>
</tr>
<tr>
<td>Indicator</td>
<td>Source</td>
<td>Most recent data at the census tract level accessible at time required. Chosen to represent Guelph demographically.</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Percentage of People with a Certificate, Diploma or University Degree</td>
<td>Statistics Canada Data (2006)(^1)</td>
<td>Most recent data at the census tract level accessible at time required. Chosen to represent Guelph demographically.</td>
</tr>
<tr>
<td>Tree Cover</td>
<td>Google Earth (2011).(^3) Manual Assessment on a scale of 1-5 (1=no tree cover, 5=complete tree cover)</td>
<td>It was important to understand how the canopy in various neighbourhoods would either make the sunlight very beneficial to gardening or very unbeneicial to gardening.</td>
</tr>
<tr>
<td>Percentage of Immigrants</td>
<td>Statistics Canada Data (2006)(^1)</td>
<td>Most recent data at the census tract level accessible at time required. Chosen to represent Guelph demographically.</td>
</tr>
<tr>
<td>Yard Size</td>
<td>ArcGIS using City of Guelph Data (2011)(^2)</td>
<td>It was important to understand the average yard size as this was an important factor in whether gardening was possible or not.</td>
</tr>
<tr>
<td>Population Density</td>
<td>Statistics Canada Data (2006)(^1)</td>
<td>Most recent data at the census tract level accessible at time required. Chosen to represent Guelph demographically.</td>
</tr>
</tbody>
</table>

\(^1\) Statistics Canada, 2010.  
\(^2\) The City of Guelph Municipal Data, 2011a; 2011b; 2011c; 2006  
\(^3\) Google Inc., 2011

**Why were these Indicators Chosen?**

Total population and population density of the census tract was chosen as an indicator to ensure that the selected census tracts were representative of Guelph. Median age and median income were chosen to eliminate the outliers involved with using the average income and to confirm that the age and income profiles were representative of Guelph’s total population. Percentage of people with some form of post-secondary education and percentage of immigrants were chosen to ensure that each census tract represented Guelph’s diversity as closely as possible. Furthermore, immigrant percentage was chosen because as Fraser and Kenney found in 2000, certain cultural groups are more commonly suited to backyard food production than others and therefore specific cultures may yield substantially less or more urban food production than others.
The remaining indicators above facilitated basic demographic variables. Tree cover and yard size were assessed in an attempt to select census tracts that were representative of Guelph as a whole, rather than those that were possibly most conducive to gardening.

*How was Each Indicator Used to Choose a Census Tract?*

Each indicator was standardized using Z-scores and then ranked. The equation is:

$$ Z \text{ score} = \frac{x - \text{Mean}}{\text{Standard Deviation}} $$

The Z-score was calculated for each variable in each census tract, which illustrates how far the variable in each specific census tract was away from the mean for that variable for the city. Then each Z-score was ranked out of 27 (there were 27 census tracts) to illustrate how similar to the average that variable was compared with all other census tracts. The smaller ranking represented a close alignment with the mean of that variable. Then the ranks were added together for each census tract to conclude which census tract was more representative of the city by being the closest to the city average on all the variables combined. The lowest numbers represented the census tracts most representative of Guelph based on the variables selected. The two census tracts most representative of Guelph were then chosen in order to begin random sampling.

Approximately 230 addresses were chosen in each census tract and sampled. These same addresses were later used in the research process for the estimation of gardening activity in Guelph.

*How Addresses were Randomly Chosen*

In order to adequately assess which census tracts best represented Guelph, it was necessary to use ArcGIS data files. The data used in this research were provided by the City of Guelph. The addresses, building polygons and land parcels were 2011 data and
the zoning data were 2006 data, as 2011 data were unavailable (The City of Guelph, 2011a; 2011b; 2011c; 2006). Statistics Canada provided the census tract boundary data as well as the census tract demographic data, both from 2006, as 2011 data were unavailable at the time at the census tract level (Geography Division, Statistics Canada, 2006).

The census tract selection involved the following process. The first step was to select all areas zoned as ‘residential’ in Guelph and to export any addresses that overlapped these parcels as a new layer. The second step was to select all the parcel polygons that overlapped with the address layer. The third step was to calculate the built area (representing homes) and the non-built area (yard area). To do this, the building footprints were simply removed from the size of the property and a new layer was created. What was left was simply the yard size, as the building area has been subtracted or erased from the size of the property. This method was 98.98% effective in capturing all residential properties. The remaining 1.02% represented properties with anomalies and therefore were excluded. Once the desired census tracts were decided upon, a ‘fishnet’, or grid, was applied to the map of Guelph to reduce the possibility of clustering in the sample; the tool ‘Geospatial Modeling Environment’ was then used to randomly generate addresses in each grid cell. A second round of random addresses was required, meaning that the previously generated addresses were removed as possible options and new addresses were selected. Approximately 230 addresses were selected per census tract, per round. This was based on an initial goal of 200 participants for the research study which proved to be impossible given that there was no list of gardeners available to target, nor was there time to compile one.
Ethics
Due to the involvement of human participants in this project, ethical clearance was sought. The letter of certificate is displayed in Appendix A. The major ethical concern for this project was protecting the confidentiality of the participants. To this end, little identifying information was collected; however, any that was collected was encrypted and password protected. The work-study student who worked on this project also signed a confidentiality agreement to ensure the protection of the identity of the participants. Due to the procedure for ethical clearance at the University of Guelph, this delayed the commencement of recruitment by almost a month. Once the Research Ethics Board cleared the study, recruitment began the next day.

Recruitment
Recruitment commenced on April 24th, 2012. The normal outdoor planting date for the Guelph area is generally accepted as the Victoria Day long weekend when the risk of frost is very low. Therefore recruitment began one month in advance of this date. The recruitment method was twofold. The first approach was using a random sample of addresses in census tracts that were representative of Guelph, as described above. This required that the lead researcher use a door-to-door recruitment technique in which letters were delivered, that was then followed by a visit to the home. Each letter was hand-signed and hand-addressed to increase the response rate (Scott and Edwards, 2006). After three weeks of using this recruitment technique, the response rate was a dismal 3% of the total number of homes visited and 6.5% of the homes where someone answered their door. At this point, 300 homes had been visited and only 137 potential participants had been home. Additionally, only 9 participants had agreed to participate. Due to the nature of gardening and with the season moving forward, it was determined that a new
recruitment strategy was needed. Therefore, a snowball sample was undertaken with all known gardener contacts to identify additional potential gardeners and try to recruit them. This meant that every time a gardener was recruited, they were asked if they knew any other gardeners, and these people were then recruited (Alder and Clark, 2008). This technique is useful when population listings, such as a list of all gardeners in Guelph, are unavailable (Alder and Clark, 2008). From adopting this recruitment method, the participant list grew quickly from 9 to 57 by June 9th 2012, when recruitment ceased.

**Sample Characterization**

*Garden Size*

The size of gardens contained in the sample varied greatly. The minimum garden size was 0.53m$^2$ while the maximum was 300.7m$^2$. While the range was large, 80% of the gardens were less than 26.53m$^2$. Due to the large range, the outliers determined that the mean was not an appropriate measure of central tendency and therefore the median was employed. The median garden size of the sample was 12.55m$^2$.

*Representativeness*

Due to the non-random sampling method employed in this work, it was important to determine where the biases may have occurred in the sample. Table 3.2 indicates the level at which the sample was representative of Guelph and Ontario demographically.

<p>| Table 3.2: Demographic Characteristics of Sample Compared to Guelph and Ontario |
|---------------------------------|-----------------|----------------|----------------|
| <strong>Demographic Characteristic</strong>  | <strong>Sample of Gardeners</strong> | <strong>Guelph</strong> | <strong>Ontario</strong> |
| Age (Median)                    | 30s              | 38.7\textsuperscript{\textdagger} | 40.4\textsuperscript{\textdagger} |
| Sex                             |                  |              |               |
| Male                            | 32%             | 49%\textsuperscript{\textdagger} | 48.7%\textsuperscript{\textdagger} |
| Female                          | 68%             | 51%\textsuperscript{\textdagger} | 51.3%\textsuperscript{\textdagger} |
| Education                       |                  |              |               |
| Did not graduate high school    | 0%              | 20.4%\textsuperscript{\textdagger} | 22.2%\textsuperscript{\textdagger} |
| High school diploma             | 2%              | 27.5%\textsuperscript{\textdagger} | 26.8%\textsuperscript{\textdagger} |</p>
<table>
<thead>
<tr>
<th>Education Level</th>
<th>%</th>
<th>2012 %</th>
<th>2010 %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some college or university</td>
<td>12%</td>
<td>10.7%</td>
<td>12.1%</td>
</tr>
<tr>
<td>College Diploma or university Degree</td>
<td>46%</td>
<td>86%</td>
<td>41.4%</td>
</tr>
<tr>
<td>Graduate or professional degree</td>
<td>40%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sources:

From Table 3.2, it is clear that there were some biases within the sample, meaning that they may not have provided a perfect representation of the City of Guelph or the province of Ontario, however, this is to be expected as gardeners are a specific group of people and therefore are unlikely to mimic the general population. The age of the gardener sample was just slightly younger than the general population. There was, however, a bias as the gender breakdown of the sample did not align with the City. The education data illustrated that the sample was substantially more educated than the City average.

**Type of Garden**
There were three types of gardens present in the study. The majority of gardeners kept gardens in their backyards (66%), while many others were involved in community gardening projects (27%). A small minority also existed in which participants were involved in both of the previously mentioned groups (4%). Again, it is challenging to judge if this represents all gardeners or not.

**Data Collection**
There were four items within this research that required data collection. The first requirement was to reach a random sample in order to accurately estimate the number of vegetable gardens in Guelph. To do this, the initial recruitment method of door-to-door knocking was employed and the first question was whether they had a vegetable garden.
This response was recorded. As previously mentioned, the door-to-door method had to be abandoned; therefore, this objective used an alternative method. The same randomly-generated addresses were telephoned (using the website www.411.ca to acquire their phone number) and asked whether or not they kept a vegetable garden. As established by Sheskin (1985), 384 respondents provide the researcher 95% confidence with a population over 100,000. Therefore, 384 residents were contacted to determine if they kept a vegetable garden or not. If a respondent was unable to be reached (called three times with no answer) or unable to be called (not listed on the website), their address was dropped and a new random address was entered into the calling list.

The second item requiring data collection was gardener diaries. Diaries are a useful way to acquire continuous data at regular intervals (Schmitz and Perels, 2011; Midtgaard et al., 2007). It would be very challenging for participants to try to remember all of their labour and capital inputs as well as their harvest quantities at the end of the gardening season; thus a gardener diary was a useful tool in this research. This self-reported information provided the researcher with an estimate of the input each gardener used to produce the food as well as a clear indication of how much food they actually did produce. The main limitation of using a diary method is that the researcher may have to deal with incomplete data and there is no way to ensure that the participants are filling the diary out throughout the duration of the project instead of just at the end (Palermo et al., 2003). However, in this specific research trial, all of the participants who did not drop out submitted completed diaries. While some did admit that they forgot occasionally, they assured the lead researcher that they were able to accurately fill any missing sections shortly after they remembered.
When a potential participant expressed interest in the study, the lead researcher traveled to the location of their garden to explain what participation entailed and to subsequently ask them to sign a consent form (Appendix B). Next, the participant and lead researcher went to the garden space and measured it. Routine email messages were sent to the participants to remind them to continue to input their data into their diary. Upon completion of the diary, the lead researcher again traveled to the location of the garden to acquire the diary. He checked the level of completeness and prompted the participants to complete any sections left incomplete. A small number (6) of participants dropped out of the study. They were instructed that they could simply dispose of the diary as they saw fit and were thanked for their efforts.

Semi-structured interviews were the third item requiring data collection because the researcher wanted the participants to have the option to deviate from the questions but also wanted to have content-focused interviews (Hay, 2010). These interviews were carried out because little research had been done about motivations and barriers specific to vegetable gardening. Therefore, the researcher understood what some common motivations to gardening generally might be, but wanted there to be flexibility to discover new motivations and barriers specific to vegetable gardening.

The data collection for the interviews was somewhat similar. Email messages were sent to all participants and those who responded were then interviewed by the lead researcher at a place and time of their convenience. When they met, the lead researcher explained the process of the interview and explained another consent form (Appendix C). Once the participant understood and signed the ethics form, the interview took place. The interviews were audio-recorded and then transcribed for further analysis.
The project involved 43 interviews in total, each one lasting on average 20 minutes and 13 seconds. In total, there were 14.36 hours of interviews conducted with the shortest one lasting 9 minutes and 49 seconds and the longest lasting 39 minutes and 28 seconds. While all participants were offered interviews, many did not initially respond. Additional emails were sent to these participants and after receiving one additional email many were interested in being interviewed. Rounds of emails continued until no new data surfaced in the interviews, otherwise known as reaching theoretical saturation (Adler and Clark, 2008; Smith, 2007; Glaser and Strauss, 1967). At this point, recruitment for interviews ceased. It should be noted that 8 participants were not interviewed.

The final item requiring data collection was to obtain average weights for the produce which the participants were growing. To this end, three grocery stores were visited on different weeks to ensure that different shipments of produce were present in all stores. In Guelph, there are only two major retailer chains (or their subsidiaries) which include Loblaw and Metro; therefore, these were two of the grocery stores sampled. The third grocery store sampled was Market Fresh, which is a prominent independent grocery store in Guelph. Where possible, Ontario field vegetables were chosen over alternatives. After purchasing, the vegetables were weighed on a kitchen scale. The weight calculations are available in Appendix D. If the participant recorded a weight, that weight was used rather than the calculated averages.

**Limitations**

There were a few limitations to this project. The first one was that the data was self-reported, meaning that there was likely some recording error from the participants.
In order to avoid this limitation, the researcher would have had to abandon the method of data collection that was already deemed to be the best empirical approach possible. However, a study on seat belt use found no significant difference between self-reported use and observed use (Nelson, 1996); illustrating that self-reported data may have potential to actually be comparable to observational. Another study on the tasks of nurses found that self-reported was actually not an effective way to measure the work tasks of ward-based nurses (Ampt et al., 2007). Part of the problem was that the nurses did not like self-reporting their work tasks, however the gardeners were volunteering and able to drop out at any time and therefore this limitation was at least partially mitigated. A self-reported design was pursued in the end, as an observational methodology was not feasible.

A second limitation was that the vegetable weights were averaged, meaning that each participant did not weigh their harvest. Using estimated quantity was decided upon however, because it was thought that if weighing the produce was part of the participation process, the sample size would have diminished, the cost would have increased dramatically, and the participants would have been less likely to record all of their harvest due to the inconvenience of weighing it.

Generalizability was also a limitation in this project. This was undertaken as a case study, and the results provided a reliable estimation of how much food Guelph can produce. In cities similar to Guelph, in terms of climate as well as demographic or cultural profiles, it is likely that these results would be representative of those locations as well. In cities where this is not the case, these results may not be as relevant.
Nevertheless, this research provides a starting point to estimate the potential yields and costs of urban agriculture in North America.

A further limitation was that this study took place over one gardening season and therefore was only able to contribute preliminary results that hint at possible long-term averages. While multiple cropping seasons would have been desirable, this was simply not feasible in the framework of a Master’s program. This study does, however, present a snapshot into a particular period of time.

**The Weather During the Summer of 2012**

The weather during the study period was abnormal. The year 2012 was drier than most years by roughly 100mm of rain during the garden season of May 1st to October 1st. Figure 3.1 illustrates the monthly variation; however the majority of the differences between climate data and recorded rainfall in the summer of 2012 occurred between June 15 and August 31. During this time, the recorded rainfall was 108.8mm compared to the 30-year climatic average of 215mm (The Weather Network, 2013a; 2013b). Furthermore, there were 164 additional growing degree-days this summer than average (The Weather Network, 2013b). Not only was it drier, but it was also warmer.

