URBAN AGRICULTURE IN KINGSTON: PRESENT AND FUTURE POTENTIAL FOR RE-LOCALIZATION AND SUSTAINABILITY

by

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Abstract

Urbanization and the globalization of the food system are causing social, environmental, economic and political problems worldwide. Rapid urbanization is increasing environmental degradation and food insecurity. Urban agriculture is one tool for sustainable development that has the potential to provide food or related services within or on the edges of urban areas. The goal of this research was to determine the current situation and the future potential of urban agriculture in Kingston. A literature review, questionnaires, interviews and case studies were used to determine the perceptions of relevant stakeholders, barriers and ways to overcome those barriers. Conservative estimates of urban agriculture's value to Kingston's environmental, social, community health, food security and economic dimensions were made through modeling. Study participants demonstrated a relatively greater awareness of environmental and community benefits of urban agriculture compared to food security, health or economic benefits. Modeling and calculations indicated that urban agriculture could contribute at least $190 to $860 million per year in positive environmental, health and economic benefits. Modeling indicated that sourcing more local urban produced foods could reduce greenhouse gas emissions by at least 1300 to 14000 tonnes annually for 39 common fresh fruits and vegetables. Urban agriculture could meet the fresh fruits and vegetables needs of up to 76% or more of the Kingston CMA population. There appeared to be 5600 ha of area in the inner-city that could be used for food production. Major challenges identified were perceptions of limited space, limited resources and education. Recommendations to address these challenges are also provided. Overall, urban agriculture has potential to contribute to sustainability in Kingston.

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ABBREVIATIONS

Various abbreviations are sometimes used within the document.

Abbreviation	Full Description
CG(s)	Community garden(s)
CISA	Community Involved in Supporting Agriculture
CMA	Census Metropolitan Area
CO2e	Carbon dioxide emission(s)
COAG	FAO Committee on Agriculture
COP	City Official Plan
CSA	Community supported agriculture
CUHI	University of Toronto Centre for Urban Health Initiatives
ECS	Economic cost savings
ES	Ecosystem services
FAO	United Nations Food and Agricultural Organization
FFV	Fresh fruits and vegetables
FRILL	Friends Revitalizing Industrial Land Lovingly Community Garden
GHG	Greenhouse gas(es)
GHGe	Greenhouse gas emission(s)
GTA	Greater Toronto Area
KFL&A	Kingston, Frontenac, Lennox & Addington Counties
KR	Kingston Region (see also KFL&A)
LM	Local multiplier
LME	Local multiplier effect
OPIRG	Ontario Public Interest Research Group
PU	Peri-urban area
PUA	Peri-urban agriculture[1]
SURP	Queen's University School of Urban and Regional Planning
TFPC	Toronto Food Policy Council
U	Urban area
UA	Urban agriculture
UGROW	Urban Gardening Opportunities Workgroup (Project)
UPA	Urban peri-urban agriculture
VPCs	Vertical planting columns
WRAP	Waste and Resources Action Programme (United Kingdom)

Chapter 1
Introduction

Urbanization and the globalization of the food system are causing numerous social, environmental, economic and political problems worldwide[2], which run contrary to the desperate need for sustainability. Though the definition of sustainability is often contested there lies at its heart a fundamental, core set of values regarding 'parallel care and respect for the ecosystem and for the people within'[3]. By 2025 however, 60-85% of human beings will be living in urban areas[4]. This will lead to greater resource pressures from increased competition, environmental degradation from pollution and urban food insecurity[5]. These pressures are making it increasingly difficult to sustain our environmental and social relationships over time. The food we eat travels ever-increasing distances to reach the urban citizen with ramifications on how we relate to food and the environment[6 7]. Urbanization is linked to increasing greenhouse gas emissions from increased energy expenditures in rapidly expanding cities[8 9]. There is the growing possibility of future food shocks due to the volatile nature of the global food system and massive food imports of growing populations like China[10 11]. Some degree of re-localization is needed to rein in increasing "food-miles", protect against possible global food insecurity[12 13] and to mitigate or perhaps reverse the various impacts of urbanization. This is not only integral to the developing world but also the developed[14]. One method of adapting to this situation would be to expand upon urban agricultural (UPA) practices as a tool to achieve food security, food sovereignty, sustainable urbanization and re-localization[15 16].

Urban agriculture (UPA) can be defined as "an activity that produces, processes, and markets food, fuel, and other outputs[17]. This is largely in response to the daily demand of citizens within an urban area. UPA can occur on many types of private or public land or water bodies both within and on the edges of cities, taking on many forms depending on the local context"[18]. Urban agriculture often applies space maximizing production methods[19] to yield an array of land-, water- and air-based biodiversity, contributing to the food security[20], health, livelihood and habitat of all living beings and systems[21]. It can be a transient or permanent feature in both developed and developing nations. Over 800 million urban residents worldwide are involved in UPA for either pleasure, commercial gain or survival and it has a significant impact on food security[22]. It is a resurgent international movement that has been growing among the poorest sectors of urban societies due to an increasing wealth disparity in many nations and the breakdown of rural communities[23]. UPA alone cannot solve the problems of our current food system though it can greatly complement other strategies that address socio-economic and environmental problems that the present food system creates.

"Food security exists when all people, at all times, have physical and economic access to sufficient, safe, culturally acceptable, and nutritious food to meet their dietary needs and food preferences for an active and healthy life through local non-emergency sources."[24] Linked to the concept of food security is the idea of food sovereignty or the "right to feed oneself" and all that that entails[25] (see the Glossary, page 231). The ability to produce sufficient food to meet one's needs is an important aspect[26] of food security and sovereignty worldwide and that capability is under threat. Urban agriculture can help to re-establish some of the self-sufficiency we have lost over time.

To achieve food sovereignty will likely require a major reform of not just the food system, it will mean significant changes to the entire way society operates in terms of natural resource use and cultural norms. Dr. Wayne Roberts[27], the Director of the Toronto Food Policy Council stated during a recent talk: "Reforming the food system is seen as a disruptive innovation" to business as usual and is thus resisted. Dr. Kevin Morgan[28], a renowned UK food system researcher proclaimed that the universal right to food was one of the most important and yet also one of the "most fundamentally violated" worldwide. At the 1996 World Food Summit, Canada made a pledge to reduce the number of undernourished households to half by 2015. Yet fifteen percent of Canadians reported living in food insecure households as of 2001 and the number has not fallen. Urban centres like Waterloo and Kingston are at best 7-10% self-sufficient in local food production such that there may be implications on future food security and sovereignty given the state of current global affairs[29].

Agriculture has been the cornerstone of our society for thousands of years. Globally, over 800 million hectares of land are devoted to agriculture – which is 38-40% of the useable land on earth[30]. Agriculture consumes 70% of accessible global water supplies and affects biodiversity at a genetic, species and ecosystem level[31]. Over the next five decades however, the human population will rise to 8.6 billion people or more. Modern chemically intensive (sometimes called "toxic rescue") agriculture[32] has only given us short-term increases in food production and the resulting long-term loss in ecosystem services[33] and food sovereignty. The falling yields of chemical intensive food production technologies mean progressively more land is required per person over time. It is very likely that there will not be enough land to do that in the future[34].

The demand for food however continues to rise due to rapid population growth and increased buying power while the pressure on land, water and food scarcity continues to grow[35]. Climate change and shrinking biodiversity are also threatening the viability of farming in various locales. From 1960 to 2000 the global demand for ecosystem services grew significantly. Meanwhile it has been estimated that 60% of ecosystems worldwide are being degraded or managed unsustainably, with the resultant loss of the services they provide. [36] A good local example of this degradation is the 28000 tonnes of pesticide runoff from agriculture per year into the Great Lakes basin[37]. Approximately 40% of global croplands are suffering some level of soil erosion, reduced fertility and overgrazing. As these ecosystem services erode they in turn impact food production in a vicious race to the bottom[38]. All of this can be seen as a precursor to a global crisis that will be made worse by the uncertain impacts of climate change[39]. Scarce resources in terms of food, water and shelter contribute to civil unrest and violence throughout the world[40]. Local solutions such as urban agriculture or new innovations like urban vertical tower farms may be needed to prevent the decline of remaining ecosystems both regionally and worldwide.

UPA can be far more than just community or backyard gardening in amount, value and scale[41]. Its numerous benefits and multiple functions [Box 1, page 188] are being recognized in wealthy nations like the UK, the Netherlands, Germany, Austria and the US[42]. Unlike simple open spaces or parks, urban and peri-urban agriculture is an activity that pays for itself many times over[43].

The expansion of urban agriculture is being driven by communities, individuals and NGOs and sometimes research institutions[44]. In Canada, there has been little large-scale food production of this type except in Ottawa, Burnaby[45] (BC) and the greenbelt around the Greater Toronto Area[46 47]. Urban agriculture can also deal with city poverty, public health, environmental impacts, land-use and sustainable resource-waste management – all of which are strongly linked to urbanization issues[48]. By its very nature, urban agriculture is well suited to reducing or eliminating the inefficiencies and environmental externalities of the global long-distance transport of food[49] and aiding the re-localization movement[50].

Chapter 2
Literature Review

In this chapter I discuss urban agriculture in the Canadian and Kingston context. The objectives for the study are outlined at the end of this chapter. The reasoning and methods used to conduct the qualitative and quantitative research are outlined in Chapter 3. How the two research methodologies were interwoven is also elaborated on. In Chapter 4, I present the synthesized analysis of the questionnaires, interviews, participatory observation and the results of the quantitative model. It is broken down into the broad categories of environment, community, food security and sovereignty, health and economics. The challenges to urban agriculture and the case studies are presented at the end. Finally in Chapter 5, some possible ideas and actions for establishing more urban agriculture in and around Kingston are proposed. The limitations of the study and avenues for future research directions are also provided. What follows is a discussion of the current context and the linkages between urban agriculture and sustainability.