While this did have an impact on the results, the impact may not be as substantial as the data indicate. Due to the crops being grown on a household scale, the majority of the gardeners did have access to city water and therefore were able to mitigate any lack of rainfall encountered between the middle of June and the beginning of September. Although this was possible, some participants did not water during these dry periods as they were unable to use their rain barrels due to lack of rain. Therefore, the drought in July did, in some cases, affect their garden yields. Additionally, adequate irrigation was
not possible for the urban agricultural companies included which may have therefore affected their yield.

**Summary**

The methods used in this research were mixed, involving a quantitative survey and qualitative interviews. The sampling method was a convenience snowball sample for the recruitment of participants. The study design was a case study, using the City of Guelph during the summer of 2012. Fifty garden diaries were collected and 43 semi-structured interviews were conducted. The results of this fieldwork are provided in the next chapters.
CHAPTER FOUR: PRELIMINARY ESTIMATION OF CURRENT LEVELS OF GARDEN FOOD PRODUCTION IN GUELPH AND THE ASSOCIATED COSTS OF LAND, LABOUR AND CAPITAL.

“Gardening is not a rational act.”
-Margaret Atwood

Introduction

This chapter presents results from the garden diaries, on how much food was produced by the gardens involved in the sample of Guelph as well as the cost of this food in terms of land, labour and capital invested in the gardens. The following themes are discussed: the crop selection of the study participants, the garden yields, the inputs (time, capital and space), which demographics are the more productive gardeners, how much was produced in the summer of 2012, how business production compares to private production, the inefficiencies noted, the impact that crop selection had on yield as well as the impact the density of the vegetables had upon results and finally the discussion.

What was Grown in Participants’ Gardens

As shown in Figure 4.1, there were many different types of vegetables grown in the gardens involved in this study.
It is clear that tomatoes are a popular vegetable, followed by potatoes, cucumbers and various greens. With the exception of tomatoes and potatoes, the remaining significant vegetables are all planted in relatively equal quantities showing a mixed vegetable production in private gardens in Guelph.

**Garden Yield**

Garden productivity varies across even small samples by an incredible amount. The minimum yield in this study was 0.08kg/m$^2$, while the maximum was 5.18kg/m$^2$. This range is comparable to a study of community gardens in Montreal that yielded between 0.3kg/m$^2$ and 5.4kg/m$^2$ (Duchemin et al., 2009). The average yield for this research project was 1.43kg/m$^2$ with a standard deviation of 1.22kg/m$^2$. Figure 4.2 illustrates the spread of garden productivity.
Figure 4.2 shows that the majority was at or below the average, with fewer outliers much above. Due to this variation, the median was a better measure of central tendency which was found to be 1.17kg/m². Fourteen percent were above the 3kg/m² level, indicating that while higher production was possible, it was definitely achieved by the minority.

In this study, there were also production differences between the types of gardens. Home gardeners averaged 1.53kg/m², while community gardeners were less productive, averaging only 1.04kg/m². There were also two gardeners who had both home and community vegetable garden plots. These gardeners were much more productive, averaging 2.41kg/m².
One of these avid gardeners, with a plot at home and in a community garden stated:

“I grow everything. The front is ornamental, the side is environmental, it’s a pollinator garden and the back is a combination of ornamental and food but I find that food is slowly taking over. And I’m starting to play with combining ornamentals and food… so, like, put some asparagus in my fern garden because I think the asparagus ferns are really beautiful. So it will start off being food and end up being ornamental.”

While this only represents one gardener’s ideas about food versus non-food gardens, it is clear that this participant was not only excited about growing many different things, but also about increasing food production in the garden. In contrast to this, a community gardener with a low productivity had this opinion about gardening:

“I actually wasn’t going to [garden], but I don’t know, spring comes around and I just had this need that I wanted to grow my own stuff. So, I did it again.”

These two gardeners differed in production by 2.92kg/m². Their total production is drastically different. The gardener who wondered whether to have a garden this year produced 1.07kg of food from the entire garden. The ambitious gardener produced 214.96kg of food in the garden. Their difference in mentality is likely at least partially responsible for the substantial difference in production.

<table>
<thead>
<tr>
<th>Gardener</th>
<th>Top Crops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambitious Gardener</td>
<td>Lettuce, Tomatoes, Kale, Cucumber, Potatoes, Swiss Chard, Blackberries, Peppers and Beans</td>
</tr>
<tr>
<td>Unsure Gardener</td>
<td>Lettuce, Tomatoes, Peppers and Beans</td>
</tr>
</tbody>
</table>
It is clear from their crop selections that the ambitious gardener grew everything the unsure gardener did and then additional crops, while the unsure gardener stuck to the basics. The major difference in their crop selection is that the ambitious gardener grew many potatoes while the unsure gardener did not grow potatoes. The four common crops account for substantial amounts of both production values. The conviction in each quote also illustrates that the gardener with both a home plot and community plot had a real passion and interest in gardening, while the participant with a community garden plot seemed to view gardening as an inconvenience. This may indicate that they were simply not committed to their garden.

**Inputs: Time, Capital And Space**

The average amount of time spent gardening was 3.03 hours/m² over the whole season and with a standard deviation of 3.7 hours/m². The median, however, was only 1.84 hours/m². As noted in Figure 4.3, there were some substantial outliers much above the average.
The minimum amount of time spent per m$^2$ was 0.16 hours (9.6 minutes). This gardener was able to produce 0.24kg/m$^2$. In this case, the low time spent resulted in a low output of production. However, in another case, a gardener spent 0.64 hours (38.4 minutes) per m$^2$ and was able to yield 1.48kg/m$^2$, indicating that a low amount of time spent would not necessarily relate to low yield. On the opposite end of the spectrum, the maximum recorded time spent per m$^2$ was 22 hours (1320 minutes) and this participant was able to produce only 1.32kg/m$^2$. Another participant spent 7 hours per m$^2$ and yielded 1.87kg/m$^2$. This illustrates the large variation across each of these variables. While it is possible that part of this is error in reporting, the significance of the error would not greatly impact the significance of the range. The majority of times recorded in the diaries were, at most, in 1-2 hour-entries and often in as little as five-minute entries. Therefore, while error probably exists, it will not have an impact of the large variation. To test the
significance of this relationship, reducing the variation was important; therefore, a log function was applied to each variable (hr/m² and kg/m²). When this was applied, there was a significant relationship (P<0.05), indicating that as hours/m² increased, so did kg/m². Intuitively, this makes sense: if gardeners spend more time in their gardens, they will be able to harvest more vegetables. However, as noted in Figure 4.4, the line of best fit indicates that, while there is a relationship, the increase in yield for each unit of time is not dramatic.

![Figure 4.4: Yield vs Time Spent](image)

Additionally, due to the low R² value, this relationship accounts only for 18% of the variability in yield, so there are clearly further aspects to be explored.

The financial input for a garden had great variation as well. One garden had absolutely no cost recorded (cost of water was not measured), because that gardener was able to acquire the entirety of their required materials from friends and relatives. In
contrast, the highest recorded financial input was $113.55/m², which represented a young adult trying to grow some tomatoes and peppers indoors. The average input cost was $11.14/m². This indicates a very large range. Based on this research, spending an average of $11.14/m² means that, in order to produce an acre of backyard garden-produced vegetables, it would cost just under $45,000, without considering a cost for labour.

While reporting these results in terms of space is useful, for understanding the costs of a potential garden, breaking down the inputs of time and capital by kilogram allows for a more relatable analysis in illustrating the true cost in terms of output.

The time input per kilogram on average was 3.6hr/kg. This is important because it illustrates, that regardless of the capital inputs, in a garden, a substantial amount of time will be involved. If it is assumed that there is a value attached to that time, even at the Ontario minimum wage of $10.25, this adds an average cost of $36.90/kg. This number, however, was open to substantial variation, ranging between 0.3 hours, or 18 minutes, to 21.9 hours. To put this in perspective, the lower end was only adding $3.08 in labour to each kilogram of food produced, but the upper end was adding $224.48 in labour to each kilogram produced. It is clear that very quickly, as the hourly wage increases, the cost of each kilogram of vegetables also increases dramatically. Table 4.2 illustrates this problem.

<table>
<thead>
<tr>
<th>Time Assumption</th>
<th>Minimum</th>
<th>Average</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assuming Time is Worth</td>
<td>0.3 hr/kg</td>
<td>3.6hr/kg</td>
<td>21.9hr/kg</td>
</tr>
<tr>
<td>$10.25/hr (or $20,500/a)</td>
<td>$3.08</td>
<td>$36.90</td>
<td>$224.48</td>
</tr>
</tbody>
</table>
As is clear in Table 4.2, the cost of homegrown vegetables, when accounting for labour, can be very expensive indeed depending on the assumed value of labour and based on the range of labour efficiencies presented in the garden diaries. In fact, if earning $100,000 per year and spending 21.9 hours to get each kilogram, the investment only in the value of time is almost $1,100.00/kg. This is a clear indication that gardening efficiently is rather challenging to achieve, however, as will be discussed later, efficiency is not the goal of garden production and therefore it is logical that gardens are inefficient. Even if projected at peak efficiency levels in terms of time, the cost is still $15.00/kg. This is more expensive than the grocery store.

While many of these values may seem shocking, these only include the labour costs at various wages and not the fixed recorded costs, such as seeds, fertilizer or plants. The average cost per kg (without labour) was $12.40/kg. The minimum was $0.00 but the maximum was $102.70/kg. To quantify this, the participant spending $102.70/kg also spent 12.8hr/kg. At minimum wage, this means that their cost was $233.90 for each kilogram of vegetables produced.

When applying minimum wage, the average participant spent $49.24 on each kilogram of vegetables produced (total cost, including labour). The range was from $4.26-$259.39/kg. Again, this is a further confirmation that gardening, as practiced by these gardeners, is not an efficient way to produce our own food. This further hints that efficiency was not the goal of the participants. It is also clear that hiring someone is not a
plausible alternative, as even at minimum wage, the cost to produce one kilogram of vegetables is astronomical when using backyard household techniques.

Space is an important input to quantify. The average garden size was 29.84m$^2$, but there were some large outliers, so the median was a better measure of central tendency, which was 12.55m$^2$. If everyone had a garden of this size across the city, this would still only account for 1.4% of the total available yard space in Guelph. This indicates that gardening is not a major land use in Guelph currently. Simply put, vegetable gardens in the Guelph backyards only represent a small portion of their yard. This makes a fair bit of sense because many people have no interest in having a vegetable garden in their backyard and there are multiple uses for a backyard and gardening requires relatively permanent infrastructure in the yard, which eliminates that space for other uses.

**Garden Yield and Inputs**

When garden yield is compared with the input costs, there are a couple observations which are worth noting. Figure 4.5 presents the averages of these measures
by location of the garden.

<table>
<thead>
<tr>
<th>Productivity Measure</th>
<th>Home Gardens</th>
<th>Community Gardens</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kg Produced/m²</td>
<td>1.31</td>
<td>0.94</td>
</tr>
<tr>
<td>Hours Spent/m²</td>
<td>4.28</td>
<td>1.87</td>
</tr>
<tr>
<td>Dollars Spent/m²</td>
<td>22.73</td>
<td>2.81</td>
</tr>
</tbody>
</table>

Note: The Standard Deviations:

It is clear from the Figure that production appears low and inputs seem high. From the standard deviations, it can be noted that the ranges are very large for some measures. This variability indicates that while some people are able to garden successfully, the average gardener is not successful enough to contribute to food production in a meaningful way.

It is interesting that, while there is not a large amount of variation with the production aspect, there is a much larger variation with inputs. Dollars spent has very large variation, especially with gardens at people’s homes. The astronomical difference may be accounted for because homeowners are willing to invest in their garden while
people with garden plots in community gardens may be less inclined as they will not own the space. The smaller variation in time spent for community gardeners is probably due to having to travel to the garden, whereas home gardeners only need to go out their back door to work in their garden.

Who Makes the Best Gardeners?

Basic demographic data were collected in the hopes of establishing what type of person would make the best gardener. When thinking about this, it seems logical that anyone could be good at gardening if they were interested in it and, while this is probably true, this study established that some people might be more likely to be successful at gardening than others.

Gender, income and education did not have any statistically significant correlations with productivity or efficiency. The researcher has a number of hypotheses about how each of these demographic measures might relate to garden productivity, none of which were supported by the research. This indicates that the gender, income and education have no impact of the productivity of the garden, according to these results.

Age was statistically significant in terms of yield. Those who were above 40 years of age yielded significantly higher amounts of food than those younger than 40 years of age (P<0.05). Forty was the tipping point because age data was collected in cohorts and therefore the cohorts below the ‘40s’ were less productive than the cohorts including and above the ‘40s’. This suggests that as one gets older, one’s garden becomes more productive. The reasons for this could be multiple. It is possible that once 40 years of age is reached, then their gardening experience has developed substantially enough for them to gain high-yielding crops. It is also possible that people over 40 may
have been more likely to have learned gardening from their parents, whereas younger
people may have not been born into a gardening culture. It is challenging to explain this
further with the results, as this was not part of the interview process.

The final demographic item that was collected was the amount of experience in
gardening. This also yielded statistically significant results. This research determined
that gardeners with 7 or more years of experience had significantly higher production
(P<0.05). Gardeners with 7 or more years of experience yielded on average just under
0.75kg more per m². This is a logical result; as gardeners gain more experience, it makes
sense that they will also have higher yields, as they will be more suitable to care for the
plants.

**How Much Food was Grown in the City of Guelph in the Summer of 2012**

An estimation of the amount of food grown in the City of Guelph over the 2012
growing season was an objective for this thesis. There are 30,627 residential addresses
(properties with multiple addresses were filtered out) in the City of Guelph. The level of
gardeners is estimated at 35.69% of the Guelph households. This would mean that there
are 10,930 gardens in Guelph. Due to outliers, the median was used to estimate the size
of the garden of an average gardening household. The median garden size was 12.55m²,
as stated above. This would mean that there was 137,171.5m² of gardening space in
Guelph, which is just less than 34 acres of garden space with a potential of 6,677 acres of
yard space in all of Guelph. This indicates that gardening is occupying 0.05% of
available yard space. Based on average yields, this projects that there was 196,155.25kg
of vegetables harvested in Guelph in the summer of 2012.
In order to produce these vegetables, the gardeners of Guelph would have spent $1,528,090.51 on input costs, not including labour. They also would have spent 415,629.65 hours gardening. This is approximately equivalent to 200 full-time year round jobs or 452 full-time jobs during the gardening season (May 1 – Oct 1) in the 10,930 vegetable gardens in Guelph.

Overall, these calculations indicate that there is a substantial amount of gardening happening. Over one third of residents have vegetable gardens on their property. The problem is that the gardening is not an efficient way to produce food, as previously indicated by these results. If those 452 full time jobs were valued at $10.25/hr, then the total cost of those vegetables would increase from $1.5 million to approximately $5.8 million dollars. While just less than 200,000 kg of vegetables is substantial, $1.5 million dollars is not a realistic value in today’s food economy, let alone $5.8 million if someone was paid the minimum hourly wage. However, if the motivations of gardeners are considered (which is the focus of the next chapter), it is not surprising that these inefficiencies exist. This does, however, represent a significant hurdle that would have to be overcome if homegrown food was to ever become a significant source of food in North America.

*Are Businesses More Productive When Growing Food Within the City?*

There are multiple methods to growing food within the city. While the data already presented focused on private gardens (backyard and community plots), it is also possible for professional gardeners to grow food within the city for profit using various business models. To capture the possibility that professional gardeners might be much more efficient, two businesses were included in this work for comparison purposes as a
means to understand whether greater productivity could be achieved in backyard or professional production. Professional urban agriculture companies suggest that their gardeners are experienced in horticulture and that, since they are driven by profit as opposed to other non-production motivations, they have the potential to be increasingly productive within the contours of the city.

The first company examined (Company A) was producing food on over 32,000m² (or 8 acres) and operating a community-supported agriculture project. The company was located near the edge of the city, but was less than a 60-second drive from the city proper. The second company (Company B) operated within the city on just over 8000m² (2 acres) which was split into two equal sized gardens (4000m²). This company operated a community-shared agriculture project as well as a market and a number of restaurant-direct sales. While the hypothesis was that professional urban agriculture companies would be more productive than private gardeners in terms of land, labour and capital, the data did not support this conclusion. In terms of land, Company A yielded 0.57kg/m² while Company B yielded even less, registering at 0.30kg/m². This indicates that private garden production in this sample is at least a 2.5 times more productive use of space and may be up to more than 4.75 times more productive in terms of yield. However, this is only accounting for the production in terms of space.