2.1 Urban Agriculture and the Canadian Situation

Urban agriculture is not a new phenomenon even in Canada. People have been growing food for thousands of years well before the Hanging Gardens of Babylon (one of the Seven Ancient Wonders of the World) ever appeared in 600 BCE[51]. From 1890 to 1930, Canadian Pacific Rail planted the first urban gardens and school gardens became an important part of the education curriculum. During World War I, urban gardens expanded to provide surplus food production to feed the war effort becoming the Victory Garden network. It was tangible proof that urban production could ensure food security and sovereignty in Canada. Eventually it declined with suburbanization and rose again during the OPEC oil crises of the 1970s. Local UPA initiatives are increasingly important to meet a growing demand for fresh, high-quality, accessible produce as urbanization continues.[52]

Urban food security, health, local economic development, social inclusion and urban environmental management are some vital dimensions of cities that should be examined in order to achieve sustainability.

Urban food security and nutritional health are significant assets to protect and maintain from a long-term viewpoint considering the rising cost of energy, lack of a food safety net[53] and growing poverty[54]. Improved access to fresh food directly relates to improved health and reduced medical costs[55 56]. As of 2005, nearly 3 million citizens in Canada were food insecure[57] and this is inexorably increasing[58]. Some experts believe that Canada has yet to experience a food crisis on par with other nations such that food security has not risen to the top of the agenda for citizens and politicians alike[59].

Putting farmland to productive and environmentally sustainable use instead of paving over it would also reduce pollution from stormwater runoff that occurs with paved surfaces. Maintaining and fostering urban agriculture within the city limits could strengthen regions like Kingston through agricultural tourism. Prime examples of incredible success can be seen in regions like Devon (UK), Northwest Sydney (Australia), metropolitan Beijing (China), Mexico City and Hanoi (Vietnam)[60] (Box 1, page 188).

Using urban agriculture as an innovative means of reducing greenhouse gases and air pollutants also carries economic benefits in terms of reducing energy use. Fossil fuel consumption and its impacts are rapidly growing due to increased road transport and other transport of the food that we consume. Overall transportation energy use in Canada has risen by more than 26% since 1990 with a corresponding 25%[61] increase in transport emitted greenhouse gases. Freight transport by road in 2003 accounted for *80% of all energy use* in the transport sector and is steadily increasing [62 63 64]. Additionally increasing automobile use to reach and access food within Canadian urban areas[65] contributes to rising energy use leading to poor air quality and more greenhouse gas emissions[66] (**Figure 2**)[67]. Unfortunately there has been little research on how much of the energy use is directly related to transport at all points of the food system (production, distribution, processing, etc.). The preceding statistics give us only a general idea that transportation energy use is growing.

Waste issues are also becoming a serious environmental problem for the majority of Canadian cities and towns. It is estimated that Canadian citizens waste 14 million tonnes of food annually[68]. The demands put on waste disposal systems are also escalating[69]. This problem could be partly solved by turning the organic portion of urban waste streams into a productive resource through compost production, vermiculture and wastewater irrigation for urban agriculture. These functions of urban agriculture serve to reduce the ecological footprint[70] of any urban centre – be it Toronto or Kingston[71].

Many Canadian municipalities have not seriously considered supporting UPA unless spurred on by progressive civil action or financial rationale (usually the former). Composting, urban forestry and wastewater reuse are a few aspects of UPA that are more likely to be considered while urban gardens and animal husbandry remain the most politically disfavoured[72] within the Canadian context[73]. A review of the literature shows this is still the case today, as urban agriculture remains mostly undervalued in the developed nations. The situation however is beginning to change. The current challenge both here and elsewhere is the recognition of multi-functionality, mitigation of any negative risks and integration of urban agriculture into city planning in order to reap the numerous benefits that it can provide for urban Canadians[74].

2.2 Urban Agriculture and Research in Canada

Research on urban agriculture is often carried out under the umbrella of urban food security, community building, urban planning and local economic development. Lifecycles in Victoria, BC[75] showed that urban agriculture increased biodiversity in urban areas. The Toronto Food Policy Council (TFPC)[76] highlighted that 20% of food could be grown within city boundaries. More recently, the work by UGROW and CUHI[77] illustrated the importance of community gardens in the lives of citizens, contributing to their wellbeing and a better community ambience. In Waterloo, Sutic (2003) studied how green roofs and rooftop gardens could improve the urban environment of the city while Mazereeuw (2005) released an urban agriculture report that studied its potential for the region. Dow (2006) examined the challenges facing community gardens in Waterloo for a SURP master's thesis. In Montreal, Devaux *et al*. (2002) did a feasibility and market research study for establishing an urban organic greenhouse for an NGO. In Quebec, Beauchesne and Bryant (1998) found that the urban fringe of a city could foster new forms of innovative agriculture especially organic varieties. In Vancouver, Barbolet *et al*. (2005) discussed examples of where UPA could be the foundation for food sector enterprises. The only known UPA research specific to Kingston was the SURP master's thesis by Robinson (1993), which examined community gardens in the context of municipal planning policy.

All of the previous studies indicate urban agriculture has multiple roles and functions that play an important part in[78]: enhancing urban food security, nutrition and health; creating urban job opportunities and income generation especially for impoverished urban groups and provision of a social safety net for these groups; contributing to increased recycling of nutrients (turning urban organic wastes into a resource); facilitating social inclusion of disadvantaged groups and community development; urban greening and maintenance of open green spaces and mitigating climate change impacts.

The most central issues to be dealt with include[79] assuring urban food security especially among the marginalized parts of the population and through strengthening the local economy with income and jobs. It includes the provision of fresh, healthy, readily accessible, high-quality food to all urban citizens. Finally it involves mitigating the negative environmental impacts of modern, intensive agri-business[80].

2.3 Food Security in Kingston and Urban Agriculture

Food insecurity in Kingston however remains a difficult challenge to deal with according to KFL&A Public Health[81]; an estimated 11-16% of the Kingston population is food insecure and this is steadily increasing. The estimate would be even larger if we account for the quality of the food. Some of the particular problems in Kingston revolve around availability, accessibility and monetary cost (not just production)[82]. In North Kingston (**Box 2**, page 189 and **Figure 4**, page 195) the recent closure of the IGA supermarket has worsened the food access situation. For many residents in that area, reaching the nearest supermarket to obtain fresh fruits and vegetables now takes ~45-60 minutes by walking or a $9-10 taxi ride[83].

A study by Van Bers and Robinson (1993)[84] deduced that Canadian cities could meet 20% of their vegetable needs (using ecological techniques) from within their boundaries. It stands to reason that Kingston should be able to achieve a similar level of self-provisioning in terms of fresh fruit and vegetable products. Urban agriculture is an efficient means of delivering micronutrients to vulnerable populations by improving their access to fresh produce - literally right in their yards and communities[85].

2.4 Objective

From this context, I examine urban agriculture in the City of Kingston as a potentially expandable, adaptive tool for re-localization and sustainable development – providing solutions to environmental, economic, and social and health problems.

I sought to determine and report on the current state of urban agricultural practices and aspects within the local region and on the fringes of the City of Kingston with regards to the views and visions of decision-makers, practitioners and other stakeholders (particularly those in the inner-city of Kingston). I wanted to estimate the quantity and value of plant produce created through UPA. I desired to know who, why, where and how many people are practicing UPA and to perform a case study on two community garden groups (Friends Revitalizing Industrial Land Lovingly or FRILL and Sunnyside Community Garden) in Kingston as an illustration of some of the problems that citizen run urban agriculture initiatives face. It would also mean examining the other barriers to expansion of UPA in the Kingston context. I wanted to ascertain the potential for improving, expanding and creating UPA opportunities through practices that have worked elsewhere in the world and could work in Kingston. I also wanted to estimate the potential contribution of UPA to relocalization, sustainability and "food-miles" reduction in Kingston. Ultimately I hoped to make a final report that was accessible to all involved and interested stakeholders and establish baseline research to aid future action oriented projects or studies in Kingston involving urban agriculture, local food, re-localization and sustainability.

In summary, issues of environmental degradation, social inequalities and food insecurity need to be addressed at a global, regional and local level. There is a pressing need to study UPA as a means of achieving sustainability for urban domains large and small. In light of the situation and to achieve the objectives outlined above, I developed a means to examine and assess urban agriculture in Kingston using a blend of qualitative and quantitative methods. This methodology is detailed in the next chapter.

Chapter 3
Methodology

The bulk of the research on UPA has been focused on developing countries, yet parallel problems have arisen in developed countries as well[86]. There appears to be a lack of significantly applicable UPA research in the North American and Canadian context that tries to examine all of its sustainability impacts beyond just economics and food security. It was for this reason that I use both qualitative and quantitative methods through the process of triangulation to provide a better picture of current urban agriculture in Kingston, as well as its potential to contribute to sustainability[87]. Urban agriculture is complex and by using a combination of methods, I hoped to illustrate its usefulness in achieving a more multi-functional urban landscape, which can contribute greatly to improving the environment, society, health and the local economy[88]. The qualitative research lends depth to the quantitative analysis. There is information that numbers alone cannot tell us without a social context[89]. Questions used in questionnaires and interviews are found on page 95. A more detailed and technical recounting of the methods can be found on page 106. In the following sections, a general overview of the qualitative and quantitative research is given followed by a discussion of the different phases of the study in chronological order. The discussion of how I synthesized all of the qualitative and quantitative research is left until the end of the chapter.

3.1 General Overview of the Qualitative and Quantitative Research

In this section, I briefly explain the general reasoning for using qualitative and quantitative research methodologies. The specific details of each method in terms of questionnaires or modeling for example are discussed in the next section in the order with which they were used in the study. The qualitative research sought to determine the perceptions and visions of various stakeholders; to determine whom, why, where and how many people were currently involved; and to try and find areas of challenge, commonality and opportunity for UPA in Kingston. In addition, two case studies of FRILL and Sunnyside Community Garden were conducted in order to gather some sense of the experience that grassroots groups face when trying to start or maintain a community garden or other UPA initiatives. It is hard to understand complex topics like urban agriculture using only literature reviews of research in other places or through aggregated data. For this thesis the best way to gain deep insight and detailed understanding was through a combination of questionnaires, interviews and participatory interaction with various individuals and groups.[90]

To develop a well-rounded understanding of UPA in Kingston, I engaged citizens, producers, planners, city officials and local community advocates. Citizens were considered to be individuals or families who grew food for personal consumption. Urban producers were considered to be any individual or group of citizens who grew food in quantities greater than what a single household would produce for personal consumption. Urban planners were professionals not affiliated with the municipal government. City officials included both politicians and bureaucrats from various departments that could have a role to play in UPA integration. Local community advocates were any individuals with active real-world experience and knowledge on issues of environment, social justice, education and especially agriculture.

After the questionnaires and interviews were completed, all of the responses (n = 163) were analyzed through a commercial diagram-mapping program called Omnigraffle Professional. This allowed me to sort interview and questionnaire responses with ease in order to find strong, common themes and sub-themes by grouping them together. Each individual response was given equal weight in the analysis. Every response was counted for each sub-theme, providing an indication of how often it was mentioned and helped identify the most prominent, common perceptions among the consulted groups. The themes served as an organizational tool for my final analysis. The analysis results are found on page 205.

The quantitative analysis aimed to estimate the area, yield, production value and positive externalities of edible urban agriculture in the year 2006-2007. It has a predictive role[91] of determining what sort of impacts would occur if more food was grown for local consumption. Official data for urban agriculture is often lacking in many situations[92] and this study helps to address that problem for Kingston by being a foundation piece that recognizes the value of activities that are often overlooked.

Quantitative data was used to complement the qualitative research[93]. For example, the numerical analysis provides more evidence to show that UPA is actually a financial opportunity that should not be ignored by decision makers or by economic development agencies. The model was also used to examine the possible health cost savings and food security potential of UPA for Kingston.

The beneficial externalities of UPA were assessed and presented in terms of a tangible monetary value where possible. Economic value is a common language that most people can understand. A "positive externality arises when an action by an individual or a group confers benefits to others."[94] Positive side effects like better health or a clean environment are often overlooked in decision making due to the difficulty of putting a value to them. Without giving some level of due consideration to these extra benefits we are ignoring incredible opportunities. The monetary values generated for these externalities by the model are very likely an underestimate if not a minimum. It does serve as a crucial starting point for factoring in environment, society and health into decision-making by Kingston citizens and government. The model is still in its early stages and further research will be required to sharpen its capabilities.

The literature reviewed showed no study that tried to examine the sustainability of urban agriculture in the comprehensive manner that I have attempted through modeling (i.e. looking at environment, community, food security, health and economic values simultaneously). This meant I had to generate a model of my own in order to meet the objectives that I set out within my technical skill set and resource limits. Many elements of the quantitative model were derived from isolated units of information in the literature and the presentations of experts. I simply tried to pull all of these puzzle pieces together in a coherent manner. It may be possible to transfer some of the model’s ideas to other municipalities and demonstrate the value of available area for urban, peri-urban and rural agriculture for sustainability.

In the following section, I discuss the different phases of the study in greater detail and in as close to chronological order as possible. Ethics approval was secured in order to conduct the questionnaires and interviews.

3.2 Surveying Citizens

Questionnaires are a common tool for collecting information. They are useful for gathering first hand, primary information about people, their behaviour, attitudes, opinions and perceptions of specific issues. Questionnaires can be used to categorize the number of people with particular characteristics in specific groups[95]. For this study, citizens responded to short 5 - 10 minute questionnaires. The actual questions from the citizen questionnaire are reproduced on page 95. The citizen questionnaire is not identical to the local community advocate questionnaire (page 100) discussed later on.

The purpose of the citizen questionnaires was to obtain both qualitative and quantitative information. I wanted to know if there was support for urban agriculture among the Kingston populace. I wanted to know how aware citizens were of the positive benefits of urban agriculture for them and the community. I also wanted to know how many citizens gardened, why they did or did not grow food, how large typical backyard gardens were, whether citizens were interested in seeing more urban agriculture (and why) and how citizens perceived the relation between urban agriculture and the environment. The number of citizens who gardened and the size of backyard gardens would be important in analyzing the potential for more backyard urban horticulture in the model I would later develop. I did ask a question about how much citizens grew. Unfortunately many citizens did not keep records or remember. As a result I stopped asking that question and decided to use the model to estimate yield. The reasons why citizens were interested in seeing more urban agriculture in Kingston, why they did or did not garden and how they perceived the relation between agriculture and environment could indicate to me some of the challenges to establishing urban agriculture in Kingston.

I was expecting greater support for urban agriculture in Kingston relative to the 1990s when a study was undertaken on community gardens in the municipal planning context.[96] I theorized that current global environmental and social crises like climate change, rising energy costs and increasing income disparities might have some influence on awareness of urban agriculture. I was expecting that social benefits of urban agriculture would be more likely mentioned according to the literature i.e. aesthetics[97].

The citizen participation rate was 91% (n = 139) indicating that few of those surveyed found the questionnaire to be particularly demanding. For surveying citizens, the short length of the questionnaire was vital, as they did not want to stop for long to answer questions for various reasons – usually time [98]. It often took less than 5 minutes to finish a questionnaire[99].

The citizen survey was conducted over the months of July and August 2006. Anyone who happened to frequent markets or supermarkets or was passing through an area that had such an establishment nearby was asked to participate. Citizens at the Kingston Farmers' Market (KFM) and the Kingston bus terminal (KBT) were queried in order to generate a preliminary idea of the Kingston population's perception of urban agriculture. There were 12 site days at the KFM over the course of June that garnered 68 responses and 10 site days interspersed throughout August at the KBT garnering 71 responses.[100]

At the KFM, the survey was conducted from 1200-1400 hours[101]. At the KBT, the survey was from 1200-1800 hours. The KFM was chosen due to its popularity, high traffic and centralized location. I realized later on that those who could not afford the relatively higher prices of the KFM and those who did not frequent the downtown core would likely be excluded[102]. I chose to conduct additional questionnaires at the KBT in order to obtain a more representative sample of the Kingston population. The KBT is a high traffic area frequented by people from all over the city[103] and it is near a major commercial supermarket (Loblaws). Just observing the KBT site revealed that people of many different backgrounds pass through the terminal on a daily basis.

The target population within the study area was defined as anyone who lives in the City of Kingston. The citizen survey was used because I did not have enough resources in terms of manpower and suitable transportation to sample a large geographical area. The original survey quota had been 50 at the KFM and then increased by another 50 with the inclusion of the KBT. This was determined on the basis of the time it would take to conduct the questionnaires, the likely number of citizens who would be willing to answer these questionnaires and the experienced advice of other researchers. Citizens of many walks of life were surveyed - from high-school students to elderly individuals and people from different ethnic backgrounds. A general idea of their backgrounds was ascertained through friendly conversation in most cases unless it was visually apparent (i.e. elderly or visible minorities). I made a deliberate attempt to approach a wide variety of people to avoid a significant level of interviewer bias[104].

3.3 Survey of Local Community Advocates

The local community advocates questionnaires were conducted at the same time as the citizen questionnaires (July to August 2006). The local community advocates questionnaire is not identical to the citizen questionnaire (page 95) discussed previously. The purpose of the local community advocates survey was to find out what opinions and beliefs they held [105] regarding the importance of and challenges to urban agriculture that the everyday citizen or stakeholder might never contemplate or have experienced. I expected that they would be supportive of the idea of urban agriculture. I also expected that they would share some advice on what could be done to make urban agriculture a reality in Kingston given their expertise in the area of environment and food production. Local community advocates were recruited through the snowballing technique. Snowballing is a method of using one contact to help recruit another contact, which in turn can put a researcher in touch with someone else[106]. There were no difficulties in recruiting advocates for the survey. The questionnaires required less than 10 minutes to finish and five were completed. The actual questions from the local community advocate questionnaire are reproduced on page 100.

3.4 Interviews with Producers, City Officials and Planners

Interviews[107] were conducted with urban producers, city officials, and an urban planner in parallel with the questionnaires of citizens and local community advocates throughout July and August 2006. Interviews give a more intricate understanding of the meanings and values that each group holds[108]. Interviews allow for a more purposeful conversation that grants the interviewee an unparalleled chance to explain complex subject matter and to raise issues that I would never have considered. These are aspects that simply cannot be achieved by using questionnaires.

The main purpose of the interviews with city officials and planners was to determine if there was support for urban agriculture among decision makers given the current situation regarding climate change and rising energy costs. I expected that there would be little support for urban agriculture in terms of policy or planning according to the literature review[109]. I expected both community garden and commercial urban producers to be supportive however I consulted them in order to determine what sort of challenges they presently faced in practicing urban agriculture and what could be done to bypass those obstacles. Quantitative information was also obtained in terms of the size of urban growing operations. This would be used to determine and forecast production of inner-city urban producers in the model that I would develop.

All of the interviewees were selected through background research using the Internet. Contact information was determined and then a request was emailed or they were telephoned. Individuals were chosen on the basis of their affiliation to a particular group or department and its relevance to urban agriculture. Questions were tailored for the group being interviewed (pages 97, 98 and 101) and were used only as a guide leading to semi-open, semi-structured interviews that granted much leeway for the participant to speak their mind and reveal things that direct questioning alone might not bring forth. It allows the researcher a chance to understand issues in the interviewee's own terms[110]. The freely given answers would also be more likely to reveal their actual opinions or viewpoints. Notes were taken and observations of the interviewee were made. No interviews were audio recorded since most participants declined that option. The notes and personal observations proved to be sufficient for later evaluation despite the loss of advantages that audio recording could provide[111]. I noted down all the important and relevant details during and immediately after the interviews.

3.5 Case Studies

The goal of the case studies was to give some real Kingston examples of inner-city urban production that any citizen could relate to or get involved in and that could demonstrate some actual challenges that these producers face. I expected responses pertaining to the lack of supportive policies and difficulties with insecure land access or tenure according to the literature review[112]. Interviews with the organizers of Sunnyside Garden during August and September 2006 provided insights about their difficulties in trying to start up a community garden. These open and unstructured interviews (see page 103 for the questions used) took no longer than 30 minutes and were very informative[113].