While the companies were not efficient in terms of their use of space, they were much more efficient in terms of time. Company A invested 0.33hr/m² over the growing season, or 20 minutes. Company B was slightly less efficient, at 0.73hr/m². When compared with the average gardener (3.03hr/m²), it is clear that the labour invested by companies is much more skilled and therefore required substantially less labour. There
was also a financial incentive for these companies to use less labour because this will reduce their overall costs. The differences in efficiency are clear when comparing the hours/kg statistics. Company A achieved 0.59hr/kg while Company B achieved 2.41hr/kg, indicating that Company A was substantially more efficient in terms of weight.

In terms of money invested, the companies were also more efficient than backyard gardeners. Company A spent $3.28/m² and Company B spent $8.35/m². While this was less than the $11.14/m² gardener figure, this included their labour costs, which they acquired at a discount through the C.R.A.F.T Internship Program. If the labour costs were not included to facilitate an even comparison (since backyard gardeners were not paying themselves a wage), the efficiency of the companies would grow even further. Company A, when not including labour, spent $0.76/m² and Company B spent $1.77/m². This indicates that there are some economies of scale to be achieved with larger tracts of land in production, but paying an hourly wage is not an effective way to grow food in the city, based on the two models of urban farming considered in Guelph.

One interesting case of high productivity was a church group that participated in the study. This church group was comprised of 20 volunteers who took turns working in the garden. They worked in parties of 4 or 5 and, therefore, each only worked one weekend/month in the garden. All the food they grew was donated to a food pantry to be given to the poor. Therefore, their motivation was different than the others in the study, as they wanted to produce as much as possible for the food pantry. This church group was able to produce 21.15kg/m² which was over 4 times more than any other production rate recorded. They did spend 10.44hr/m² which was 3 times more than the average and
they invested $18.53/m² which again was above the average. When looking at the cost per kilogram, they were substantially under the averages, which is due to their high yield. Each kilogram of vegetables cost $0.88/kg and 0.5hr/kg. The average for this across the sample was 3.6hr/kg and $12.35/kg. Therefore, while they invested more inputs into each meter of their garden, their costs were low due to the level of output achieved.

*Inefficiencies*

As part of the methodology, each participant was asked to record what they were doing when they spent time in the garden. It was hypothesized that the more time spent in the garden, the higher the yields would be. This did have statistical significance. The next step was to determine which activities substantially increased productivity; the two most common activities were weeding and watering. However, when tested to determine if there was a statistical relationship between the amount of time spent weeding or watering, it was discovered that there was no such relationship. There appears to be a dichotomy, with some gardeners able to input relatively little time and money and still achieve a respectable yield, which represents the efficient gardeners. The other gardeners, or inefficient gardeners, spent lots of time and money in the garden and were unable to achieve a high yield. This large variability illustrates an opportunity to improve efficiencies.

While private gardeners were more productive in terms of their use of space, there is still substantial room for improvement. Within the space they had already devoted to vegetable production, some gardeners had that was left unproductive for various reasons, including crop failure, fallowing or paths. This unproductive space across the sample amounted to 423.01m² of 1492.04m² of total vegetable garden space. If this land had not
been left unproductive, then 604.90kg more vegetables across the sample would have been collected, which is an increase of 35%. This does mean continuous production and without paths it would be important to use a garden design that would not require paths. However, the point remains, 35% of gardens are not being used in production.

If this is expanded to the City of Guelph, this means that 38,408.02m² of space already dedicated to a vegetable garden would have been left unproductive and that, had this space been put into active production, an extra 54,923kg of produce could have been produced in Guelph. However, the inputs—labour, land and capital—would remain the same. In 2012, the sample spent 1.16 hours to yield each kilogram of vegetables. If they had used the space allocated to vegetable gardening fully, they would have only spent 0.86 hours for each kilogram, thus improving their labour efficiency by 57%.

**How Much Impact Does the Selection of Crops Grown Have Upon Yields?**

The methodology of using weight to represent yield has one major drawback: it equates heavier vegetables with higher yields. To try to counteract this, the researcher also asked participants what kinds of vegetables they grew. However the crop selection was relatively similar across the sample and the crop choices did not appear to have much of an impact on yields. To illustrate this, tomatoes will be used as 45/50 gardeners grew tomatoes. In Table 4.3, it is clear that the level of tomato production overall is relatively unchanged and this is true of the other vegetables as well.

<table>
<thead>
<tr>
<th>Table 4.3: Percentage of Tomatoes and Yield Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of Tomatoes in Yield</td>
</tr>
<tr>
<td>Entire Sample</td>
</tr>
<tr>
<td>Low Yielding Gardener</td>
</tr>
<tr>
<td>Middle Yielding Gardener</td>
</tr>
<tr>
<td>High Yielding Gardener</td>
</tr>
</tbody>
</table>
It does seem clear that tomatoes made up a substantial portion of the yield, partly due to their weight and partly due to their popularity in gardens. Tomatoes appeared in 45/50 private gardens, or 90%, indicating that while they do account for a large portion of the total, they also account for a large amount of the area put into production, at 15.5% of garden space. If this is combined with unproductive space within the vegetable garden, the result is 43.5% of garden space, meaning that all other vegetables are planted in only 56.5% of the garden.

**Which Crops Yield the Highest in Terms of Weight?**

When considering which crops yield the best, it is important to consider two things. First, heavy crops will yield better in the methodology used because the vegetables were measured in terms of weight. Secondly, the number of participants who grew the crop, as noted in Table 4.4, is important. For instance, Japanese eggplant seems to have had a very high yield, but they were only grown by two participants indicating that perhaps this specific case represented a couple of gardeners with very high skill with that particular crop rather than representing a truly high yielding crop. The lower half of the chart are predominantly harder vegetables to grow so their high yield from a few gardeners may likely represent skilled gardeners.

<table>
<thead>
<tr>
<th>Crop</th>
<th>Kg/m²</th>
<th>Number of Participants Growing this Crop (n=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>2.85kg/m²</td>
<td>45</td>
</tr>
<tr>
<td>Beets</td>
<td>1.97kg/m²</td>
<td>16</td>
</tr>
<tr>
<td>Carrots</td>
<td>2.54kg/m²</td>
<td>19</td>
</tr>
<tr>
<td>Swiss Chard</td>
<td>3.11kg/m²</td>
<td>10</td>
</tr>
<tr>
<td>Cucumber</td>
<td>3.63kg/m²</td>
<td>14</td>
</tr>
<tr>
<td>Brussel Sprouts</td>
<td>2.06kg/m²</td>
<td>4</td>
</tr>
<tr>
<td>Leeks</td>
<td>4.26kg/m²</td>
<td>6</td>
</tr>
<tr>
<td>Japanese Eggplant</td>
<td>4.54kg/m²</td>
<td>2</td>
</tr>
<tr>
<td>Cabbage</td>
<td>3.2kg/m²</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>6.51kg/m²</td>
<td>1</td>
</tr>
<tr>
<td>----------------</td>
<td>-----------</td>
<td>---</td>
</tr>
<tr>
<td>Jerusalem Artichokes</td>
<td>6.51kg/m²</td>
<td>1</td>
</tr>
</tbody>
</table>

It is evident from this table that tomatoes, carrots, cucumber, Swiss chard and beets yield highly in terms of space. This is further evidence that Brussel sprouts, leeks, Japanese eggplant, cabbage and Jerusalem artichokes have the potential to yield highly in terms of space, but due to very few respondents actually growing these, it is hard to tell if this result is crop-specific or gardener-specific.

Discussion
This section will discuss three major themes. The first will contain a discussion on the yields reported. This will include an estimation of how much production is enough, how the yields compare to conventional production and how the yields relate to the daily intake of fresh produce for Canadians. The second major theme is a discussion of the large amount of effort involved in gardening and how this relates to the location of the garden. The final theme will be a discussion of the large ranges involved and how this may relate to a loss of food growing skills.

It was challenging to determine what an acceptable level of productivity was. One figure is available from Cuba, which is 25.8kg/m² (Koont, 2008), but even this was impossible to draw a comparison from. Cuba is located at a different latitude, has a different political structure and it was not clear what is being grown in these gardens or what the inputs were or even how the data was collected.

When presented with a production value of 1.43kg/m², it can be challenging to understand how this relates to mainstream agriculture. It begs the question, is urban gardening productive or not? When comparing conventional tomato harvests with those of urban agriculture production, the picture becomes clearer. Backyard tomato
production yielded 2.85kg/m². When compared with 2010 Chatham-Kent tomato yields (latest available), they yielded 7.68kg/m², or were just over 2.5 times more productive than backyard tomato production (OMAFRA, 2012). Obviously, the conventional tomato farmers in Chatham-Kent have different motivations than the backyard gardeners in Guelph and this comparison is only to give context to the yield of backyard gardeners. Interestingly, the urban agricultural companies were actually less successful in terms of yields per area than backyard gardeners. This is possibly because they were not constrained by space, despite using similar techniques as backyard gardeners (generally manual labour). This confirms that mainstream agriculture is likely an effective way to grow food but these techniques have not yet been applied effectively to the urban geography as discovered in this sample. The two companies examined trying to grow food for profit within the city were not very effective at it.

A church group who participated in the study grew tomatoes as well. They were extremely productive and their tomato yield was 18.38kg/m², which was more than double the production of conventional tomato production. This indicates that if substantial time and money are invested in a small area, then that area can yield higher production than conventional practices, but it also illustrates that this is not a common situation.

According to Statistics Canada, the average Canadian ate 40.7kg of vegetables in 2009, not including potatoes (Statistics Canada, 2010). If potatoes are included, this means that Canadians consumed 68.6kg of vegetables in 2009 (Statistics Canada, 2010). If Canadians wanted to simply grow this amount, not preserve or store, then they would have needed to employ 48m² of garden space at average yield levels. From the Guelph
sample, 7 gardeners, or 16%, grew more than the average amount of fresh vegetable intake for Canadians in one year. Although, it must be considered that the majority of these gardens were family gardens feeding at least two people, which means that they would have had to produce 137.2kg of vegetables. Only 3 participants, or 7%, would have been able to feed a family of two. It is clear that as the family gets larger, the potential of their garden diminishes; for example, a family of four would require a garden of 192m$^2$ to produce enough vegetables to meet the average Canadian intake. Few participants were interested in self-sufficiency, however none of them were able to achieve it and at current production rates, they would require very large spaces if they decided to make this their goal.

Another notable implication of this research is that if urban gardening is ever to represent a substantial portion of our food system, it is going to require an enormous amount of effort. At current rates, it will require a substantial increase in money spent on food. Rather than simply spending money at the grocery store, society will have to spend more money and then do all the labour for production as well. This will further translate into a substantial increase in the amount of time society has to input into the production of their food as well. To improve this efficiency, a significant improvement of gardening knowledge through the implementation of education will be necessary, which will lead to the production of the food gardeners are already consuming, but with substantially more effort involved.

The differences noted between the locations of the gardens can be explained by access to the garden. Those with home gardens had more access to their garden than those with gardens in a community plot. The time required to travel to the community
plot was an inconvenience that some people preferred to do only when required. One participant remarked:

“I haven’t been biking up to the garden at Ignatius. [My partner] rides up there, but I drive my car usually, and that’s an impediment. I’m not very happy about that; I don’t want to be expending the CO\textsuperscript{2} pollution, the money, and the gas. It’s convenient as can be, so I do it, but there’s a bit of a tension there.”

This indicates how having to commute to the garden, although still something this participant was willing to do, provided them with a reason to take less care than if it had been in their backyard. Participants with both community plots and home gardens were very active gardeners who expanded their space by getting an additional plot; therefore they were more likely to obtain high yields due to their interest in gardening and the scale of their gardens.

The final main point from these results is that while there are instances of very successful gardeners, there is a very large range. People are gardening without any skills and knowledge while others are gardening with expert knowledge. The same is true with efficiency measures. Some are spending very little money to grow their own food while others are spending extraordinary amounts of money to grow their own food. This enormous range in both success and efficiency suggests that urban gardening is a possibility, if the higher levels of yields were achievable, but it also suggests that these higher levels are not achievable by most people. Therefore, it would be better to give more land to those skilled at urban gardening than to invest in improving the skill level of the entire population at gardening. It illustrates that those who are not skilled cannot hope to grow a substantial portion of their own food without acquiring and improving their skills in the garden. It also illustrates that gardening is an activity that requires a
specific skills set that only some people have; it requires dedication to learn and improve
to be able to obtain yields that are high enough to notably contribute to the food
consumption of a household, but also to be efficient enough that it is a practice worth
pursuing. It is clear that as more time was spent in the garden, the likelihood of
producing higher yields increased. This suggests that higher yields are possible if
gardening becomes a priority where people are willing to devote a significant amount of
their time to being out in the garden or if they are willing to pay a skilled urban farmer to
grow it for them. Higher yields were also achieved when gardening experience and age
were higher. These two variables are likely correlated because the older a gardener is the
more likely it is that they have gained more gardening experience. This suggests that
gardening will improve as experience grows; thus, there is preliminary evidence that an
education program implemented at a young age (such as in schools) would benefit the
production of private urban agriculture.

There may be some benefits to this, however. There is a large amount of
literature about the loss of food skills which dates from the early 20th century (Vileisis,
2007; Jaffe and Gertler, 2006; Halweil, 2002). The inefficiencies recorded in this study
may represent a similar loss of skills. Weeding and watering were the two most common
activities practiced in the garden, but there was no statistical relationship between the
amount of time spent weeding or watering with yield. This indicates that the two most
time-consuming activities across the sample did not have an impact on the yield, which
indicates that gardeners are very inefficient in the ways they weed and water their
gardens. This inefficiency may be because of a lack of skills, in this case specifically
garden skills, but this is beyond the scope of this research. With the increased interaction
with the food consumed, it is likely that many of these lost food skills will return and continue to be developed again, much as they were in an era lost two or three decades ago.

**Summary**

In conclusion, these results provide an estimate of garden productivity in Guelph during the summer of 2012. It is clear that not only are gardens not yielding substantial quantities of vegetables, but also that urban agriculture companies are using the space even less effectively in the city. Gardening experience and age do seem to have a role in the quantity of food produced but crop selection does not appear to have significant impact on overall productivity. At present, urban gardening yields in this study are neither high enough nor efficient enough to substantially contribute to our food system. As will be noted in the next chapter, this is not their goal.
“Gardening is cheaper than therapy and you get tomatoes.”
-Unknown Author

**Introduction**

Of all the gardeners involved in this research, 86% participated in an interview to help discover common motivations and barriers to gardening. From these interviews, a number of common motivations and barriers were discovered. This chapter will report the benefits and motivations of gardening, the common barriers and the most challenging barriers and how these related to efficiency.

It was determined desirable to understand the motivations and barriers that gardeners were experiencing because this study set out to determine the potential of urban gardening in Guelph. To fully understand the potential, it is important to understand why people are interested in gardening and what is preventing them from getting involved on greater scales. The motivations are especially important because they describe how to target expansion and the barriers indicate where resistance may be located and therefore give a starting point to the expansion of urban agriculture. The changes in these motivations are also important. In historic work, a major motivation among vegetable gardeners were the tangible benefits, such as the food (Kaplan, 1973), while a more recent study found that food production was no longer a significant motivation to gardening (Clayton, 2007). Deepening academia’s understanding of these motivations therefore will aid in understanding the shifts in our society’s values when it comes to urban agriculture.
Benefits of Gardening

One of the most useful questions asked was regarding the benefits each gardener was experiencing from gardening. Logically, these were common reasons why they would grow food in their backyards. Figure 5.1 illustrates what percentage of people identified each common benefit.

This section will deal with the most significant benefits, that of bonding, health benefits, improved quality of food and enjoyment.