Participatory observation and interaction formed the basis for the FRILL Community Garden case study from November 2005 to June 2007. Participatory observation is concerned with knowing the views and everyday lives of actual people from 'within'[114]. FRILL (page 182) is a 2-year-old community garden on private land owned by Loblaws at the corner of Charles and Bagot Street. FRILL was selected for several reasons. The community garden was still relatively new and was still dealing with the start-up issues. It was the only community garden officially on private land in Kingston, which offered a unique insight into future policy. For example, what if the City one day decided to foster urban agriculture on private lands? What sort of problems might appear that might be similar to the present FRILL experience? FRILL was also a very open and inclusive group - inviting anyone and everyone to join in on its initiatives and community building regardless of background. Even people from as far as the United States have dropped in on the garden as they were passing through because of what they heard about it. This made FRILL an irresistible environment for participatory observation. By joining them, I essentially put myself in their shoes. This allowed me to gain the perspective of someone both on the inside and the outside that would ultimately shape the way I viewed and developed the rest of the study. [115]

This participatory observation process consisted of paying attention to activities of the community or group under study – in this case, the gardeners – while at the same time being part of the activities that they engaged in [116]. I was part of the day-to-day planning and activities as well as the daily community life around the garden as a "researcher participant". I did not have a plot in the garden to avoid excluding someone from the local community from being involved. The gardeners were made aware of the fact that I was including the community garden in my research at the very beginning of my participation to conform to university ethics guidelines. [117]

My actions took the form of transplanting seedlings, digging and cultivating, being the unofficial secretary at nearly every meeting, designing newsletters, assisting with community outreach, project implementation, grant writing, publicity, fund-raising, event planning, playing music, baking or cooking while learning about the experiences in the garden and community first hand. The primary research material to come out of this was the collection of email correspondence, personal notes, recollections, the recorded minutes from nearly all the planning meetings, and the various visioning events.

3.6 Modeling Analysis

Significant development of the model occurred from October 2006 to July 2007. This was well after all relevant information from citizen questionnaires and interviews with inner-city producers was collected. The qualitative data from local community advocate questionnaires were not a part of the modeling. First, I created the model to determine the cultivated area, yield and equivalent or estimated economic production value of current urban and peri-urban agriculture using Microsoft Excel. One of the city official interviews sparked the idea of including calculations involving peri-urban agriculture. Data from the citizen questionnaires and inner-city urban producer interviews were integrated into the calculations at this point. Second, I used the available literature from journals, NGO and government publications, government statistics and the knowledge of experts in various fields to model most of the current and potential positive externalities or benefits that UPA was generating for the city of Kingston.

There were five factors considered in the model – the amount of increased land-use relative to the present time, the amount of local food, the percentage of ecological agriculture, the percentage of food used for human consumption (not for animal feed) and the percentage of food waste (see page 116). I configured the model to vary the percentage of food produced through UPA for local consumption. The other factors in the model were kept constant in this thesis in order to keep things clear and understandable to a wide variety of stakeholders. In the current situation, the percentage of food that remains for local Kingston consumption is 7% according to the 2006 Kingston Agricultural Study[118], the percentage of ecological agriculture in the Kingston CMA [119] is estimated to be 8.3% using information from Statistics Canada[120], the percentage of food available for human consumption is 18.2% using information from Statistics Canada (page 116) and the percentage of food waste was 32% using information from the TFPC and WRAP[121]. Increasing it from 7% (business as usual in 2006-07) to 25%, 50% and 100% varied the percentage of food that remains for local Kingston consumption.

In addition, I am still experimenting with the model's capabilities and its ability to generate various scenarios especially those relating to increased ecological agriculture in the Kingston region. It is anticipated that the other factors will be used in future research at some later date. The model was configured to present four different scenarios that are described below and summarized in **Table 1**. Population was determined using information from Statistics Canada[122].

Table 1. The five factors (percentage of local food, percentage of ecological agriculture, percentage of food used for human consumption and percentage of food waste) in the model for four different scenarios with percentage values for each scenario.

Scenario	Increased Area Relative to 2006-2007 (%)	Percentage of Food That Remains Local (%)	Percentage of Ecological Agriculture (%)	Percentage of Food Used for Human Consumption (Not Animal Feed) (%)	Percentage of Food Waste (%)
1	0	7	8.3	18	32
2	0	25	8.3	18	32
3	0	50	8.3	18	32
4	0	100	8.3	18	32

3.7 Triangulation and Interweaving

Once all the phases of the research were complete, the information was subjected to a process of interweaving or triangulation[123]. This was integral because it allowed me to draw on different viewpoints and sources of information to gain the best possible picture of what urban agriculture was like at present and the possible potential for sustainability[124]. I reviewed the qualitative information to guide the development of my model.

Without the modeling I could not have seen how much potential urban agriculture had for meeting some food security needs from a production stand point. As I examined the quantitative data obtained from the citizen questionnaires I realized that I could do some calculations to estimate the current level of inner-city urban agriculture that was possible in Kingston. A look at the qualitative responses indicated few cohesive linkages between urban agriculture and food security, health and economy. All of this combined with the literature review, sparked the 'idea' of creating a comprehensive model that tried to fill in some of the apparent gaps that I had discovered. Without the interviews and questionnaires I could not have learned of the barriers that stood in the way of achieving the potential that my model was indicating. Together the questionnaires, interviews and participatory observations provided a much more coherent understanding of the stakeholders involved and the challenges that UPA faces[125].

The interweaving also meant more than avoiding the limitations of a single method or counterbalancing the shortcomings between the methodologies used[126]. It was about making the research valid to the people who would be most impacted by its information - such as the various groups that were surveyed and interviewed. Without those participants, the information in my study would have no context or applicable use for the situation it was meant to study and possibly address[127].

In this study the process was not simply a combination of methods, as qualitative and quantitative information were both given equal weight[128]. They were complementary and promoted coherence by leaving "fewer questions unanswered... fewer answers unquestioned". It helped to increase confidence in the study results[129]. "Answers provided by investigators using qualitative methods must give rise to questions that are interesting from a quantitative point of view and vice versa." [130]

There are two things to keep in mind. The first is that we are examining only the potential of growing crops and other plants linked to health or food consumption[131]. The second is that the majority of interviewed urban producers in this study were from the inner-city due to difficulties in transportation and reaching various, often very busy peri-urban farmers. Consequently the qualitative analysis is much more focused on the needs of inner-city residents. In addition, this study complements the work of the 2006 Agricultural Study for Kingston by examining the food producing potential of the inner-city. The 2006 Agricultural Study for Kingston[132] addresses the views of peri-urban producers out to the bounds of the official city of Kingston while leaving out the inner-city in its evaluation. In the 2006 study an inventory of farms and support services was conducted. Contemporary trends and issues were analyzed and an economic analysis was made which gauged the economic impact of peri-urban agriculture for the City. The study addressed current policies and recommended changes to the COP. The quantitative modeling in this study however also made estimations regarding the peri-urban region and it will be interesting to see what similarities there are between this study and the Agricultural Study when the latter report is made fully available.

In summary, there was integration of findings as results from the questionnaires and interviews informed the development of and calculations in the model. The complete fusion of qualitative and numerical information is dealt with in the discussion and recommendations chapters[133]. By using these different methods it was hoped that it would maximize the amount of understanding about urban agriculture in Kingston. Both were of equal importance in interpreting and evaluating the Kingston UPA situation and its role in sustainability[134]. The results of this analysis are found in the next chapter.

Chapter 4
Investigation and Analysis

This chapter combines the most prominent perceptions of the various stakeholders with the quantitative modeling analysis. Some aspects of the quantitative analysis served to complement what was found in the qualitative work and fill in areas such as food security and health that were vital and not brought up in the questionnaires and interviews. Based on the interview and questionnaire results, the first five sections or broad categorizations of analysis were created: Environment, Community, Food Security & Sovereignty, Health and Economy. The final section details the challenges that urban agriculture currently faces. The case studies that detail the experiences of two community grassroots urban agriculture initiatives (FRILL and Sunnyside Garden) are found on pages 180 and 182.

The Environment section is used to discuss three major themes that came out of the interviews and questionnaires. I present the information from the model regarding the amount of physical ecosystem services UPA can provide, and how much greenhouse gas emissions Kingston could avoid through better urban agricultural practices and producing more fresh fruits and vegetables for local consumption. In the Community section, I discuss several threads that came out of the qualitative research and explore a possible way to measure the monetary impact of UPA on communities. The Food Security and Sovereignty section is where I consider the self-sufficiency issue in the Kingston context. I present information on how urban and peri-urban food production can be used to meet some of the nutritional needs of the population. In the Health section, I touch on the apparent lack of qualitative research in this area. As a starting point, I present the cost of illnesses linked to poor diet that could be addressed through urban agriculture. Finally the Economy section examines the perceptual deficit of seeing UPA in terms of local development. The section presents the model's results on how urban and peri-urban agriculture could contribute to the economy through the local economic multiplier effect and supporting sustainable incomes and jobs.

4.1 Environment

The environment is the foundation upon which all living beings depend for survival. Without clear air, water and land, good health would be impossible to maintain. Humans, other living beings and other components of the world are dynamically a part of one universal fabric.

In this section I discuss four major themes that fall within this category. Stakeholders perceived that urban agriculture provided direct environmental benefits, reduced energy use as well as long-distance transport of food, was a better use of space and fostered biodiversity. The fact that urban agriculture provided direct environmental benefits was mentioned nearly twice as often during the interviews and questionnaires than the other major themes except aesthetics. The most common responses involved improving city air and environment; reducing water, air and other pollution; releasing oxygen; stormwater management;[135] and mitigating climate change (see page 205). One interviewed official commented that urban agriculture "...helps to reduce global warming which has an environmental cost in a society of specialized and industrial foods."

Kingston certainly has a role to play in maintaining and nurturing ecosystems that it depends on. "Ecosystem goods (e.g. like food) and services (e.g. waste assimilation) represent the benefits that humans derive, directly or indirectly, from ecosystem functions. In order to keep things understandable, ecosystem goods and services are referred together as 'ecosystem services'."[136] Two ecosystem services that urban and peri-urban agriculture provide to Kingston are soil formation and nitrogen fixation. The one that urban agriculture could potentially provide is waste recycling of organic matter. The minimum values of these services are found in **Table 2**, **Table 20**, and **Table 21** (also see page 143). The value of these three ecosystem services using a very conservative estimate is $1.8 million annually.

I cannot emphasize enough how difficult it is to value ecosystem services[137]. Relative to the health and economic valuations explained later on, the environmental valuation here seems far too small. The environment is the foundation of our society, our economy and ultimately our personal health. Thus the value of ecosystem services should be as large if not larger than the value of *all* other benefits that stem from it.

Table 2. The estimated minimum value of physical ecosystem services that urban and peri-urban agriculture provide in 2006-07. The waste recycling value is what could be provided if all organic waste in Kingston was used as compost for urban and peri-urban food production.[138]

Ecosystem Service	Estimated Value ($CDN/yr)
Soil formation	$9,000
Nitrogen fixation	$34,000
Waste recycling	$1,800,000
Total	**~$1,800,000**

Urban agriculture could also reduce GHGe and air pollution through better agricultural practices and reduced long-distance transport of foods. Ecological farming practices in Kingston region currently prevent a minimum of 370 tonnes of GHGe yearly from entering the atmosphere. This is equivalent to taking 120 cars, driving 18000 km per year off the road. Since the percentage of ecological agriculture in the Kingston region was assumed to remain constant in this study, this reduction value also remained constant throughout the four scenarios. The current percentage of locally produced and consumed food[139] avoids an additional 980 tonnes of greenhouse gas emissions (GHGe) annually or 320 cars. As the percentage of local food increases, the GHGe reductions grow as shown in **Table 3** (also see page 148).

Participants in the study also stated that urban agriculture could help to reduce long-distance transportation of food (food-miles) and energy use involved in that transport. According to FAO and WRAP, 20-25% of climate change emissions are linked to production, processing, transport and storage of food[140]. Thus growing more of one's food through urban agriculture could help to save energy and prevent some greenhouse gas emissions due to importation. Quantitative analysis done in a previous study[141] on fresh fruit and vegetable production indicates that 39 of the most commonly eaten vegetable products that could be grown locally travel an average distance of 4700 km. The average GHG emission per kg of plant product was 1.2 kg. Kingston CMA consumes 11000 tonnes of 39 common plant product imports with annual GHG emissions of approximately 14000 tonnes (equivalent to driving 4700 cars 18000 km annually). Eight out of the top ten greenhouse emitting imported food items were vegetables or fruit that could be grown locally through UPA (see **Table 33**) – lettuce, pears, tomatoes, potatoes, peppers, apples, onions and carrots. This is especially the case with lettuce (second place - 1900 tonnes annually) and tomatoes (fourth place – 1200 tonnes annually). Both of these vegetables are well suited to vertical growing methods and other simple or innovative cultivation techniques.

Growing these 39 commonly eaten fruits and vegetables using local urban and peri-urban agriculture production within 30 km of Kingston would generate approximately 81 times less GHGe than imported versions. This is likely an underestimate considering the GHG emissions not accounted for during production, in sending products to distant locations for processing, in discarding wasted food to land fills with trucks or the emissions from driving automobiles to get food for example.

What happens when you combine this with the GHGe reduction through improved agricultural practices? The benefits of both better agricultural practices and reduced long-distance transport combine in a synergistic manner (**Table 3**, **Table 22**, page 143). These minimum estimates provide a good argument that local food and local urban/peri-urban agriculture has potential for reducing energy use, greenhouse gas emissions, air pollution and the distance that food travels.

Table 3. A summary of the amount of GHGe reductions through better agricultural practices and reduced long-distance imports of 39 common fresh fruit and vegetable products that can be grown locally in Kingston.

Percentage of Food That Remains Local	GHGe Reduction Through Better Agricultural Practices When Cultivating FFV (CO_2 equivalent tonnes/yr)	GHGe Reduction Through Reduced Long Distance Edible Plant Imports (CO_2 equivalent tonnes/yr)	Total GHGe Reduction (CO_2 equivalent tonnes/yr)*
Business as Usual	370	980	~1,300
25%	370	3,400	~3,800
50%	370	7,000	~7,400
100%	370	14,000	~14,000

* This is the total of columns two and three.

In terms of improved space usage, 12% of all citizens (n = 139) who were surveyed indicated that urban agriculture was an efficient use of an area. According to one urban producer, fast growing leafy vegetable or small fruit crop production is ideal for the urban environment where temperatures are higher and where pests that would normally make such crops difficult to grow in rural areas are less abundant. Biodiversity was also a topic that came up during the questionnaires and interviews. Conservation, habitat preservation, and diversity were other typical responses. Urban agriculture can bring greater biodiversity to monoculture green spaces through greater variety of plant life (providing a habitat for mammals, birds, insects, aquatic and other life)[142].

The interviews and questionnaires demonstrated that citizens and other stakeholders were aware of the likely environmental benefits of urban agriculture especially in terms of direct environmental benefits. The quantitative analysis provided some strong evidence that urban agriculture can contribute valuable ecosystem services, which can be accounted for in decision-making. Overall there appears to be some awareness regarding the role of urban agriculture in achieving environmental sustainability.

4.2 Community

Community is likely one of the most important factors in shaping sustainability. The way people relate to one another has significant consequences on how we relate to our environment. Cultural factors play a role in how we view living beings within the world and the world itself. If people cannot relate to one another in a mutually respectful and enlightened manner it is likely that we may be unable to do the same towards aspects of the environment that support us.

There were several major themes from the qualitative analysis that fell under the category of community. They were aesthetics, community building, recreation, enjoyment and exercise. Aesthetics was an oft-mentioned point in the discussions and answers among participants (30% of all citizens surveyed for example; n = 139). It was brought up about 50% more often than community building or recreation related responses. Answers revolved around greening, beauty and urban renewal (especially of vacant lots). It is a fairly typical motivation for urban agriculture in a developed nation like Canada[143]. Recreation, enjoyment and exercise were also common responses among all participants. This was mentioned by about 13% of citizens who were surveyed for example (n = 139). (See page 205)

Urban agriculture was also seen as building community and strengthening social cohesion - the next most cited response in this category account for 6% of responses by citizens (n = 139). Urban gardens made excellent meeting and gathering places. Community gardens for example help to "increase comfort, decrease isolation" and "provide a sense ... of belonging to the neighbourhood" according to one interviewed city official. Such initiatives help to "provide a sense of pride and ownership" and nothing is more satisfying than "picking and eating something you yourself produced" according to another. "Gardens can address some negative aspects of urban life like vandalism" one city official said. "It provides a stronger bond and feeling of looking out for each other. It tends to discourage criminal behaviour like graffiti."[144]

There was a strong link between urban agriculture and social cohesion in the minds of stakeholders. "It provides a sense of community" one interviewed official said while another stated that it helped to "develop stronger bonds". It was about building community; sharing; growing friends and good acquaintances as well as having something in common. The idea of interactive cultural diversity and meeting new people was also raised. In fact one interviewed gardening participant said he enjoyed getting to know the Chinese and other international folks from the nearby apartment buildings ringing the community garden. It wasn't just about cultural diversity - the idea of equity and diversity in physical or mental capability or age was also brought up. One community garden for example provided plots for mentally or physically challenged individuals while another promoted the use of their garden for both young people and seniors (ages 15-60). There was also reference to social cohesion in terms of a direct relationship between city farmers and citizens. "This encourages farmer-citizen bonding. This is especially true in farmer's markets. Urban farmers who sell at farmer's markets can partake of the social and recreational aspect of that venue - the bargaining, interaction and fun."

Urban gardening helps to foster a sense of responsibility to maintain the living environment. Another city official stated that urban agriculture "would be a good experiment for troubled youth" to learn that sense of responsibility. UPA was seen as a means of "educating the younger and current generation on where their food really comes from." According to another interviewed official "some kids don't even realize that milk comes not from the supermarket but from a cow." There was a need to break the "belief that all food comes from the grocery store." Tangible agricultural activity within an urban setting is a wonderful means of re-establishing lost connections to land and community. An entertaining idea would be to see urban agriculture as a highly visible 'ambassador' between those who produce the food in the countryside and those within the city.

Unfortunately, there has not been a way to reliably model the social impact of urban agriculture in tangible monetary terms. The Whitmire Study[145] in St. Louis, USA hints at the social value of community gardens that could apply to Kingston neighbourhoods. In 48 of 53 cases, the rent in the immediate vicinity of gardens increased more than $10 per month. When gross rents fell in St. Louis City between 1990-2000, the areas where gardens were located were unaffected. In fact, the median gross rents in areas immediately surrounding the gardens increased by $113 and were significantly higher than St. Louis City as a whole. "The areas directly around the gardens have increased what people are willing to pay at a greater amount than in the larger Tracts and city as a whole." This may indicate that people are willing to pay more to stay in neighbourhoods with community gardens because of the value they place on community spirit and the bonds that can be forged.

In summary, aesthetics; strengthening community; recreation, enjoyment and exercise came out as some of the strongest themes in this category. Citizens and other stakeholders all indicate that urban agriculture is of great value to strengthening the social bonds and feeling of community that makes Kingston such a wonderful place to live.

4.3 Food Security and Sovereignty

Food security and sovereignty is a topic that touches all other dimensions of sustainability in some way. People who are unable to meet their basic needs of food, water and shelter will be unlikely to have the full capability to deal with issues like environmental degradation or environmental injustice. From the questionnaires and interviews for this study the strongest theme in this category was the idea of self-sufficiency. There was a need to reduce extreme "dependency on outside sources" stated one city official. Unfortunately it seemed this idea was not as frequently mentioned as other response categories (see page 205). For example only 4% of citizens surveyed made mention of self-sufficiency (n = 139). Urban agriculture would help people to "grow some of their food source" especially for those unable to buy fresh, nutritious food according to one interviewee. An area in Kingston that could benefit from this idea is Rideau Heights in North Kingston. A recent interim report showed that the area was a “food desert” with insufficient access to nutritious food[146] (see the Glossary, page 231). There also appears to be several large parks adjacent to the area that could be used for fresh fruit and vegetable production especially Belle Park (**Box 2**, page 189).