The most commonly-cited benefit from gardening was ‘bonding’, which 60% of the participants expressed. One commented about how gardening brought he/her closer to the neighbours:

“The neighbours, it does become social because I’ll drop off bowls of grape tomatoes…that’s the big one that’s popular in the neighbourhood. It gives us a chance to catch up.”
Another participant noticed the same thing, but instead of sharing produce they were sharing knowledge:

“I talked to my neighbour the other day, a neighbour that I hadn’t really spoken to, like we just say hi sometimes, […]. So I, like, looked at her and was, like, it’s nice to talk to you and she was telling me about tomatoes and how there was no light for them. She was just sharing her knowledge, so I shared knowledge with her.”

While this bonding was common with many people who gardened at their homes, not everyone experienced this. Interestingly, a member at a community garden noted that they had not developed a strong sense of community:

“I wouldn’t say friends. I mean, we talk to whoever’s there. […] But no, I wouldn’t say that we’ve necessarily made friends. But everyone there is very nice, and it’s nice to be in a situation like that. It doesn’t seem to matter whether you’re from the church or not; everybody just seems to be friendly.”

This sort of relationship was not uncommon among the research participants. Another member of a community garden said:

“Yeah, I was excited to do that [meet new people]. A lot of the times I was there, I didn’t see anyone else.”

It is clear that bonding seems to be an important part of gardening, however, some of the community gardening participants experienced a lack of bonding opportunities within
their community garden. In the last example, this participant was interested in bonding but was relatively unsuccessful in accomplishing it.

In addition to the bonding aspect of gardening, health benefits, both physical and mental, were very prominently identified, with 56% and 35% identifying these benefits respectively. One participant identified the physical health benefits this way:

“You’re spending time outdoors getting fresh air and you’re actually doing physical labour and then it’s just raw organic stuff out of your garden. So how better can it get? You’re growing fruits and vegetables, it’s not like you’re growing steak or deep-fried food. So, yeah, I definitely think there is a health benefit to it and I think it encourages you to eat healthily as well.”

As is clear from this quotation, while there are perceived health benefits from gardening, it is unclear whether this actually benefited this participant’s health. Many participants mentioned nutrition, in which they indicated that their diet had improved from having a garden, but again, to quantify this it would be necessary to understand the participant’s vegetable intake before they started gardening, and this is outside the scope of this research.

Another participant discussing the mental health benefits of gardening said this:

“I’m just able to go there and step away. It’s like, when I’m in the midst of all of my work, I’m just like “I’m going to the garden”. It’s just a way to release, like it’s really calming.”

This comment, at least at surface level, seems to be more direct. It is clear to see the positive mental health effect the garden has had on this participant; being in the garden adds a dimension that varies from their usual day.
The one commonly-cited benefit that was related to food was an improvement in the quality of produce that the gardener was eating. This was cited by 53% of the gardeners. One gardener phrased it like this:

“It’s the pleasure of the freshness of the stuff. There’s just not a comparison to what you can get 10 feet out your door to what’s traveled in a truck from Florida or California or Mexico.”

It is clear that the gardeners were also aware of some of the distances food travels in our global food system and had noticed that food grown in their backyards at least had a perceived improvement in quality.

Another popular benefit, which had heavy overlap with motivations, was enjoyment. Fifty-one percent of respondents stated that enjoyment was a benefit from gardening. One participant said:

“I get the satisfaction when I actually get something to grow, rather than watching it wilt. So that’s always fun.”

Enjoyment or fun was also one of the most commonly-cited reasons to grow food in a garden. Yield did not seem to be a strong motivation likely because two of the very common responses bonding and having fun do not need high yields to be accomplished.

Other common benefits included meeting new people (30%), learning experience (23%), a continuous supply of produce (14%), and saving money (9%).
Motivations for Gardening

Each interview began with an obvious and open-ended question: “Why do you garden?” Figure 5.2 illustrates how the participants responded.

Fun was the most common reason and then the remaining answers were all relatively equal. This section will discuss enjoyment, followed by freshness and then yield. Then success will be discussed and how this related to yield and therapeutic reasons for gardening. The section ends with common motivations for gardening in the first place.

The most common answer, with 60% of respondents identifying this as one of their reasons, was fun followed by self-sufficiency at 33%. The third and fourth most common responses, each with 23% of respondents, were freshness of the vegetables and for therapeutic reasons.

One participant explained their enjoyment from gardening in this way:
The other reason is just because it’s kind of exciting to actually produce something yourself and then consume it. You get some satisfaction seeing it from start to finish, and then eating it. It’s kind of like a reward for your efforts. It’s far more enjoyable than just going to the supermarket, there isn’t really a reward system there, [and] it’s just for consumption.”

The concept of enjoying gardening because it is rewarding or satisfying was mentioned in numerous interviews. Not all of these participants took issue with the supermarket portion of our food system (although many did), but all took enjoyment from producing something they would eat or give to someone else to eat.

One participant, when expressing freshness as an important part of why they were gardening, said this:

“But the main thing, as well, is that the quality of food that you buy in the store is not that high, and it’s mostly picked unripe. A lot of things are imported from California and from Mexico in the winter. So I can get high-quality fruits and vegetables that I know have no pesticides on them, and I know to pick it when it’s actually ripe. And again, it’s high quality”

This indicates that this participant was gardening because they were disappointed by the quality of vegetables in the grocery store, and urban agriculture in their backyard was their most suitable option to acquire the quality of food they desired. Only a subset of the sample population regarded this freshness as a motivator for gardening, with 77% not identifying this as a motivator. However, 53% did articulate that a key benefit to gardening was high quality produce and 7% actually selected what they were going to grow based on how much better those items would taste fresh from their garden. One participant for instance said:
“I think we also grew things, too, that we knew would be better if you
grew them here in Ontario versus getting them anywhere in the grocery
store. Like garlic, we’re not getting garlic from China, it’s garlic from here
and it’s usually a lot bigger and better and tastier. So, you can pick the
strains you want. So, yeah, I guess garlic was the big thing for us, and hot
peppers. So, you can pick a good strain for hot sauce.”

From this it is clear that there is at least a perceived difference from what is possible to
buy and what is possible to grow in a backyard. Other vegetables that were mentioned as
having substantial difference between the grocery store and garden plot were beans and
tomatoes.

It is interesting that the role of actual yield played in the motivations for
gardening; very few people mentioned this as a reason for gardening. The actual food as
a motivation was only mentioned by 16%, and self-sufficiency, which is inevitably tied to
yield, was only mentioned by 33%. The closest benefit identified as a common theme
relating to yield was the continuous supply of produce that was identified by 14%. From
these results, it seems that the yield is not a strong motivation when planting a vegetable
garden. When asked specific questions regarding the role of yield in the process of
planning what to grow, 56% did not consider yield and 16% sometimes did and
sometimes did not, leaving only 28% of gardeners who were concerned with yield.
However, when asked how they defined the success of their garden, 86% of respondents
indicated that success was based on yield. This indicates a paradox in the results.
Although gardeners usually do not plan for high yields nor are they motivated by them,
this is still the standard by which success is measured. For example, when asked if they
looked for high-yield plants, one participant said this:
Participant: “My decision is basically based purely on emotional and past experiences with my family. It’s not the yield that…”

Researcher: “So you grow the same varieties?”

Participant: “Every time. It has nothing to do with the yield; that’s not my reason for gardening or whatever I grow. It’s just what I love and I love to grow tomatoes.”

But when asked how they defined success, the same participant said:

“One where all of my flowers turn into tomatoes. I’ve had years where the plants have lots of abundance of blooms, but then they all fall off and I don’t get any tomatoes. Or, I’ve tried to grow bell pepper plants and they just die. So, a successful season is to yield a good quantity of vegetables from the plant that you’ve grown and not have them die or have some rodent eat them. That’s what I would consider a successful gardening season.”

It is interesting that this participant picks what types of tomatoes they will grow based on emotional reasons, rather than on high-yielding varieties, yet they measures success based on yield. When asked why they gardened, this participant answered:

“Because I love to garden. My dad was a gardener. He had a much bigger garden than I do. He loved it, and since we’re a family of nine, we all participated in it when we were kids. And when he got older, we did it for him. He died two years ago of cancer. I just can’t not do it. It’s something that bonds me with my father. It feels good to dig in the dirt.”

This indicates that success, based on this gardener’s reasons for gardening, should simply be defined as the act of gardening. However, this gardener measure their success on yield, which suggests that success is hinged on yield, regardless of why the person is motivated to garden.
Not everyone in the sample indicated that success was determined by yield. There was a minority who defined success simply as the act of gardening or the process of gardening. One participant said:

“I wouldn’t look at it in terms of harvest. I know that. Yeah, having stuff growing, like not having blank patches of soil, it’s just…as long as stuff comes up I guess and just having time to be in it.”

This same participant, when asked why they gardened, answered:

“[I]t’s just really relaxing to go outside and know that you have a purpose but it’s not something that you should get stressed about and it’s just something fun that you can go and do.”

From this response, it seems clear that the act of gardening is a success because this participant uses it as a form of therapy. There are NGO projects which try to promote this benefit to people, specifically youth\(^1\). Although of the 10 participants who indicated that gardening was a form of therapy, only 2 also indicated that success was defined by the act of gardening. This indicates that as a society, it is challenging to differentiate ourselves from the productive aspect of vegetable gardening when considering the success of such a venture.

While the motivations for starting to garden were often the same as the motivations for continuing to garden year after year, there were other motivations that often influenced the participants to begin their garden. For instance, 77% indicated that they had grown up in a home with a garden. This suggests that growing up in an environment with gardening as part of it will, at least on some level, move people to grow

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\(^1\) See The Julian Project at www.thejulienproject.com
some of their own food. Some participants had only a loose notion that growing up with some type of food production had motivated them, such as this participant:

Participant: “My mom did, yes, sort of on and off. I have one memory of gardening; I remember weeding a big front lawn.”

Researcher: “Would you say that had any impact on your decision to grow your own garden?”

Participant: “Maybe. The one place where we lived had a peach tree and an apple tree and a big garden. I remember cucumbers and the fruit. It just tasted better. And I remember the family connection, and that sort of thing, so maybe.”

While others had strong notions that their interest in gardening had sprung from being raised in and around the garden:

“Yes, absolutely. And I did 4-H, and I was quite heavily involved with that. We did a lot of gardening programs and stuff like that. It was interesting.”

Other less popular reasons for starting a garden were that they thought it would be a good learning experience (23%), that the garden was already established (5%), and the participant wanted to meet new people (2%).

Barriers to Gardening

The second portion of the interview focused on barriers that gardeners would, or at least could, encounter in gardening. Freelistings were used for the participants to list the barriers they felt gardeners encountered. The top five identified barriers are listed in Table 5.1 along with the percentage of participants who felt this was a barrier.

Table 5.1: Top Five Barriers Which Gardeners Have To Overcome
<table>
<thead>
<tr>
<th>Barrier</th>
<th>Percentage of Gardeners who Identified it</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to land</td>
<td>74%</td>
</tr>
<tr>
<td>Not enough time</td>
<td>53%</td>
</tr>
<tr>
<td>Not enough knowledge of gardening</td>
<td>40%</td>
</tr>
<tr>
<td>Cost too high</td>
<td>30%</td>
</tr>
<tr>
<td>Not enough interest in gardening</td>
<td>28%</td>
</tr>
</tbody>
</table>

Participants were encouraged to enter as many potential barriers as they could think of in 30 seconds; therefore, multiple answers were common.

These findings indicate that ‘access to land’ is a major limitation to gardening in the city. This is interesting because everyone interviewed had overcome this barrier, as they all had a garden. Some did have trouble overcoming this barrier and were gardening in a community space, while others owned their home with adequate backyard space to grow food in their backyard. ‘Lack of time’ however, while only identified by roughly half the participants, was experienced by many. Some struggled with finding time to remain committed to their garden over the course of the summer. It is relatively fair to assume that the majority of gardeners have never done a cost analysis on their garden; the reported barrier of ‘high cost’ is therefore interesting. From the results of the garden diary, it seems it is actually very expensive to garden. The average cost per kilogram was $12.35/kg without factoring in labour (with labour at $10.25/hr, the cost per kilogram is $49.24/kg). While only 30% of participants indicated this as a barrier, it seems plausible that this is a substantial barrier as there are much more productive things to do with one’s time, given the productivity levels by these gardeners. The final barrier presented is lack of interest in gardening. With growing disconnection between the food we eat and how it is grown, otherwise known as food skills (Jaffe and Gertler, 2006), there is less interest in
understanding how it is grown; thus, ‘interest’ is a major barrier even though this was only identified by 28% of participants.

**What were the Most Challenging Barriers?**

Each participant was asked which barrier they felt would be most challenging for a gardener or potential gardener to overcome. Figure 5.3 shows the distribution of common answers to this question.

![Figure 5.3: Most Challenging Barriers (%)](image)

This section will illustrate why participants felt that their barriers were the most challenging to overcome.

Since the most commonly stated barrier was ‘access to space’, it would make sense that this would be reported as the hardest barrier for someone to overcome. However, 23% indicated that this would be the most challenging barrier while 28%
thought that ‘lack of desire’ would be the hardest to overcome. One participant explained desire as a big challenge this way:

“I think so, because once you have the desire, people will figure out how to do it. And I think it would take a few more food scares like E. coli in the spinach and all the things we’ve had to maybe scare some people into doing it.”

This participant thought that if food was perceived as, or actually was, unsafe, then the desire to produce one’s own food would increase. This seems a logical assumption, but if such circumstances are the only way to motivate people to garden, is it even something society should be interested in? There were also some gardeners who struggled with the desire to garden, even though they did have a garden:

“[I]n the garden it’s just, it’s not interesting to me to begin with and that’s partially because I’m not a natural at it so it’s not successful so I’m like ‘Why bother?’.”

It is interesting to note that this particular garden plot, perhaps partially due to a lack of interest, was only able to yield 0.08kg/m² and was the least successful garden within the sample. By comparison, the participant who felt that food scares would change people’s desires, who was also very interested in gardening and food production, was able to yield 3.06kg/m². This suggests that interest in gardening could have a substantial impact on yields. To statistically test this is outside the scope of this research.

Another challenging barrier indicated by 19% of respondents was ‘time’. One participant said:
“I think we prioritize almost everything above gardening. I mean, we water but that’s about it.”

Another gardener had ‘time’ as a barrier, but prioritized the garden and commented:

“Vacation is definitely a barrier. We went away this year for two and a half weeks and we had to ask friends to water for us, and that’s challenging because it’s a lot to ask of someone to do that. It could take up to an hour watering by yourself.”

Perhaps ‘time’ is a barrier for everyone, but the real challenge is prioritizing your garden to overcome this barrier. Interestingly, while 19% said time was the most challenging barrier, 12% said that it would be the easiest to overcome.

Knowledge was most commonly cited as the easiest barrier to overcome. One participant who thought this said:

Participant: “I think probably knowledge, because a lot of it is free and it’s in your neighbour’s head, or…”

Researcher: “It’s accessible.”

Participant: “Yeah, it’s very accessible. Possibly slightly overwhelming because there’s so much out there in terms of information. I guess it’s not really knowledge until you’ve got it and you’re doing something with it. But in its information state, it’s very accessible and there’s a lot out there, and anything that you want to know, you can probably very easily find out. It’s whether or not you have the desire to do something with it.”

This participant makes a great point; knowledge can be easy to overcome because it is widely available to the public. Another participant, who thought that knowledge was a challenging barrier, expressed this concern:
“I would stick to knowledge, because it’s not just as easy as throwing something in a hole. It’s not easy to just find something on the Internet when you don’t know what you’re looking for. It’s not easy to find that.”

In this case, while the information is accessible, the sheer amount that is available makes it challenging for the novice gardener to decipher which of it is useful knowledge.

_How Do People’s Opinions Relate to the Efficiency of Production?_

There were a number of themes discovered in the interviews that related significantly to measures of productivity and efficiency. When asked why they gardened (referring specifically to vegetable gardening), there were three answers that yielded a statistically significant relationship with the amount of time spent in their gardens. Those who gardened for “freshness” of the produce (n=10) spent significantly less time in the garden per m² than those who gardened for other reasons (P<0.05). Those who said they gardened for fun (n=25) spent significantly more time in their garden per m² (P<0.05). Finally, those who said they gardened for the food (n=6) spent significantly less time in their gardens (P<0.05).