The quantitative analysis mostly dealt with food security and self-sufficiency from the production side in terms of fresh fruits and vegetables only. In the current situation, local urban and peri-urban agricultural production is estimated to be meeting the minimal fresh fruit and vegetable needs of 11000 to 15000 people or 7-9% of the entire Kingston Census Metropolitan Area (CMA) population at most[147]. Increasing the amount of local food (Table 4, **Table 24**, **Table 25**, **Table 26**, page 151) however, improves the ability of Kingston CMA to be secure in terms of fresh fruits and vegetables. Protein, grain, fat and other nutrients still have to be supplied in order to achieve full food security and maximum health.

Table 4. **The number of people whose minimal fruit and vegetables servings can be potentially met through urban and peri-urban agriculture. The Kingston CMA population is 152,000 people and Kingston city population is 117,000 in 2006-07.**

	Area Analysis		Yield Analysis	
Percentage of Food That Remains Local	**# Of People Whose Minimal FFV Needs Can Be Met (#/yr)**	**% Of Kingston CMA Population**	**# Of People Whose Minimal FFV Needs Can Be Met (#/yr)**	**% Of Kingston CMA Population**
Business as Usual	11,000	7.2%	15,000	9.7%
25%	31,000	21%	43,000	28%
50%	60,000	49%	83,000	54%
100%	120,000	76%	160,000	110%

In conclusion, food security, sovereignty and self-sufficiency issues did not appear to be prominent in the minds of the average citizen. Quantitative analyses pointed to the potential of urban agriculture to help meet food needs in terms of quantity however declining ecosystem services and climate change outcomes may already be undermining our ability to produce food sustainably.

4.4 Health

Health is greatly impacted by the environment we live in and the food we derive from it. An ecosystem is a dynamic equilibrium of all living and non-living beings including humans. Worldwide, environmental factors dramatically affect the health of millions of adults and children through polluted air, water and soil. Such effects ultimately undermine health and the inherent ability to change the situation for the better.[148]

From the interviews and questionnaires, health as a category faired relatively poorly among the responses from the various groups. There appeared to be few cohesive linkages between health and urban agriculture in the minds of nearly all stakeholders when taken on the whole. This seems to be supported by consistent marketing research that shows that many consumers are not interested in health outcomes when considering matters related to food[149]. Mental health benefits of urban agriculture (**Figure 5**) or its potent use in horticultural therapy was certainly not on the minds of the vast majority of participants responding to questionnaires, interviews and case studies. In support of research evidence[150] from other urban agriculture and community garden projects the research in Kingston uncovered the health benefits of gardening for one participant. The gardener (and former farm worker) at one community garden in Kingston was heavily afflicted with anxiety, numerous ailments and conditions (including epilepsy and Parkinson's Disease) that denied him the ability to work and to make full use of his hands. Yet when he operated on his small, 10 x 10 ft patch he found himself considerably more relaxed and at peace - he could even make significant use of his hands for gardening while in this calm state! This indicates that working the earth, creating and growing edible landscapes and re-developing a link to the environment that supports all life is something that helps to soothe and heal the mind, spirit and body.

The quantitative analysis provided some idea of the value of edible urban landscapes in lowering future health costs and improving the quality of life in terms of nutrition. It is estimated that 80% of cardiovascular disease, 90% of diabetes and 30% of cancers are caused by a poor quality diet[151]. Urban agriculture is one means of providing fresh fruits and vegetables to counter those costs. Low bound cost estimates of cases in Kingston CMA that can be linked to a poor quality diet are found in Table 5. The potential savings that improved diets through urban and peri-urban produced fresh fruits and vegetables could be valued at a minimum of $130 million. These conservative values are only in terms of direct and indirect health care costs and do not include psycho-social losses from depression, poor self-image, stress or other similar ailments. The number of cases of diabetes and cancer are known to be increasing rapidly[152]. More information can be found on pages 160 and 225.

Table 5. Estimated annual minimum health costs of current heart disease, diabetes and cancer cases in Kingston CMA that can be linked to a poor quality diet.

Disease	**Health Costs Attributed to a Poor Quality Diet ($CDN/yr)**
Heart Disease	$100,000,000
Diabetes	$7,500,000
Cancers	$25,000,000
Total	**~$130,000,000**

In summary, health did not appear to be a prominent concern among Kingston stakeholders as responses were practically non-existent. Yet the current situation with health care and the possible health-related financial burdens that Kingston might have to deal with in the future are likely mounting (especially in an age of cost downloading onto municipalities). Quantitative analysis and the literature[153] however indicates actions like fostering more urban agriculture could be one of many methods in lowering healthcare costs that could free up taxpayer dollars for environmental and social programs.

4.5 Economy

A sustainable livelihood is integral to a vibrant community where citizens respect each other, the environment they dwell in and value their personal health. Supporting local food and urban agriculture both within the city and on its fringes can help reach this goal and improve the economic outlook for Kingston.

The interviews and questionnaires of Kingston citizens and other stakeholders indicated that the vast majority did not view urban agriculture as helping the economy in any way beyond produce sales. Some city officials for example claimed that "Kingston's historical heritage was a more important lure for tourists" and agriculture of any sort was not seen as an asset for the tourism industry. No citizen questioned even entertained the idea that urban agriculture was as economically important as it could be. One official however did talk about the successes of regional agri-tourism in Ontario such as "Taste of the Town" where farmers open up their homes to tourists[154]. It has similar design elements to the farm gate trail in Northwest Sydney, Australia and the initiative in Devon, England[155]. The official made specific mention of the nearby Prince Edward grape orchards and wineries pointing out how successful it has become since their inception. If the global ecotourism industry ($500 billion annually[156]) is any indication, agri-tourism appears to have potential for helping farmers make a living[157].

The quantitative analysis indicates that urban agriculture in Kingston can contribute significantly to the local economy. Depending on the level of production and the amount that is locally sold, there can be large increases in local income, jobs and the local economic multiplier effect[158]. Better agricultural practices and fewer food-miles lead to reduced greenhouse gases that would have value in any emissions trading scheme that might be implemented in the future. In the current situation, urban and peri-urban agriculture is valued at $250 million in equivalent economic production value (**Table 12** and page 120), providing $92 million in labour income that could support up to 3,000 jobs (**Table 12** and page 173). It is likely generating a local economic multiplier effect of up to $54 million (see page 168). A local economic multiplier effect is an indicator of how well an activity like urban agriculture can improve the local economy. A local economic multiplier effect value represents how much money is being re-spent locally. The value of foregone GHGe due to environmentally friendly agricultural practices and reduced food-miles emissions is estimated to be at least $16,000 based on Kyoto negotiations in 2003[159] (Table 3, Table 6 and page 171). If the percentage of food produced for local consumption increases however, the collateral economic benefits will improve (Table 6, **Table 27**, **Table 28**, **Table 29**, **Table 30** and page 168).

Table 6. Economic benefits generated when the percentage of food produced through UPA remains for local Kingston consumption in four different scenarios. (LME = local multiplier effect) The 2003 Kyoto carbon emissions trading value of reduced GHGe is included.

Percentage of Food That Remains Local	**LME (million $CDN)**	**Relative to Current Situation in 2006-7 (times)**	**2003 Kyoto Value *($CDN/yr)***
Business as Usual	$54	1	$16,000
25%	$180	3	$46,000
50%	$370	7	$88,000
100%	$730	14	$170,000

It can be surmised that most of the stakeholders consulted did not consider urban agriculture as something that could contribute to economic vitality. The quantitative analysis on the other hand certainly pointed out that local urban and peri-urban agriculture could contribute towards a more prosperous Kingston.

4.6 Urban Agriculture: The Challenges

There were various concerns that were expressed by the different groups regarding the establishment of urban agriculture in Kingston. Of these however three of them were the most prominent among all of the stakeholders. They were limited space, limited resources and education. Each is discussed in more detail below.

4.6.1 Limited Space

One of the biggest challenges to urban agriculture that came out of questionnaire responses and discussions appeared to be the idea that there was limited space for growing food in urban settings. Among citizens for example, 29% of those who didn't grow their own food (n = 88) said it was because they lived in high-density residential homes such as apartments or condominiums. Approximately 28-30% of Kingston lives in high-density residential according to statistics[160]. Increased construction and use of high-rise, high-density apartment or condominium complexes have often been considered a sustainable solution to urbanization pressures. The problem is that by filling up urban spaces with high-density residential buildings or "infilling" people often lack access to any sort of green space for edible gardening or other uses. Some have criticized this sort of planning for its lack of multiple land-use considerations[161]. There is a need to innovate, integrate, retrofit or build new infrastructure to allow gardening on these buildings, adjacent to them or within the surrounding neighbourhood. Regardless, the perception that there is a lack of space for edible landscapes may be an inaccurate one. It may be possible to utilize parkland spread throughout the inner-city, brownfields, rooftops, vertical surfaces and even basements. The following model was not exhaustive and does not yet account for the possibilities of gardening on unused non-residential lawn spaces, unused parking lots or asphalt in schoolyards as demonstrated by cases in Berkeley, Chicago and Milwaukee[162]. Further information can be found starting on page 118. What follows below is a brief examination of the land in Kingston that is being used or could be used for inner-city urban agriculture. This discussion is expanded further in the recommendations chapter starting on page 57.

1. **Citizen Backyards**: At present, 28% of citizens surveyed said they grew food in their backyards (n = 139)[163]. Current estimates put the area utilized at 14 ha with a potential yield of up to 480 tonnes valued at ~ $940,000 (**Table 10**, **Table 11**, **Table 12** and page 121). Table 7 summarizes the theoretical possibility if every household in the Kingston CMA cultivated a 9.3 m^2 plot of backyard space. The value of 9.3 $m^2$was determined from the quantitative information gathered through citizen questionnaires. On page 49 and 57 there is a discussion about the future possibilities of having urban community supported agriculture (CSAs) and entrepreneurial urban farmers utilize that space. The calculations exclude households in high-density residential living spaces[164]. (See page 124) There are potentially 37 ha of useable backyard space in the inner-city of Kingston.

2. **Parks**: There are 680 ha of parks (excluding conservation areas) not being used for food in any official capacity throughout the city. Some of them are very large. One such park that I encountered was Compton Park in North Kingston – an area with food desert and food access issues. It was large enough to run dozens of sports matches at once. Would it not be possible to devote even a fraction of that to food production? Estimates indicate that these areas can provide a readily accessible surplus of food to those

who need it in addition to other cultural and recreational uses (Table 7). (See page 134 and Box 2 on page 189)

3. **Brown-fields**: These areas[165] are generally not considered an option for food production due to health and safety concerns. I decided to examine the possibility of raised bed gardening in these areas that would help to avoid any legacy of soil contamination. There are 72 ha of vacant lots out of ~200 ha of brownfield area in Kingston. Values in Table 7 indicate that there is some merit in utilizing its untapped capacity for food production. (See page 136)

4. **Rooftops:** These were only considered in passing with regards to food production according to the interviews and questionnaires. Quantitative analysis indicates that there is great potential for them - possibly on non-residential buildings where flat roofs are the norm. Good examples are high-rise apartment buildings, office complexes, condominiums and warehouses (Table 7). An analysis of a building's ability to support a rooftop garden should be undertaken. (See page 137)

5. **Vertical surfaces:** Vertical surfaces or external walls in Kingston are not being used for food production in any large-scale capacity[166]. Calculations indicate that there is a significant amount of growing area to be utilized with vertical surfaces if the right technologies can be used (Table 7). (See page 138)

6. **Basements**: At this point in time there are no known situations where basements are used for urban mushroom production within Kingston. Using data from a previous study[167], it is estimated that the entire Kingston Region (KFL&A) imports ~110 tonnes of mushrooms annually. The quantitative model indicates that there are some significant possibilities with regards to supplying our own mushrooms (Table 7). (See page 140) The health and safety concerns are briefly acknowledged in a section found on page 57.

The purpose of Table 7 is to illustrate that utilizing even a fraction of the potential space in some manner (I emphasize "fraction") could be possible and beneficial. Table 7 reflects an ideal situation. If all space was used in Kingston, the inner-city could be a vegetable exporter. The amount of fresh fruits and vegetables that Kingston citizens can consume is a limiting factor. It is highly improbable that Kingston would utilize every bit of urban space for food production. The table suggests that there are some spaces that are easily accessible like parks. The potential for waste recycling services that was discussed in the previous Environment section could be applicable to these areas. I have not found a way to integrate this on a value per unit area or yield basis at the present time into the calculations involving Table 7. Overall, the values in Table 7 reflect the possible potential for inner city urban agriculture.

In the final tally, the analysis seems to point to a large amount of unutilized area in inner-city Kingston. Residents with income issues (and without a large backyard) or those in high-density residential areas would likely find parks, rooftops, brownfields or abandoned lots as suitable areas for growing food if they are given the knowledge and skills to do so. A creative use of space and a desire to adaptively innovate would allow these often underused and overlooked venues to spring alive – with all the commensurate environmental, societal, health and economic benefits that might grow from that.

Table 7. ***Maximum value*** **for potential area useable, yield, potential economic effects and potential ecosystem service contributions for citizen backyards, parks, brownfields, basements, rooftops and vertical walls in Kingston. [LME = local multiplier effect]**

	Potential Area Useable		**Potential Yield**
	(ha)	(acres)	(tonnes)
Citizen Backyards	37	91	1200
Parks	680	1,700	28,000
Brownfields	72	180	2,900
Basements	540	1,300	22,000
Rooftops	2,100	5,300	88,000
Vertical Walls	2,100	5,300	88,000
Total	~5,600	~14,000	~230,000

	Potential Economic Effects			
	Equivalent Economic Production Value	**LME**	**Labour Income**	**Jobs Supported**
	($CDN)	($CDN)	($CDN)	(#)
Citizen Backyards	2,400,000	7,000,000	920,000	31
Parks	55,000,000	160,000,000	21,000,000	700
Brownfields	6,000,000	17,000,000	2,200,000	73
Basements	43,000,000	130,000,000	16,000,000	550
Rooftops	170,000,000	510,000,000	65,000,000	2,200
Vertical Walls	170,000,000	510,000,000	65,000,000	2,200
Total	~450,000,000	~1,300,000,000	~170,000,000	~5,700

	Potential Value of Ecosystem Services	
	Soil Formation	**Nitrogen Fixation**
	($CDN)	($CDN)
Citizen Backyards	330	1,300
Parks	6,200	24,000
Brownfields	660	2,500
Basements	0	0
Rooftops	20,000	76,000
Vertical Walls	20,000	76,000
Total	~46,000	~180,000

4.6.2 Limited Resources

Limited resources were a problem for different types of urban producers and citizens in various ways. For some community gardens, water access was a significant problem especially if gardeners had physical limitations that made bringing water difficult (see the FRILL case study on page 182). For commercial producers, the cost of various inputs was "becoming more expensive". "Input suppliers can be distant," said one producer leading to rising to transport costs. Interestingly enough none of the participants talked about large scale/community level reuse or "waste" conversion into a resource (i.e. starting up vermi-composting programs that would turn large amounts of organic food waste into a vital, high-quality input for food production and soil fertility[168]). While all producers practiced it at a small scale, successful initiatives elsewhere[169] have demonstrated that very large-scale reuse is possible to achieve spectacular results and solve this 'input problem'. Composting urban organic household wastes could be highly beneficial to the municipal tax base if the city government were to sell this compost to farmers.

A lack of time, effort and human resources was also seen as a challenge. Among citizens for example, 8% of those who did not grow their own food stated that it was too much work (n = 88)[170]. Officials saw maintenance as an issue if urban agriculture required constant city upkeep. One city official stated that there would be no "problems having gardens as long as they maintained the site in a tidy, orderly fashion". "Enthusiasm often vanishes too quickly," the official claimed resulting in the City having to "clean it up".

In the case of different urban producers "manpower is" often "limited" - it can be hard to find good, qualified help or enough volunteers. Having too large a garden might "mean greater maintenance and work for too few staff". City officials indicated that there were "limited" city "resources" to help alleviate these problems. One official stated that the City was "hamstrung with too little time, too much to do". When asked if government might ever provide some sort of incentives to urban agriculture, one official stated that the "municipality wouldn't finance or subsidize community gardens, green roofs and other such individual choices just as they wouldn't pay for your water bill or roof repairs." Another official however did state "some resources should be devoted to make it (i.e. urban agriculture especially community gardens) easier." Paying for your own water bill or roof repairs that might only influence yourself is one thing - creating community gardens and rooftop gardens however for food, for a clean environment, for greater wildlife and pollinator diversity, for jobs, for a more lively community and more is another. Individuals and groups making those choices are providing public goods that strengthen not just themselves - they also strengthen everyone else in the community and ultimately the whole city itself.

The most limiting resource according to the participants as a whole was monetary ones. The first dimension involves capital costs and operating or maintenance costs. One official asked "who's going to foot the start up and capital costs" of urban agricultural initiatives? One urban producer (which was "self-funded") however said that the "city provided no money" to support them even though they operated on public land (the city however did provide water). Their "tools were getting old and were hard to replace". Another producer stated that "expansion" of its garden "could proceed faster" if it had sufficient funding. Currently they "have to do it step by step..."

In terms of peri-urban agriculture - it has similar if not identical financial difficulties that are faced by more distant rural operations in terms of initial and ongoing expenditures. "Capital costs to start up are prohibitive" and "large" as several officials stated. Land and equipment remain expensive to purchase. For example - a 100-acre farm might cost $300,000 to $400,000 dollars making it difficult for new farmers to afford[171]. "It costs $50,000 just to get a new tractor". It is "hard to get financing from private investors or banks". Then there are "transport costs to ship in inputs and ship out products" and the cost for the "storage for grains" that has to be factored into operating expenses. Issues of global trade, oversupply, low price and magnified storage burdens serve only to exacerbate financial issues – reflected in part through the current farm income crisis[172].

Any "investment is a huge risk in Kingston" in terms of agriculture one official believed. There is a perception that the Kingston "area simply lacks good farming land." Yet there are farmers who successfully grow crops on what would be classified as mostly "sour soils over rock" or worse (Class 4 or higher) on a regional soil analysis map using highly adaptable, ecological agriculture methods[173].

Insurance costs are one of the biggest thorns found in the operating budget of many inner city urban producers, whoever they may be. For community gardens insurance can be their biggest expense. One garden of 40 plots collected $1000 in plot fees per year only to spend all of that on a liability insurance policy. The garden coordinator said, "… We practically have no surplus to put back into and improve the garden". For a smaller garden like FRILL (12 plots; see p. 182), fund raising and grant writing (something few other community gardens do on a consistent basis) is absolutely essential to pay its $700/year insurance premium (the policy is worth ~$2 million). All of this only serves to aggravate other resource scarcity issues as previously mentioned.

4.6.3 Enlightenment, Education and Empowerment

The idea of "enlightenment" through urban agriculture was probably the strongest theme that came out of the visual analysis (page 11) - one that touched upon every other notion raised. It was so strong that it warranted its own section. In fact it was mentioned twice as often as any other concept except aesthetics. It was discussed as both a benefit and as a challenge. Among citizens, 9% of those surveyed (n = 139) indicated that urban agriculture was important for some form of education, awareness, knowledge or skill transfer relating to food, agriculture and environment. Among citizens and local community advocates, ideas of reconnection to food and land, ecological education, knowledge and skills training and local food all fell under this 'enlightenment' theme and were the most strongly expressed. Producers, city officials and the urban planner also made mention of this role though with less force.