When participants were asked about what benefits they experienced from gardening, there were two statistically significant correlations with efficiency. First, those who indicated that a benefit of vegetable production was that they received better produce (n=23) spent significantly less time for each kilogram of produce they harvested (P<0.05). Second, those who indicated that a benefit was saving money (n=4) actually spent significantly more for each kilogram of food (P<0.05).

Those who indicated that the most challenging barrier that gardeners faced was time (n=8) spent significantly less time in their garden per m² (P<0.05) and significantly less money for each kilogram they harvested (P<0.05).
Many participants indicated that they had a family influence in their childhood that encouraged them to garden (n=33); these participants spent significantly less time for each kilogram they harvested (P<0.05).

When participants were asked how they chose what to grow in their garden, those who answered “what was possible in the space” (n=11) spent significantly more money for each kilogram of food than those who chose their crops for other reasons (P<0.05). Those who acquired at least some of their seeds through informal networks (n=18) spent significantly less capital in their gardens (P<0.05). Those who acquired at least some of their seeds through seed saving (n=13) spent significantly less time for each kilogram of produce harvested (P<0.05).

Discussion

It was interesting to find that bonding was the most commonly-reported benefit of vegetable gardening. The researcher hypothesized that while this might be a common benefit of regular gardening, those specifically growing food would likely have something else motivating them. It was hypothesized that they would have a strong interest in their food. This does not appear to be the case. Clayton (2007) found that spending time outdoors, observing nature and relaxation were the highest motivations for gardening. This research, which focused on food gardening rather than gardening in general, found that the most common benefit was bonding, followed by physical health benefits that included spending time outdoors, and also changes in diet and exercise. Bonding has especially been regarded as a significant motivation for older gardeners (Ashton-Shaeffer and Constant, 2005). The third most common benefit to vegetable
production was an improvement in the quality of the vegetables being consumed, as measured by the participants’ perception of their produce being higher in quality.

This research found many instances of commonality regarding the motivations of gardening, but a few substantial deviations from the literature as well. The improved sense of community was present, which has been noted by many scholars (Roubanis and Landis, 2007; Glover et al., 2005; Saldivar-Tanaka and Krasny, 2004; Glover, 2004), but mainly among people gardening in their backyards rather than in community plots. Very few people mentioned any type of logistical benefit directly; however, one participant felt that vegetable gardening was improving her resiliency, and many were gardening to improve their self-sufficiency. This illustrates that they may identify with a decrease in dependency as a benefit of growing their own food. Many people felt their health was improved with gardening, but usually in abstract ways. Many stated that they ate more vegetables, but this was not measured against any standard. While there is some literature focusing on improving the urban environment, this was not found to be a large motivation in the current study. A few participants, however, did comment that the beauty of the vegetable garden was a benefit. The income benefits were not mentioned at all by the participants. This and the lack of a sense of community experienced by some members were the two deviations from the literature.

While there is much excitement about the possibility of making money from vegetable gardening, by and large the majority of vegetables grown in the backyards of participants in this study were grown in such an inefficient manner that they could not hope to earn income from their produce, especially if accounting for labour. This however was not the goal of their gardens. Even the urban agriculture companies
involved in this research found it hard to turn a profit, similar to agriculture as a whole. The main limitation for them was labour costs, but even without these costs of labour, there was not a substantial profit to be made. As explained by a personal correspondence, this was not due to issues selling the produce. In fact, selling the produce was easy; the problem was gaining a high enough level of production and subsequently selling it for high enough margins to compensate for the labour costs. This raises the question, are many urban agricultural companies not-for-profit because profits are usually hard to achieve?

These results indicate that there were many instances of a lack of community in the community gardening projects that participated. This is contrary to what most literature says on the topic; community gardens have positive effects on the communities where they are located (McClintock, 2010; Guthman, 2008; Saldivar-Tanaka, 2004). This is possibly because of the types and sizes of community gardens studied. Community gardens that participated in this study that showed a lack of community development were relatively small, whereas the larger ones did display a sense of community development. The majority of community gardening participants in the present study were focused in the smaller garden plots; this may provide insight as to why there were many instances of a lack of community observed in this research. Furthermore, the gardens in this study with less observed community were also very inexpensive to participate in while the ones with community development were much more expensive. There may be a relationship between this ‘status’ and the type of participants who are involved in each garden type, as well as and their level of interest in gardening. However, testing this hypothesis is outside the scope of this research.
The relationship between participants’ opinions and measures of efficiency was a very interesting one. Firstly, those who cited benefits related to production (freshness and food) were more efficient than those who cited fun as a benefit. This is an intuitive finding, as those who undertake gardening to experience ‘fun’ as a benefit likely do not attempt to be very efficient at it. Secondly, those who indicated that they acquired better produce spent less on their garden, since they were trying to produce food efficiently. Interestingly, those who cited ‘saving money’ as a benefit of gardening actually spent more on their gardens. Since the results of this study indicate that the gardeners studied are very inefficient, it is possible that these participants had simply never considered the costs associated with vegetable gardening over the summer. Thirdly, those who indicated that time was a challenging barrier also spent significantly less time and money in their garden. Since they spent less time in their gardens, it is also probable that they required less investment. Finally, those who acquired their materials through some sort of method other than purchasing them were more efficient gardeners. This could be attributed to the fact that they were either more knowledgeable about gardening or networked with other gardeners.

According to the interviews it seems that gardening is a way to build social capital, which can be accomplished via two major routes; through bonding, which improves the social bonds within a group and through bridging which connects disconnected groups (Newell et al., 2004). From the participants in this study, it is clear that bonding was present but bridging was rare. This indicates that gardening enhances already established communities but may not be useful in connecting communities. This may be due to the small size of the community gardens and the lack of bonding that
occurred within them. Bonding was often present in backyard gardeners as this gave them an opportunity to bond with their neighbours.

**Summary**

In conclusion, this chapter examined the common motivations and barriers that influence people to garden, as provided through participant’s responses to interview questions. These motivations and barriers were also corresponded with efficiency measures to determine which motivations have an impact on efficiency. It is clear that the findings in this study are similar to those of previous studies in that they do not suggest that the most common motivation is the production of food. They do, however, add to the literature in the suggestion that bonding is an important motivation in producing food.
CHAPTER SIX: PRELIMINARY ASSESSMENT ON HOW TO IMPROVE THE CONTRIBUTION OF GARDENING ON THE FOOD SUPPLY AT THE MUNICIPAL SCALE

“If you have a garden and a library, you have everything you need.”
-Cicero

Introduction
While the previous two chapters have presented results that have characterized the production of vegetable gardens in Guelph, this chapter and the next will analyze these results to provide insight into how they may apply to useful policy opportunities. The focus of this chapter is to discuss how the results and analysis could make a contribution to shaping policy to improve gardening within the city by evaluating common and unique suggestions. San Francisco was interested in expanding urban agriculture because, as a municipality they wanted to reduce their ecological footprint, increase the sense of community, create more green space and increase their access to fresh nutritious foods (SPUR, 2012). Gardening is different from other green space in the city because it is low cost, used intensively, developed using a bottom-up approach, locally controlled and small scale (Francis et al., 1984). Community gardens specifically contain sustainable designs and sustainable activities (Clavin, 2011).

What Could a Municipality Do to Improve the Quantity and Quality of Urban Food Production?
When gardeners were asked what their municipality could do to improve the quantity and quality of urban gardening in the city, they produced a number of responses. The most common response was that the municipality should be involved in educating the public about how to garden. This was suggested by 60% of the participants. One said:
“[M]aybe encouraging people to look into perennial plants. I feel like they’re a lot more low maintenance plants and the initial cost you pay the first year and then you don’t have to pay it again. So, that could really get people’s interest knowing that they don’t have to dedicate lots of money or time to it.”

This quote suggests that educating the public about the benefits of various types of plants could help the residents in the City of Guelph to invest their efforts more efficiently, which would make gardening easier to do and therefore possibly more desirable.

The next most common suggestion was that the municipality should invest their efforts in the promotion of gardening to improve the quantity and quality of gardening in Guelph. This was articulated by 44% of the interview participants. One said:

“[B]ut whatever the policy is, I think the goal of it would be to promote, ‘This is a means through which you can have healthy families and healthy living, and those things translate into a healthy community and a healthy city’. I think that’s how it would work.”

When the research began and this question was added to the interview guide, it was thought that simply providing more space would be what gardeners would want and that this would be articulated through demands for more community gardens. This was a popular suggestion, but only 42% of those interviewed thought this. One participant articulated:

“Another one, in my opinion, would be to have community gardens in a lot of the parks. There are a lot of parks we have with space that’s just never used.”
However, another participant articulated that the City of Guelph was doing a pretty good job of providing space with community garden projects and just felt they had to build on what they had already started:

“They are doing a good job of supporting groups to get started, but it’s not enough; it needs to be scaled up.”

There were a number of variations on giving useful items to the public to assist in their gardening effort, such as providing raw materials, including fertilizer and seeds; tools, such as rakes and shovels; or start-up capital, including money to bring in topsoil or to create raised beds.

Another interesting solution was that the City could provide tax breaks for gardeners. These tax breaks were suggested by 28%, but the nature of the tax break was not uniform. It seemed that gardeners would be happy with small tax breaks. One gardener suggested that even a 2% tax break on their water bill would be sufficient to satisfy them. Property tax breaks were also suggested, with the rationale that a garden would improve the health of the city. Since the municipality collects property tax, they could give a tax break to create an environment where gardening, which beautifies the city, is encouraged.

There were two other common suggestions, though they were only suggested by small percentages, which would be quite easy for the city to encourage and complete. The first, suggested by 9%, was the creation of a network of gardening resources and contacts which the city would maintain, but it would only really entail the collection of the network items and then general maintenance on a website. The City of Guelph has
begun this with the community gardening section of their website, but they could easily enlarge this to have contacts and information regarding general gardening rather than focusing solely on community gardening. Community gardening could still be a major section, but not the focus. This would allow the website to be of use to all gardeners instead of solely to those looking for a community garden plot.

The second suggestion was to change by-laws, as suggested by 7% of interviewees. The idea would be to create by-laws that would encourage gardening within the city. An example is the ‘backyard chicken by-law’ in Guelph that allows people to keep chickens in their backyards as long as they meet a number of conditions. It might also be useful to change or remove by-laws that are currently not beneficial or prohibitive to gardening. For instance, Guelph has a by-law that states that vegetable plants cannot be watered during a Level 3 water ban (City of Guelph, 2010). This could be removed to assist vegetable gardens during drought. While Guelph does not currently have any restrictions on front yard gardening, this has happened in other places, such as Toronto (Day, 2010). Removing such by-laws would be beneficial to help encourage urban food production.

**Unique Solutions**

Unique solutions refer to solutions mentioned in the interview process that were usually mentioned only once; however, such solutions seemed to provide insight into potentially useful solutions. Therefore, unique solutions will be explored in this section.

One of the first unique solutions presented was mentioned by a retired couple who owned their own home. They suggested that the municipality could mandate a
substantial amount of topsoil be left on the lot when developers construct a new housing development. The participant said:

“I’d say at least 30cm. Absolute minimum 30cm. And then people won’t have to be hauling soil in and they’ll have half-decent soil in their own backyards. And they can work with it.”

Current in the ‘Site Plan Approval Application’ in Guelph there is no explicit statement about how much topsoil must be left on the lot. This represents the possibility to enact such a by-law to substantially improve access to soil so that potential gardeners can simply plant in their backyards. The addition of adequate topsoil would benefit the quality and quantity of urban food production because there would be less effort involved for people to simply get the soil into production.

The same couple had another unique idea about a successful way to acquire soil. Guelph has a program which collects organic matter and turns it into compost. This food waste or yard waste is a ready source of compost for the city. They thought that since tax-payers are paying for these facilities anyway, the compost should be available for free to the public. They said:

“Female: You know when we’re hauling over our yard waste and it’s turning into soil? Why doesn’t the city pump back some of that soil into our backyards, instead of shipping it or selling it? Let the city pay for it, open it up for ourselves to take as much soil as we need to do our own backyard.

Male: Which, it has a precedent, because they did it in Toronto. They made compost available for the public, just at a shopping plaza. And all you had to do was bring your own containers and you could take as much compost as you needed.”
This solution would require the City to support the redistribution with some tax dollars, but they could distribute it directly from the compost facility so they would only have to pay someone to be there for distribution. Unfortunately, the compost currently produced is not sorted to be food grade and therefore if this solution was to be enacted the plant would have to have a capacity to produce food grade compost.

Another participant thought it would also be a good idea to target developers:

“I know when there is new development there is a requirement for regular park space; maybe there could be a requirement that part of that park land be for food production in the city. And maybe also encouraging things like rooftop gardens and that kind of thing, particularly in high density urban areas.”

Targeting developers makes sense as it would allow the city to mandate the growing of food within the city, and it may be possible to do it at the developer’s expense initially, which would then be passed on to the home purchaser. This would also be useful in creating spaces that are designed specifically for gardening instead of adapting spaces for gardening, and therefore usual limitations such as shade, elevation and topsoil depth could be avoided.

Another unique solution, which the city could spearhead without much work, would be to create a list of pro-gardening landlords. This suggestion was made by a young couple who rented their house and would be interested in knowing before moving in whether the landlord was willing to allow them to grow food on the property. They said:

“I guess maybe the City of Guelph could do it but, an association of landlords who were friendly to having backyard gardens. Because we rent and our landlord’s on board with it, but a lot of landlords don’t like the idea of a backyard garden, because you’re ripping up the grass.”
This solution would improve promotion of urban gardening in the city and could be a useful tool for those living in low-income housing as the tenants could grow some of their own food to reduce their grocery bills. Additionally, it would make the landlord’s property more beautiful (assuming the tenants completed the garden) and would actually reduce their maintenance required because the tenant would be responsible for that section of the property.

The same couple had another very interesting and logical solution. They suggested that the City could plant food crops on boulevards, instead of planting ornamental boulevards. They commented:

“[M]aybe the city itself, […] rather than planting all ornamental boulevards, why not make some of the boulevards planted with food crops? Then the city could offset the costs and donate some of these foods to food shelters or food banks or various things in the city. Put the food that’s produced on city land back into this system to feed it to people who need it. Obviously ornamental plants are nice, but even vegetable plants as they go through their cycles would look beautiful in boulevards, as an option. So maybe making space for food [as] part of the planning process. And I know that they’re doing some rooftop gardening on City Hall, but maybe get into it more and start producing food.”

This solution would be easy for the City to implement. They already employ city workers to maintain these flowerbeds; thus, they would simply have to change what is planted in them. The food being available to those who need it would be excellent, but even just publicizing that the food in the boulevards was for anyone in Guelph would be enough to see that the food got eaten. The problem with this solution is that there are concerns with soil toxicity, which may be circumvented by planting fruit trees instead of vegetables, but fruit trees in the Ontario climate need significant amounts of pesticides and therefore might actually not have the effect of making urban agriculture aesthetically
appealing. It might be possible however to plant other trees which could provide food for wildlife and would not require intensive labour to maintain. A few other participants also mentioned this solution.

Water is an issue that multiple participants felt the City could do a better job in assisting with. One participant said:

“And then maybe you get 2% off of your water bill or something. I know a lot of people are complaining, especially this year, that nothing’s growing because there’s no rain. But paying for water, you’re paying for it 3 times every time you flush a toilet. Every time that I take a bucket of water and put it there, I’m also watering the plants, but I’m paying for the disposal. But I shouldn’t be, because I’m not disposing of it. And the treatment I’m not treating that water. But I’m paying for that water 3 times exactly the same as I would if I did flush the toilet. Which doesn’t make any sense; there has to be a way of monitoring outdoor use where you get a certain percentage off if you’re actually greening the space. You’re helping the environment. If you’re going to help the environment, then give back.”

This idea that the City could give a tax incentive in the form of savings on a water bill is logical; however, it would mean that the City would need to monitor who had a garden. Even if the City implemented a tax break for outside water use generally, this thesis has proved inefficiency in gardening in Guelph and the water in Guelph is limited, so it might actually be a poor idea to support to inefficient use of water for gardeners to produce their own food. However, urban farmers might benefit from a tax break of this nature. Another participant said:

“I suppose that more big community buildings could have rain barrels just lined up against the side of an arena or something. So then if you wanted rainwater, you could go and get some. It’s fallen out of the sky anyway. But the problem is the same as everything who’s going to own it, and
who’s going to money with it, and who’s going to vandalize it and contaminate it? Somebody is going to have to take ownership for it.”

While this solution might not be practical for people who did not live near the building, it could be useful for those who live close by. If combined with a community garden on the property or perhaps a professional urban farm, the rain collection by public buildings could be very useful for many gardeners, however it would require enormous storage to be able to eliminate the requirement of alternative water sources. Perhaps combined with a tax-break on city water however, this could allow more skilled farmers an opportunity to be able to operate within the City. This participant brings up an important point, however; someone would have to be responsible for it. The City might have to invest in an employee to look after gardening initiatives.

Another interesting idea that was mentioned was the introduction of an urban agriculture-zoning category. This has been done in Philadelphia, where urban agriculture has an official zone, and though this helps with the planning process, it has not solved all the problems encountered between urban agriculture and zoning, as the zoning code is still a challenging process to navigate and building permits are not easy to acquire (Fried-Cassorla, 2012). One participant said:

“They could institute a zoning category of urban agricultural land so that good sized chunks of privately owned land could be zoned and maybe even taxed at a preferred rate. And the zoning would mean that that land could stay in agricultural production unless the zoning got changed, so that would help preserve the garden efforts that got started so that would lend itself to permanent plantings, like perennials and stuff.”

This is an important point. Not only would a zoning category allow more space to be put into production due to the differences in tax rates for private landholders willing to
convert an unused property to this, but the zoning would also protect the longevity of community gardens that could be zoned as urban agriculture space, especially on public land. This, as noted by the participant, would help with more permanent crop selection.

Visibility of gardens was another key point. One gardener suggested that simply the promotion of planting vegetable gardens in visible spaces, such as the front yard, would help to encourage others to grow food within the city. One participant stated:

“I would say that we need to stop thinking about backyard gardening. I don’t know if in Guelph we have by-laws against vegetable gardening in front yards, but I know that some municipalities do. Certainly encouraging people to be gardening in their front lawns would make it more visible. Why do we hide our gardens? I’m doing it too; I’m growing flowers in the front and vegetables in the back, but let’s move vegetable gardens to the boulevards and plant fruit trees and maple trees. Just make it more visible.”

This suggestion could be taken up by the City through a promotional campaign in which one portion was dedicated to the growing of food in a more visible space. The concept makes sense; if people see the food being grown, they will be more likely to participate. However it is important to make sure these gardens in visible spaces are aesthetically appealing to be sure that the garden is not in violation of property standards.

A final unique solution suggested that the creation of by-laws at the municipal level, or broader initiatives at the provincial and federal level, require large companies such as grocery stores to source a specific level of their products from producers within their municipality. This would require substantial public health requirements to be met to ensure all the food from multiple producers was safe but it would also create a ready market for gardeners to sell extra produce and would encourage others to create a garden
simply for the economic benefit. It would also expand the market possibilities for professional urban farmers. Additionally, this would encourage people to grow food with production in mind; therefore, yields could approach similar levels to that of one organization that reached the level of just over 21kg/m². This group was able to achieve such high levels because their goal was production (in their case, to give to a food shelter, which means that they were also motivated by charity), so having a ready-made market would give this type of incentive to everyone.

Discussion

The policy implications for Guelph range from relatively inexpensive to very expensive, but instituting some of them initially would provide insight as to whether the others were worth the investment or not. The most common desire of the residents of Guelph was that the municipality should provide education about gardening. This education could be practical, for example, developing workshops about how to grow plants or create raised beds, or could perhaps be more theoretical by educating people on the benefits of gardening. The City could provide these workshops free of charge or could simply support community organizations that are interested in these topics. They could be supported through tax dollars since the capital required would be low or sponsored by local related companies as an advertising method. This would provide focused information for people who are encountering the barrier of knowledge acquisition. In a developing world context, free educational workshops have been used successfully to provide capacity development (Mendoza et al., 2007).

The promotion of gardening could take multiple forms. It could be as simple as advertising gardening on city buses in May when residents are starting to decide on
whether they will grow a vegetable garden. As one gardener suggested, this promotion could take the form of visible vegetable gardening on boulevards or in front yards. It could be as simple as the City planting tomatoes in city maintained boulevards instead of roses. While there may be higher maintenance requirements for tomatoes, should the soil be deemed safe for food production, there would be more benefits to planting tomatoes than roses which may warrant the extra resources. All of these would promote vegetable gardening. A campaign in North American cities attempting to inform the public about how to deal with heat waves found that while the promotional campaign resulted in 90% of the population being aware of this as an issue, only around 50% knew what to actually do or changed their behaviour (Sheridan, 2007). This indicates that promotion might have potential to be a useful tool, but will not lead to the widespread uptake of gardening across the city as perhaps only 50% can be expected to understand the benefits of gardening.

Increasing the amount of community gardens is also a popular policy recommendation. This could be accomplished by incorporating more food production space in municipal parks, but should the City not desire to have the gardens under their responsibility, then they could create an urban agriculture zone and apply a preferential tax rate to encourage large corporations to grow food on their land. This has been done in some North American cities, with the first major city being Cleveland (Cleveland/Cuyahoga County Food Policy Coalition, n.d.). This legislation has opened Cleveland up a faster process for these sites to be approved for the building of fences and sheds (Taggart, 2010). This has been largely successful, with 215 community gardens and 36 for-profit urban farms (The Plain Dealer Editorial Board, 2012). Cleveland is a
shrinking city and Guelph is growing, but the idea of making the process easier should still lead to more urban agricultural land. This has made urban agriculture more accessible which could be useful in Guelph. Alternatively, they could also mandate that developers include gardening space on their developments, much in the same way that they include park space or sidewalk space, which the City could then own and operate. This would assist in the ‘access to land’ barrier.

The donation of materials has the potential to be expensive, but it would not necessarily have to be. For instance, mandating that developers leave more topsoil on their lots would not necessarily cost the City any more money, but it would provide homeowners with adequate topsoil to grow their own food. Another potential inexpensive way to donate materials would be to allow the food waste recycling program to provide compost free to residents, as this program is already paid for by the tax-payers of Guelph. These policies would help overcome the ‘access to materials’ barrier.

Another popular suggestion was that the municipality should grant a tax break to gardeners because they are providing benefits to the city ecosystem. One participant suggested that if watering was being completed to help the vegetables grow, then there should be a preferential water rate for that watering since it does not need to be processed by the municipal infrastructure. This would help offset the ‘cost of gardening’ barrier. Tax breaks have been used extensively to attempt to change the habits of citizens. Notably, in the environmental section, especially energy, these tax breaks have been implemented with great success (Swezey and Bird, 2001).

The creation of a network of gardening resources would be relatively easy for the City to set up and would be low cost. This could include informational items, such as
what the City already has, but could go beyond this. One suggestion was to have a list of pro-gardening landlords. This program could have the landlords paying a nominal fee to assert that they are pro-gardening, and tenants in the city would then have quick and easy access to this list so they could know which house rentals would allow them to grow some of their own food.

The final solution suggested was to change by-laws to create an environment that is most conducive to gardening. The requirement for food retailers to source some of their food from within the city, even if the percentage was very low, would aid in overcoming the barrier of the high cost of gardening because there would be a ready market to sell extra vegetable produce. This is somewhat radical, but the positive benefits of reducing food miles while increasing urban agriculture at least require that this be mentioned. Even establishing a market where people who grow their own food could sell it to others would assist in diminishing this barrier and would also increase the ‘production motivation’ of gardeners. This may be a more practical solution.

Policy Recommendations

According to the results of this thesis, the following policy recommendations should be presented to the City of Guelph to foster improvements in urban agriculture within the City.

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<tr>
<th>Table 6.1: Top Five Recommendations to the City of Guelph</th>
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<tr>
<td><strong>Recommendations</strong></td>
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<tr>
<td>Hire a full-time urban agriculture manager</td>
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<td>Recommendation</td>
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<td>Expand the “network” of gardening resources.</td>
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<td>Promote Gardening</td>
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<td>Provide educational workshops</td>
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<td>Expand the number of community gardens by 1 per year</td>
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These recommendations represent the initial steps to improving urban agriculture in Guelph. They are solutions which would start with low-cost measures and once the city realized the benefits and the citizens were increasingly interested, then it would be possible to begin some of the more expensive recommendations reported within this chapter.

**Summary**

In conclusion, this chapter reported findings about which policies gardeners believe municipalities should be responsible for, which were then transformed into policy
recommendations. This is one of the applied aspects of this work and could prove quite useful to municipalities who want to benefit from the many potentials of urban agriculture.
CHAPTER SEVEN: HOW COULD GARDEN FOOD PRODUCTION CONTRIBUTE TO THE GLOBAL FOOD SYSTEM?

“The greatest fine art of the future will be the making of a comfortable living from a small piece of land.”

-Abraham Lincoln

Introduction

The aim of this research was to estimate garden production in Guelph to gain a better understanding of the potential role that urban agriculture, in the form of gardening, could play in improving the food security in our global food system. This chapter will provide some ideas about possible scenarios, what peak efficiency would yield, which crops yield the most in Guelph, and the potential of square foot gardening and systemic incorporation of gardening.

Possible Scenarios Where Urban Agriculture May or May Not Contribute to the Global Food System

For urban agriculture to contribute to the global food system, it will require space, efficiency and high levels of production. This section will deal with “what if” scenarios in order to determine whether, under any circumstances, it will be possible for food grown in private gardens to be able to significantly contribute to the global food system.

In this first scenario, it will be assumed that current levels of gardening in Guelph are present, but the production levels are competitive with the top 10% of the sample. This would mean that across Guelph, there would have been 573,376.87kg of vegetables produced instead of 196,155.25kg. If it is assumed that these top 10% possess a higher level of gardening knowledge, then the increase in yield suggests that if gardeners were only better informed and educated, a substantially higher amount of food could be grown without changing any of the other aspects of gardening. This still would only produce
enough fresh vegetables for 8,322 people for the year from 35% of the households in Guelph. This would only feed roughly 7% of the population.

In contrast, as uninformed and untrained gardeners begin to garden they will achieve much lower yields. If it is assumed that gardeners in the bottom 10% of production represent these untrained gardeners, and if Guelph had these people gardening entirely, it would mean that only 17,074.9kg of food would have been produced. This indicates that the difference between new, inexperienced gardeners and trained, experienced gardeners in the rate of production would be 33.5 times greater when experienced than when inexperienced. This represents a possible avenue where gardening could contribute to the global food system. If training in horticulture was implemented in schools so that in 20 years all gardeners would have some experience and would be able to achieve higher production levels, then even without changing the area devoted to gardening, or the time and money invested, the level of production could jump substantially and reduce the pressure on the supermarkets (also reducing their profits perhaps, although, produce only accounts for 12% of sales (Chanil and Major, 2011), indicating that they could still turn a healthy profit). This scenario presents a situation in which self-sufficiency would still be a long way off.

This next scenario will assume that 10% of the yard space within Guelph was put into vegetable production. If this were maintained by inexperienced gardeners, the result would be 336,371.03kg of vegetables produced over the summer; this would be an increase above 2012 levels of production by 42%, even with inexperienced gardeners providing the maintenance. However, if this same area was gardened by people with experience, then 11.3 million kg of vegetables would be produced, which would surpass
2012 levels by 58 times. It is clear that there is substantial room for improving urban agriculture. If Guelph devoted 40% of yard space to food production, even at average levels, 38.6 million kg of food would be produced. This would mean that each household would produce, on average, 1261.70 kg of food over the gardening season. Not only would this represent self-sufficiency, but Guelph could actually export their excess crops to near-by urban centers.

Another scenario is if food gardening was a more prominent portion of the municipal parks in the City to cut down on some of the less used space. One participant suggested this most clearly:

“[A]ll those parks that hardly anyone goes to, those things are catering to people who want to walk their dogs or have their kids play which is weird because dog stuff can really make kids sick but none of those things appeal to me. I don’t have any of those things but if there was agriculture there I’d be willing to be a neighbourhood steward a bit. In other words, you could make the park appeal to more interests in this way all the while educating people and making food visible and public and local.”

If it is assumed that 25% of park space was put into production by average gardeners, then 2.4 million kg of food would be produced. While it might not be sensible to create all this garden space at once, over a period of 10 years it would be possible to expand slowly and allow people to sign up for gardening the space. It should be noted that if experienced gardeners (or, potentially, skilled urban farmers) were given this space to boost agricultural production in the City, then they would produce 7.1 million kg of food.

Another interesting scenario is if industrial land users were required to devote a mere 5% of their land to agricultural production and were required to hire experienced gardeners to produce food; then they could produce 1.9 million kg of food in Guelph.
This food could then be sold or given to the food bank in return for a small tax break for the value of the food. However, if the labour input by these gardeners was accounted for, then this would require 1,378,814.17 hours, which means that at $10.25/hr the cost in labour alone would be just over $14 million. This, however, is for all industrial space in Guelph. If the City agreed that this activity would negate many of the negative environmental effects associated with industrial land uses (and of course it would have to be determined that the land being used was safe), then the City could provide a tax break for the capital costs as an environmental trading program in which they have gardens that help clean the air, as all vegetation will contribute to this, and, in return be given a tax break for their improvement in air quality. Another idea would be for these companies to have their workers spend one hour per week in the garden to help alleviate some of their work stress. This could have productivity improvements for the workforce, which might make the capital outlay worth it in the end.

If the City of Guelph was willing to lower the production that private gardeners are able to achieve and instead granted 25% of park space to urban agricultural companies studied in this research (which yield less than backyard gardeners), this would greatly improve the efficiency of that production. If using peak production efficiencies from Company A, while the amount of food produced on this land would drop from 2.4 million kg to 976,843.34kg, the time required would also drop from 5.2 million hours to just over 500,000 hours. The required cost would also drop from $19 million to $5.6 million. As is clear, the amount of food would decrease slightly, but the efficiency would increase dramatically.
What Could Be Produced with Peak Efficiency?

If all the most efficient aspects of the gardening research are combined, the absolute peak possible efficiency discovered in this research is revealed. The highest measured yield was 5.18 kg/m². The lowest cost was $0.00/m². The most efficient use of time was 0.16 hr/m² (9.6 minutes). If this was applied to an average vegetable garden (12.55 m²), then 65 kg of food would be produced, there would be no cost involved and the gardener would only have spent 2 hours gardening over the entire season. This would be a very challenging scenario, however, because oftentimes efficiencies (less time per m²) are present when on larger areas due to economies of scale. Additionally, higher yields usually come at the cost of increased labour and usually more money. However, if it is assumed that over larger areas labour efficiencies could be reached and that it is possible to involve no personal capital through subsidy programs, and if 25% of all park land in the City of Guelph was devoted to this project the results would be substantial. Such a project would yield 8.8 million kg of vegetables grown in the City of Guelph. It means that 129,030 people could consume the average amount of vegetables that are consumed by Canadian citizens in one year. Interestingly, this is roughly the current population of Guelph which suggests that it would be possible for Guelph to feed itself, in terms of produce, as long as peak levels of production were achieved. Additionally, it would require 274,201.64 hours over the gardening season, or 298 full time employees from May 1 — Oct 1, to grow these vegetables at peak efficiency levels. The problem is that the City would need to pay those employees that would equate to $2.8 million dollars in wages, even at minimum wage. This is why the City should probably not be responsible for providing self-sufficient vegetable production, because it would be quite inefficient.
**Which Crops Would Yield the Most if Planted in Guelph?**

If the current backyard gardeners of Guelph only planted the top five yielding crops in equal amounts, they would produce 78,187.76kg of tomatoes, 54,045.57kg of beets, 69,683.12kg of carrots, 85,320.67kg of Swiss chard and 99,586.51kg of cucumbers. These vegetables are the highest yielding vegetables in terms of space based on the yields found in this study. This yields a combined total of 386,823.63kg of vegetables instead of 196,155.25kg or an increase of 49%. While it may not be desirable to live on a diet of tomatoes, beets, carrots, Swiss chard and cucumbers, this combination represents the best crop choice to impact the food security of gardeners (in terms of vegetable consumption) because it will yield substantially more food than other vegetable combinations.

If the gardeners of Guelph were trying to grow as much food as possible in the space they had, then cucumbers should be the sole vegetable grown. This would result in 497,932.5kg of cucumbers grown which is a 61% increase in production over the summer of 2012 in terms of yield by weight. However, this is not feasible if trying to become self-sufficient in terms of vegetable consumption as a mono-diet of cucumbers would not be adequate nutritionally.

**Anecdotal Evidence for Square Foot Gardening**

There are many approaches to gardening which urban agriculturalists generally can employ. One such option is ‘square foot gardening’. Square foot gardening is an intensive market gardening approach used by many professional gardeners. It is a method of gardening where the garden is divided into square foot sections to maximize efficiency by allowing the gardener to grow vegetables on 80% less land than a row garden (Square Foot Gardening, 2013).
Only one gardener out of 50 openly mentioned that they were gardening with a square foot gardening set up. Even though they are only one garden, their results are worth mentioning. This gardener was in their 30s and did not have much experience gardening (1-3 seasons). However, using the square foot gardening approach, they achieved the third highest yield at 3.96kg/m². Two gardeners were able to achieve higher results and two others were similar but smaller in their yield. What is interesting is that the 4 other closest gardeners in terms of yields all were very experienced gardeners (7+ seasons) and were all at least in their 40s. Though they achieved similar levels of productivity, the other four employed much more space (although not using the square foot method). The next garden in a similar yield group was over 3.5 times larger and this garden was actually found to have slightly lower in terms of productivity levels when compared to the square foot garden. The two gardens that achieved a higher yield were 6 and 16 times larger than the square foot garden plot. Additionally, in terms of total hours, once construction time (12 hours) is removed from the equation, this square foot gardener only spent approximately 5 hours gardening over the summer. In order for the higher-yielding gardens to achieve their higher level of production, the total hours that were required over the gardening season were approximately 27 hours for one and 50 hours for the other. Therefore, based on the results obtained from the sole gardener in this study who used square foot gardening, it seems to suggest that the use of square foot gardening by an inexperienced gardener can allow such a gardener to yield levels comparable with very experienced gardeners. Additionally, the time requirement for a standard square foot garden (4ft x 4ft) is very small, at just over 5 hours during the whole gardening season.
Systemic Incorporation of Gardening

One possible way to enhance the use of gardening as a means to improve our global food system would be to make it more visible. Some solutions suggested in the interviews included municipalities growing food in their boulevards, promotion of gardening in front yards, setting up preferential tax rates and a zoning category for urban agriculture, and working with developers to have space allocated for vegetable gardens in developments. These solutions, either as a whole or individually, would all have potential to increase the levels of gardening in our cities, thereby lessening the stress upon the global food system.

Through these techniques, if it were possible to make gardening something that the public was interested in broadly, similar to city parks and recreational spaces, then gardening could have an impact on the global food system. To do this, however, it will require some leadership of city councils to force developers to provide a visible space for gardening and to generally create a climate where urban agriculture is productive in more ways than just the food produced. For example, if urban agriculture was a zoning possibility, then large corporate properties (with large lawns) could have portions of their property invested in agriculture and the productive portion of this investment could provide a tax break while the produce would simply be a bonus. There is some openness to this concept by large companies (Lewington, 2012), but more openness would likely be possible if there was increased financial incentive.

Discussion

This research does not answer the question: “How can urban agriculture contribute to the global food system?” It does, however, provide a crucial starting point from which academics can build and eventually begin to answer this lofty question. If it
is to be determined that urban agriculture can contribute to the global food system, there
must be some sort of estimation as to how much produce is actually being grown. This
research suggests a number of items that are important to consider when moving forward
in urban agricultural research.

Self-sufficiency may be possible if more space is devoted to vegetable gardening. Currently, in Guelph, 0.5% of yard space is used for vegetable production. If this was increased even marginally, to 10% for example, then 56,000 people could have enough vegetables for the year with current levels of production. This means that just fewer than 50% of Guelph’s population would be fed their yearly intake of fresh vegetables through the use of 10% of the yard space within the city. However, due to the growing season in Guelph, while it may be possible to grow significant amounts, actually eating it all year is challenging because it can only be grown during the summer months requiring storage and freezing to actually have it provide year-round nourishment.

This research also clearly indicates that at the urban scale, paying an hourly rate for labour is not economic; this was clearly illustrated by the amount of time spent by individual gardeners, as well as the cost of labour that the participating companies required in operating their operations. This could partially be attributed to Ontario having a high minimum wage (Ministry of Labour, 2011).

As noted above, if there were policy changes that allowed land to be used for agriculture and there was a way to ensure that the most efficient gardens cultivated this space, then a substantial amount of food could be grown. However, present levels of production are not high enough for there to be a considerable effect on food security at the household level. While this may be true, the influx of fresh produce will still have
some benefits, even if that influx is at a low level; the changes in diet and food access are well cited in the literature (Alaimo et al., 2008). Perhaps this is the level of contribution that urban agriculture can occupy in the global food system; not a substantial amount of produce, but simply a small supplement of nutritious food into the diets of those who cultivate it.

Although the results regarding yield quantities of specific crops are based on limited data they still suggest that there are specific crops that would yield better than others and therefore would be more advantageous to grow in order to assist the global food system than others. This might be true of vegetables like cucumbers that take up a lot of space under conventional production, but could be cultivated in backyards much more efficiently. Conventional production yields 2.41kg/m$^2$ (OMAFRA, 2012) while the backyards in this study yielded 3.63kg/m$^2$, which is a 50% increase in production when using backyard techniques. This suggests that there may be crop types that can be harvested more efficiently in the city than in the field. While this breakdown is outside of the scope of this research, deciding which crops are more efficient inside the city and promoting the growth of these crops could have a substantial impact on the food system in terms of efficiency.

Square foot gardening appears to be substantially beneficial for new gardeners to more efficiently use their space and time. Therefore, this has possible implications for the contribution to the global food system. If Guelph promoted the implementation and use of square foot gardens, the levels of efficiency could increase dramatically as inexperienced gardeners could achieve the experienced-gardener levels of production. This method could also be used to shorten the learning curve. Since experienced
gardeners required 7 or more years to show statistically higher yields, square foot gardening could remove this 7-year learning period and allow new gardeners to simply start gardening and acquire high yields immediately. This would also be useful in terms of increasing public interest in gardening because if new gardeners are unsuccessful, they are less likely to remain interested in gardening, which was noted by the most unsuccessful participant (in terms of yield) in this study.

The devotion of significant amounts of public park space to vegetable gardening has potential to impact the food system. This is because there is a lot of this space available in Guelph and it has low usage in most areas. This space could be broken into multiple small gardens and given to many people, or it could be maintained as a large area and given to a couple of very skilled people or companies. This decision could be made by a democratic process to facilitate whichever option the citizens felt best. This would allow economies of scale to be reached within the city or for many people to have close access to a community garden.

The conceptualization of this project began with trying to understand how urban gardening could contribute to our global food system. Inherently, this made the assumption that the researcher expected the primary motivation for urban gardening to be the production of food. When viewing this in terms of Maslow, the researcher felt that urban gardening was meeting a physiological need, that of hunger, which is the lowest order need that Maslow identifies (Maslow, 1954).

This research has found that this is not a common motivation; people are not gardening to meet their physiological needs. Maslow identifies 7 levels of hierarchical
needs (Maslow, 1954). This research has indicated that the motivations for urban gardening are primarily in an attempt to meet higher order needs.

The second level is security needs (Maslow, 1954). Some gardeners identified a portion of their motivation to garden based on the level of resiliency it gave them. This was in response to a fear that the conventional food system was not safe or reliable. Others pursued self-sufficiency to be food secure without being involved in the conventional food system.

The next level is belonging and love needs (Maslow, 1954). The most common motivation to gardening was social benefits. People were interested in gardening because it helped them bond with their peers and meet new people. The largest concentration of motivations lay on the level of belonging.

The fourth level is esteem needs (Maslow, 1954). The vast majority of participants measured success by their success in achieving a high yield. This was less of an explicit motivation, instead being rather implicit. Few identified achievement as a motivation but their success was located on this level of Maslow’s hierarchy.

The fifth level is cognitive needs (Maslow, 1954). Many of the participants indicated that they started gardening to learn something new, thus fulfilling the human need to understand and explore. This was also listed as a benefit for many.

The sixth level of Maslow’s pyramid is aesthetic needs (Maslow, 1954). Gardening was used by participants to meet this need by making their properties more aesthetically pleasing. This was cited by fewer participants but those who did mention this found their gardens and the plants within to be truly beautiful.
The highest level on Maslow’s hierarchy is self-actualization needs (Maslow, 1954). Fewer participants’ gardens filled this need but those who did identify with this need being met with their garden often described it as pride.

The majority of participants were using their gardens to meet the middle three levels of need; however, none were using their garden to meet their total physiological needs. This indicates a disconnect. Gardening is not about meeting our need to eat, and therefore it is unlikely to contribute to our food system in a meaningful way. Gardening is about meeting our higher order needs that lead to more fulfilling lives. Gardening can provide the less concrete parts of our lives that are as significant as the food we eat, even if they are less tangible. This is the true potential of urban gardening; to help society lead fulfilling lives.

**Summary**

In conclusion, this chapter suggested a number of ways in which urban agriculture could represent a larger role in the global food system. The main conclusion is that very little space is devoted to urban gardening and if this space was expanded, an increasingly large number of residents could obtain their yearly produce intake from produce grown in the city. It is also clear that the percentage of land that would be required for production would not be extraordinarily high, but rather between 20-50% of resident yard space, depending on the skill of the gardeners. Without the expansion of space devoted to vegetable production, urban agriculture will not present a situation where the produce is substantial enough to change the consumption and shopping habits of the growers, but it may represent a supplement to their diets.
CHAPTER EIGHT: FUTURE AVENUES FOR RESEARCH AND CONCLUSION

Last night we had three small zucchini for dinner that were grown within fifty feet of our back door. I estimate they cost somewhere in the neighborhood of $371.49 each.
- Andy Rooney

Future Avenues for Research

There are many future avenues for research illuminated by this project. The most pressing of which is replication. This study is a preliminary beginning to being able to estimate the true potential of urban agriculture in North America. However, the sample was small and only based in one community. It is important to understand how yields may differ in other climates, such as coastal areas or mountainous areas and especially how they vary in different heat profiles. To this end, a future avenue for research would be to quantify garden yields in different places in North America. Additionally, because of the small sample size, this project gives preliminary results which help in the estimation of the impact urban agriculture may have on food security. Therefore, replication on a similar scale would be beneficial in either confirming or rejecting the results discovered in this research. This could have a substantial impact on food security because the vegetable garden could then be maximized to produce the most nutritional value or the greatest cost-savings.

A second avenue for future research would be to understand in greater detail how the yields recorded in this study relate to nutritional values. This is important because while it is possible to yield high weights of vegetables, if those vegetables have low nutritional benefits, then they might not realistically represent urban agriculture’s substantial impact on food security. Additionally, it would be useful to develop a cost-
savings analysis to understand the savings value of an average vegetable garden or which crops will save a family the most money at the grocery store.

This study suggested a number of unique solutions which a municipality could employ to improve the quality and quantity of the gardening in their city. A future area of research would be to explore the effectiveness of these possibilities and determine which of them would give the municipalities the most benefit for their dollar. This information could then be used to increase our understanding of how urban agriculture, could improve the quality of our food system under more ideal solutions.

This research briefly looked at the efficiency of professional urban farmers, and found that they used space less effectively, though time and money were used more effectively. Understanding in detail the breakdown of labour and capital on a crop basis could assist in estimating how much of a role professional urban farmers can play in urban agriculture.

Focusing on the outliers of this study, such as those who were very productive and those who were very unproductive, would provide insight specifically into what effective gardeners are doing to be so productive and what ineffective gardeners are doing to be so unproductive. This information could then help discern what steps can be taken to improve productivity.

If average yields were established through multiple studies of urban agriculture production, perhaps there would be some efficiencies, as measured by crop/m², identified in the city that were better than those identified in conventional agriculture; this information, could be useful in creating a more efficient food system.
Conclusion

In conclusion, this thesis has researched urban gardening in Guelph as a case study to try and understand the potential of urban agriculture in our food system. This thesis set out with the goal of answering 4 objectives, which were:

1. To collect preliminary data to estimate current levels of garden food production in Guelph and the associated costs of land, labour and capital.

2. To discover common motivations and barriers, and assess whether these have any relation to productivity.

3. To assess how to improve the contribution of gardening to the food supply at the municipal scale.

4. To consider how garden food production could contribute to the global food system.

The estimation of current levels of gardening production was determined by finding the percentage of gardeners within Guelph (~35%) and then using the median garden size to determine the amount of area involved in garden production. The average production was 1.43kg/m². The input measures of time and money were 3.03hr/m² on average and $11.14/m² respectively, which did not include labour as a cost. From these numbers it is clear that gardening is currently not an efficient way to produce food currently in Guelph.

The second objective found that the most common motivation to garden was actually bonding with people, and that the food itself was not as common a reason to grow your own food than was originally hypothesized. The most commonly identified barrier was access to land, but general interest in gardening also figured substantially. This study determined that a number of motivations and barriers were related to production.
The third objective gave a number of potential policy solutions to improve urban agriculture on a municipal scale. Most gardeners felt that their municipality was primarily responsible for educating the public and promoting gardening generally. A key policy that could be introduced would be to hire someone to manage urban agricultural projects.

The fourth objective provided an opportunity to consider how urban agriculture could impact our global food system. The main impact identified was that gardening provides a thin buffer against instability, but if production was improved, then this buffer could be expanded. A number of potential scenarios were suggested where the buffer provided by gardening could have an increasingly substantial impact on global food security. These ideas present ‘best cases scenarios’ and are not possible in the current socio-cultural landscape of Guelph.

To close, urban agriculture is currently a time-consuming, inefficient and expensive practice currently as discovered in Guelph. Without societal shifts moving towards placing greater value on producing food, it is unlikely that urban agriculture will provide much more than a hobby for most. This thesis has provided a base to begin to consider and estimate the potential role urban agriculture will play in future food systems. However, as this research was exploratory (insomuch as not much quantification work has been done in North America), more questions have been discovered than answers. These questions will surely assist in the future development of understanding urban agriculture.
BIBLIOGRAPHY


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employment and income in Malawi. *Journal of International Development*, 23(2), 181-203.


APPENDIX A: LETTER OF CERTIFICATE FOR ETHICAL APPROVAL

RESEARCH ETHICS BOARD
Certification of Ethical Acceptability of Research Involving Human Participants

<table>
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<th>APPROVAL PERIOD:</th>
<th>April 23, 2012 to April 23, 2013</th>
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<tr>
<td>TITLE OF PROJECT:</td>
<td>The Potential of Urban Food Production in Guelph</td>
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The members of the University of Guelph Research Ethics Board have examined the protocol which describes the participation of the human subjects in the above-named research project and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement.

The REB requires that you adhere to the protocol as last reviewed and approved by the REB. The REB must approve any modifications before they can be implemented. If you wish to modify your research project, please complete the Change Request Form. If there is a change in your source of funding, or a previously unfunded project receives funding, you must report this as a change to the protocol.

Adverse or unexpected events must be reported to the REB as soon as possible with an indication of how these events affect, in the view of the Responsible Faculty, the safety of the participants, and the continuation of the protocol.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and approvals of those facilities or institutions are obtained and filed with the REB prior to the initiation of any research protocols.

The Tri-council Policy Statement requires that ongoing research be monitored by, at a minimum, a final report and, if the approval period is longer than one year, annual reports. Continued approval is contingent on timely submission of reports.

Care; J. Clark, PoliSci (alt); J. Devlin, OAC; J. Dwyer, FRAN; M. Dwyer, Legal; D. Dyck, CBS; D. Emslie, Physician (alt); B. Ferguson, CME (alt); H. Gilmour, Legal (alt); J. Goertz, CME; B. Gottlieb, Psychology; S. Henson, OAC (alt); G. Holloway, CBS (alt); L. Kuczynski, Chair; J. Minogue, EHS; I. Newby-Clark, Psychology (alt); L. Niel, OVC (alt); A. Papadopoulos, OVC; B. Power, Ext.; L. Robinson, CBS; V. Shalla, SOAN (alt); J. Srbely, CBS (alt); T. Turner, SOAN; K. Wendling, Ethics.

Approved: per
Chair, Research Ethics Board

Date: ______________________
APPENDIX B: GARDEN DIARY CONSENT FORM
COLLEGE OF SOCIAL AND APPLIED HUMAN SCIENCES
Department of Geography

Participant Recruitment to Participate in Research

The Potential of Urban Food Production in Guelph

You are asked to participate in a research study conducted by Michael CoDyre and Evan Fraser from the Department of Geography at the University of Guelph.

If you have any questions or concerns about the research, please feel free to contact:

Michael CoDyre
MA Student, University of Guelph
mcodyre@uoguelph.ca

Professor Evan Fraser
Department of Geography
University of Guelph, Guelph, ON
519 824-4120 ext 53011
frasere@uoguelph.ca

PURPOSE OF THE STUDY

To determine how much food can be produced in backyard gardens and the barriers and motivations associated with urban food production.

PROCEDURES

If you volunteer to participate in this study, you will be asked to:

Keep a garden diary over the course of the gardening season (which is provided) in which you record the amount of time gardening and the money you spend on the garden as well as the produce harvested.

POTENTIAL RISKS AND DISCOMFORTS

There are no risks or potential discomforts associated with this research.

POTENTIAL BENEFITS TO PARTICIPANTS AND/OR SOCIETY

Your participation will provide data to be analyzed to understand how much food can be produced in backyard gardens and at what cost that food is produced. You will also understand how productive your garden is.

PAYMENT FOR PARTICIPATION
There is no payment for your participation

CONFIDENTIALITY

Every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study.

All answers will be kept confidential and will be used solely for the research purpose.

AUDIO RECORDING

I agree to be recorded during any interviews in which I participate. Yes ☐ No ☐

If you choose to be recorded, is it possible that exact quotations will be used in reports written from this research. If you are recorded, the recording will be an audio file that will be deleted once it has been transcribed.

STORING OF INFORMATION

Your address and name will be stored in an encrypted file on a password-protected computer to allow me to connect your responses to a particular address. This information will also be used to contact you during the study if that becomes required. All identifying information will be destroyed upon the completion of the research.

PARTICIPATION AND WITHDRAWL

You can choose whether to be in this study or not. If you volunteer to be in this study, you may withdraw at any time without consequences of any kind. You may request to have your answers removed from the study. You may refuse to answer any question and still remain in the study. The researcher reserves the right to disregard your data should circumstances arise which require this.

RIGHTS OF THE RESEARCH PARTICIPANT

You are not waiving any legal claims, rights or remedies because of your participation in this research study. This study has been reviewed and received ethics clearance through the University of Guelph Ethics Research Board. If you have any questions regarding your rights, please contact:

Sandra Auld, Research Ethics
University of Guelph
437 University Centre
Guelph, ON N1G 2W1

Telephone: (519) 824-4120, ext 56606
Email: sauld@uoguelph.ca
Fax: (519) 821-5236

I have read the information provided for the study “The Potential of Urban Food Production in Guelph” as described herein. My questions have been answered to my satisfaction and I agree to participate in the study. I have been given a copy of this form.
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**APPENDIX C: INTERVIEW CONSENT FORM**

COLLEGE OF SOCIAL AND APPLIED HUMAN SCIENCES  
Department of Geography  

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Professor Evan Fraser  
Department of Geography  
University of Guelph, Guelph, ON  
519 824-4120 ext 53011  
frasere@uoguelph.ca

---

**PURPOSE OF THE STUDY**

To determine how much food can be produced in backyard gardens and the barriers and motivations associated with urban food production.

---

**PROCEDURES**

If you volunteer to participate in this study, you will be asked to:

Participate in a 20 minute interview about why your grow food in your backyard.

---

**POTENTIAL RISKS AND DISCOMFORTS**

There are no risks or potential discomforts associated with this research.

---

**POTENTIAL BENEFITS TO PARTICIPANTS AND/OR SOCIETY**

Your participation will provide data to be analyzed to understand what motivates you to grow food in your backyard.

---

**PAYMENT FOR PARTICIPATION**

There is no payment for your participation

---

**CONFIDENTIALITY**
Every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study.

All answers will be kept confidential and will be used solely for the research purpose.

**AUDIO RECORDING**

I agree to be recorded during any interviews in which I participate. Yes ☐ No ☐

If you choose to be recorded, is it possible that exact quotations will be used in reports written from this research. If you are recorded, the recording will be an audio file that will be deleted once it has been transcribed.

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**PARTICIPATION AND WITHDRAWAL**

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## APPENDIX D: AVERAGE VEGETABLE WEIGHTS

### Average Produce Weight Chart

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<tr>
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<td>Radish</td>
<td>0.203</td>
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<tr>
<td>Peas</td>
<td>0.154</td>
<td>Pint</td>
</tr>
<tr>
<td>Spinach</td>
<td>0.056</td>
<td>Pint</td>
</tr>
<tr>
<td>Beans</td>
<td>0.155</td>
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<tr>
<td>Kale</td>
<td>0.046</td>
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<td>0.231</td>
<td>Pint</td>
</tr>
<tr>
<td>Rhubarb</td>
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</tr>
<tr>
<td>Beets</td>
<td>0.368</td>
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<tr>
<td>Broccoli</td>
<td>0.124</td>
<td>Pint</td>
</tr>
<tr>
<td>Brussel Sprouts</td>
<td>0.243</td>
<td>Pint</td>
</tr>
<tr>
<td>Swiss Chard</td>
<td>0.076</td>
<td>Pint</td>
</tr>
<tr>
<td>Cucumber</td>
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<td>Pint</td>
</tr>
<tr>
<td>Bell Pepper</td>
<td>0.221</td>
<td>Pint</td>
</tr>
<tr>
<td>Patty Pan Squash</td>
<td>0.243</td>
<td>Pint</td>
</tr>
<tr>
<td>Zucchini</td>
<td>0.207</td>
<td>Pint</td>
</tr>
<tr>
<td>Potato</td>
<td>0.300</td>
<td>Pint</td>
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<tr>
<td>Okra</td>
<td>0.194</td>
<td>Pint</td>
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<tr>
<td>Eggplant</td>
<td>0.253</td>
<td>Pint</td>
</tr>
<tr>
<td>Leek</td>
<td>0.187</td>
<td>Pint</td>
</tr>
<tr>
<td>Finger Peppers</td>
<td>0.124</td>
<td>Pint</td>
</tr>
<tr>
<td>Arugula</td>
<td>0.039</td>
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<tr>
<td>Bok Choy</td>
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<td>Asparagus</td>
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<tr>
<td>Garlic</td>
<td>0.134</td>
<td>Pint</td>
</tr>
<tr>
<td>Vegetable</td>
<td>Quantity</td>
<td>Unit</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------</td>
<td>------</td>
</tr>
<tr>
<td>Onion</td>
<td>0.097</td>
<td>Pint</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>0.276</td>
<td>Pint</td>
</tr>
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<td>Jalapeño Peppers</td>
<td>0.268</td>
<td>Pint</td>
</tr>
<tr>
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<td>0.471</td>
<td>Pint</td>
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<td>0.147</td>
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</tr>
<tr>
<td>Eggplant</td>
<td>0.526</td>
<td>Each</td>
</tr>
<tr>
<td>Zucchini</td>
<td>0.195</td>
<td>Each</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>0.869</td>
<td>Each</td>
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<tr>
<td>Cucumber</td>
<td>0.411</td>
<td>Each</td>
</tr>
<tr>
<td>Garlic</td>
<td>0.059</td>
<td>Each</td>
</tr>
<tr>
<td>Bell Peppers</td>
<td>0.216</td>
<td>Each</td>
</tr>
<tr>
<td>Finger Pepper</td>
<td>0.006</td>
<td>Each</td>
</tr>
<tr>
<td>Potato</td>
<td>0.201</td>
<td>Each</td>
</tr>
<tr>
<td>Onions</td>
<td>0.106</td>
<td>Each</td>
</tr>
<tr>
<td>Tomato</td>
<td>0.200</td>
<td>Each</td>
</tr>
<tr>
<td>Squash</td>
<td>0.925</td>
<td>Each</td>
</tr>
<tr>
<td>Lettuce</td>
<td>0.494</td>
<td>Each</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>1.020</td>
<td>Each</td>
</tr>
<tr>
<td>Beets</td>
<td>0.142</td>
<td>Each</td>
</tr>
<tr>
<td>Bean</td>
<td>0.005</td>
<td>Each</td>
</tr>
<tr>
<td>Japanese Eggplant</td>
<td>0.182</td>
<td>Each</td>
</tr>
<tr>
<td>Banana Peppers</td>
<td>0.024</td>
<td>Each</td>
</tr>
<tr>
<td>Carrots</td>
<td>0.071</td>
<td>Each</td>
</tr>
<tr>
<td>Patty Pan Squash</td>
<td>0.469</td>
<td>Each</td>
</tr>
<tr>
<td>Turnip</td>
<td>0.278</td>
<td>Each</td>
</tr>
<tr>
<td>Jalapeño Peppers</td>
<td>0.033</td>
<td>Each</td>
</tr>
<tr>
<td>Cherry Tomato</td>
<td>0.011</td>
<td>Each</td>
</tr>
<tr>
<td>Broccoli</td>
<td>0.313</td>
<td>Each</td>
</tr>
<tr>
<td>Green Onion</td>
<td>0.012</td>
<td>Each</td>
</tr>
<tr>
<td>Leek</td>
<td>0.263</td>
<td>Each</td>
</tr>
<tr>
<td>Cabbage</td>
<td>1.814</td>
<td>Each</td>
</tr>
<tr>
<td>Peas</td>
<td>0.005</td>
<td>Each</td>
</tr>
</tbody>
</table>

**Fruits**
<table>
<thead>
<tr>
<th>Fruit</th>
<th>Quantity</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raspberries</td>
<td>0.186</td>
<td>Pint</td>
</tr>
<tr>
<td>Blackberries</td>
<td>0.219</td>
<td>Pint</td>
</tr>
<tr>
<td>Blueberries</td>
<td>0.142</td>
<td>Pint</td>
</tr>
<tr>
<td>Strawberries</td>
<td>0.207</td>
<td>Pint</td>
</tr>
<tr>
<td>Herbs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Various</td>
<td>0.028 – 0.040</td>
<td>Pint</td>
</tr>
</tbody>
</table>
APPENDIX E: GARDEN DIARY

Demographic Information
Instructions: Please have the primary gardener only fill this out.

1. How old are you? (Please Circle)
   Teens  20s  30s  40s  50s  60s+

2. What is your gender? (Please Circle)
   Male    Female

3. How long have you been gardening? (Please Circle)
   None   1-3 seasons  4-7 seasons  7+ seasons

4. What is your highest education level? (Please check)
   Did not graduate High School
   High School Diploma
   Some College or University
   College Diploma or University Degree
   Graduate or Professional Degree

5. Please indicate your approximate taxable household income. (Please check)
   Less than $20,000 per year
   $20,001-$40,000 per year
   $40,001-$60,000 per year
   $60,001-$80,000 per year
   $80,001-$100,000 per year
   $100,001-$120,000 per year
   $120,001-$140,000 per year
   $140,001-$160,000 per year
   $160,000+ per year

6. What were the ethnic or cultural origins of your ancestors?

7. Please estimate how much time and money you have already committed to your
garden this season:
   a. Hours: __________
   b. Dollars: __________
**Instructions**

To fill out your garden diary, please follow the instructions listed below:

1. Please sketch your garden, making the dimensions as accurate as possible
   (Sketch Page included on page 11)
   Note: Please contact me if you would like me to measure your garden for you.
   I’m more than happy to come out and do this!

2. Please fill in each day of the calendar with the following:
   a. How much time you spend in the garden.
   b. What activity you were doing in the garden.
   c. Any money you spent that day on the garden.
   d. What you bought for the garden.
   e. How much produce you collected from the garden.
   Note: Please record hours that everyone worked in the garden, not just the primary gardener.

   **Example:**

   ![Calendar Example]

   3. If you have any questions or concerns, please do not hesitate to contact myself or my advisor:

   **Michael CoDyre**
   MA Student, University of Guelph
   mcodyre@uoguelph.ca

   **Professor Evan Fraser**
   Department of Geography
   University of Guelph, Guelph, ON
   519 824 4120 ext 53011
   frasere@uoguelph.ca
**Suggested Measurement List**

As a general rule, estimation is okay, but try to be as precise as possible. The following chart gives some general ideas about how you might measure your harvest.

<table>
<thead>
<tr>
<th>Measure Individual Vegetable or Fruit</th>
<th>Measure in Pint</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td>Potatoes</td>
</tr>
<tr>
<td>Squash</td>
<td>Strawberries</td>
</tr>
<tr>
<td>Cucumber</td>
<td>Raspberries</td>
</tr>
<tr>
<td>Apples</td>
<td>Blueberries</td>
</tr>
<tr>
<td>Onions</td>
<td>Beans (Pods)</td>
</tr>
<tr>
<td>Lettuce (head)</td>
<td>Peas (Pods)</td>
</tr>
<tr>
<td>Peppers</td>
<td>Tomatoes (Cherry)</td>
</tr>
<tr>
<td></td>
<td>Leaves of Lettuce</td>
</tr>
<tr>
<td></td>
<td>Kale</td>
</tr>
<tr>
<td></td>
<td>Spinach</td>
</tr>
</tbody>
</table>

**Examples of Hard to Measure Vegetables**

- **Pint of Potatoes**
- **Pint of Peas**
- **Pint of Beans**
- **Pint of Lettuce**
Note: The calendar portion of the garden diary continued from April until October.
Garden Sketch
(To Scale)

Note: Again, I am happy to come out and measure your garden for you!
APPENDIX F: INTERVIEW GUIDE
Semi-Structured Interview Guide for Garden Diary Participants

1. Why do you garden?
   a. What made you decide to start gardening?
   b. Did your family have a garden when you were a child?
      i. Why did you decide to keep your own garden?

2. Have you always had food as part of your garden?
   a. Has that changed over time?
   b. Why?

3. Why did you decide to include food production as part of your garden?
   a. Why not just grow flowers?
   b. Why not just grass? Less upkeep?

4. How do you choose which vegetables/fruits to cultivate?
   a. Do you consider quantity of harvest when you plant?
   b. Do you grow food you cannot buy?
   c. Where do you get your seeds?

5. Do your neighbours practice similar types/forms of gardening?
   a. Why do you think they do/don’t?

6. What are the benefits you experience from gardening?
   a. Are there any social benefits (such as praise, social recognition and social connections)?
   b. Do you feel healthier?

7. Can you describe what a successful gardening season would be like?
   a. In terms of harvest?
   b. In terms of family time together?

8. What would get in the way of a successful gardening season?

1. Please list all the possible things that may prevent an aspiring urban gardener from actually gardening fruit and vegetable crops in their backyard.
2. Can you explain why you chose these barriers

3. Why did you choose “X” as the first barrier?
   a. Is it the most important?
   b. Which one would be the most important barrier?
      i. Why?

4. Why did you choose “X” as the last barrier?
   a. Is it the least important barrier?
   b. What would the least important barrier be?
   c. Why would X be more/less important than X?

5. If we can imagine for a moment you have an official from city hall talking to you, and they are asking you what you would have them do to increase the amount of food production within the city. What would you tell them?
   a. So they can change by-laws, promote educational/promotional campaigns, create more space for gardening, add municipal tax breaks, set up city gardens etc.
      i. 100,000 dollar budget
      ii. Would it change if it was the prime minister?