The questionnaires and discussions indicated that this enlightenment still had a long way to progress in the general population. There is a general lack of awareness of environment, social and food issues and how they relate to the everyday individual. A pair of community gardeners stated that there was little promotion or awareness of the rising "interest in growing food in the city" and the increasing demand for space. In fact they "only learned of their garden space when a friend told them" about it. Another urban producer said "there needs to be more environmental education" because "no one gardens for specifically environmental reasons." A local urban producer remarked that "local food needs to be promoted" and that "producer groups are already tackling that issue with advocacy" in terms of raising awareness among the public and others. It may be however that more advertising and promotion is required. Such educational promotion is key to raising the prominence of local food and related sustainability issues[174].

Knowledge and skill transfer was also mentioned as an important aspect of this enlightenment. "There needs to be more education on food preservation techniques" mentioned one interviewed official, "this would help urban production be more sustainable and lasting." In a recent workshop by *Food Down the Road* in Kingston, the concept of "food literacy" was brought up during discussions and it relates to the importance of basic life skills, empowerment and information. "So many people have lost the knowledge and skills to cook," said Sue Hubay, a dietitian from Peterborough Public Health[175]. Fostering more urban agriculture especially in the inner-city can be an important step to immersing and training people in life and employment skills - the ability to feed oneself and to have a "sustainable livelihood".

There was a lack of pervasive awareness and information about inner-city urban agriculture possibilities in the City government. On the whole the administration was not aware of new developments beyond green roofs. The Planning and Development branch was just beginning to focus on peri-urban agriculture out to the City limits with no analysis of agriculture within built up inner-city areas[176]. There was no apparent desire to ask private landowners for temporary usage rights on behalf of urban farmers and citizens.

Environmental and health concerns were cited as reasons against using brownfields and there appeared to be no contemplation of how to overcome such concerns or whether these concerns were valid for specific areas. Officials also did not express any idea of the economic potential of urban agriculture in the inner-city nor was there any significant mention of possible environmental benefits except aesthetics in most of the interviews. Social and community benefits from UPA such as enjoyment, recreation and (to a lesser extent) greater community cohesion were mentioned more often. None of the interviewed officials linked the possibility that UPA could help deal with waste issues (as Toronto has with its green bin program and organic waste) by driving community-scale composting initiatives. Informing decision makers and city staff of the multi-fold value of urban agriculture might persuade them to change their stance regarding integrating urban agriculture into the city landscape (both inner-city and peri-urban fringe). Interviews indicated that the city remained resistant to creating policies that supported integration of urban agriculture into the cityscape. All of their most recent development and planning documents[177] make no mention of urban agriculture or any policies that might be supportive of it. At the present time there does not appear to be any move in that direction.

A table with the total environmental, health, economic and food security benefits for all four scenarios are included below (Table 8). As the amount of local food increases in the area there are calculable side benefits for Kingston ranging from $190 to $860 million. These benefits only consider ecosystem services, health and economic impacts from urban and peri-urban agriculture. Keeping more production local can reduce the amount of greenhouse gases produced of imports by approximately 1,300 to 14,000 tonnes with a small amount of that reduction due to reduced or absent agri-chemical use from ecological agriculture (~370 t GHGe). It can increase the proportion of the Kingston CMA population whose minimal fresh fruit and vegetable needs could be met locally.

Table 8. A quantitative summary of the environmental, health, economic and food security results for all four scenarios where the percentage of food that remains for local Kingston consumption increases. The amount of area increased, percentage of ecological agriculture and percentage of food waste are kept constant. All of the scenarios are relative to the 2006-2007 "business as usual" situation.

	Percentage of Food That Remains Local (%)			
	Business as Usual			
	7	25	50	100
Estimated Extra Value of Urban and Peri-Urban Agriculture (*Million $CDN/yr*)				
Environment	$1.9	$1.9	$1.9	$2.0
Health	$130	$130	$130	$130
Economic	$54	$180	$370	$730
Total	**~$190**	**~$310**	**~$500**	**~$860**
Greenhouse Gas Emission Reductions (CO2 equivalent tonnes/yr)				
Better Agricultural Practices When Cultivating FFV	370	370	370	370
Reduced Long Distance Imports of 39 Common FFV Products	980	3,400	7,000	14,000
Total	**~1,300**	**~3,800**	**~7,400**	**~14,000**
Food Security and Sovereignty				
# Of People Whose Minimal FFV Needs Can Be Met (#/yr)	11,000 - 15,000	31,000 – 43,000	60,000 – 83,000	120,000 – 160,000
% Of Kingston CMA Population	7.2-9.7	21-28	49-54	76-110

In summary, stakeholders perceived urban agriculture as being beneficial to the environment and to the community. The ideas of health, food security and economic potential did not appear to be prominent in the minds of many. The quantitative analysis served to reinforce the environmental and community benefits of urban agriculture to some degree while addressing some of the apparent knowledge gaps that were revealed in interviews, questionnaires and case studies. The qualitative research also brought to light some of the major obstacles to urban agriculture in Kingston that the modeling could not do alone. Based on all of this information some suggested recommendations are proposed in the following chapter.

Chapter 5
Recommendations and Conclusions

Sustainability is about parallel care and respect for ecosystems and all the living beings within it. Environment, society, health and economy all have to be addressed simultaneously to successfully move forward toward harmony between each other and with our surroundings. For Kingston there are some relevant, significant and practical suggestions on how to achieve this harmony in the context of urban and peri-urban agriculture. In this chapter I provide what I interpret to be the most salient recommendations for topics addressed in the previous chapter. These recommendations address several broad issues involving personal and community wellness, infrastructure, insurance, finances, production level innovations, and policy and public education. Limitations of the study and future directions are discussed at the end.

5.1 Recommendations

Kingston and other urban areas have similar environmental, social and food security problems. Ecosystem service degradation due to agricultural practices and solid waste issues are things that the city could tackle through urban agriculture. This study indicates there is a large potential to utilize different inner-city spaces for food production. This could contribute to food security and sovereignty for Kingston citizens of any background. From an economic standpoint, there appear to be good prospects for local food sourcing and agri-tourism that the City should consider for future planning. Limited resources for urban farming in terms of water and finances can be addressed with cooperation, the right knowledge and creative thinking as detailed below. Urban agriculture can also have great potential for empowering citizens and educating the public about environment, local food and food politics. Political and legal barriers to urban agriculture also exist regarding integration into official city planning and land tenure. All of these aspects need to be addressed along the path towards a more sustainable, vibrant Kingston.

5.1.1 Personal and Community Wellness

1. Assess the economic, community and food security possibilities of surplus food grown in backyards.

The majority of study participants made little mention of the economic possibilities of generating wealth from urban agriculture and this could be a crucial area to address if urban agriculture is to take root here. According to the questionnaires, apparently 75% of citizen gardeners (n = 39) ate less than 76% of the food they grew often giving it away to friends and neighbours. Otherwise, the food would go to waste. This surplus of fresh edibles could be sold to create a revenue stream for community gardens, low-income individuals or entrepreneurs. The food could be donated to the food bank if that institution can obtain significant refrigeration or preservation capacity – perhaps through an alliance with collective kitchens[178]. There is also the potential for bartering different foods that one does not grow - which could help increase social interaction between families and communities. It might even increase ethnic relations between groups like the Portuguese and Greek communities.

2. Promote the physical health and nutrition benefits of urban agriculture.

The increased fruit and vegetable intake and the exercise urban agriculture provides can be one factor in countering the rise in diet related diseases such as heart disease, diabetes and obesity that were discussed in Chapter 4[179]. Urban agriculture could be re-introduced into schools for this reason in parallel with education as to its other benefits. The important point is trying to foster good habits in youth.[180] The exposure to food, agriculture and health issues must go beyond the home environment in order to be successful and transformative[181]. Sourcing more local and sustainable food in elementary, secondary, post-secondary school and workplace cafeterias would be a good step in creating a healthy environment and culture.

3. Promote horticultural therapy and the mentally rejuvenating aspects of urban agriculture.

There are ample opportunities to use urban or peri-urban agriculture to improve the quality of life for people with disabilities or those under mental distress. Farmers or community gardens could form partnerships with health care institutions and related service providers to this end. Such therapy works to calm and relax as well as to teach new skills to those undergoing it. Urban farms and gardens could be used as relaxation and meditation centres either as a community service or for a nominal fee. I highly recommend examining the literature review on the link between urban agriculture and health conducted by Bellows *et al*. (2005).[182]

4. Urban, peri-urban and rural agriculture should be taught in elementary, secondary and post-secondary teaching institutions in Kingston.

Agriculture touches upon foundation subjects such as biology, chemistry, geography, geology and mathematics. It is also about global and local issues, religion, spirituality, philosophy, health, ethics and medicine. These linkages cannot be ignored given the current state of affairs in the world today - a holistic and well-rounded education is increasingly needed to deal with modern issues. There are incredible opportunities to link community gardens and farmers to courses as guest speakers and partners in curriculum development. Unfortunately this level of integration has yet to be achieved at a level greater than individual teachers.

5. Foster more local, "in-the-city" celebrations of food on an annual basis.

The promotion of urban and peri-urban agriculture would benefit greatly by holding more celebratory events such as the National Farmers' Union's Feast of Fields in the City. If that isn't possible then facilitating transport to such events should be seen as a priority. Such visible and tangible celebrations could empower citizens with the desire to engage and learn more about urban agriculture, local food and food politics. According to Mark Lattanzi, Technical Director of CISA[183], people first and foremost want to support people they know in their community and to have a great experience while doing it.

These celebrations also foster greater community cohesion. More community events like 'harvest festivals', celebrations and dancing is seen as a great way to bring people of various backgrounds, ages and ability together to socialize and build relationships. Music is an absolute must for these events besides the food itself[184].

5.1.2 Infrastructure

6. Create "tool banks".

These banks could be set up to take donations of surplus tools, allowing gardeners or community gardens to borrow or rent them for a small fee. This could address the lack of funding to buy expensive tools. It might be possible for a large organization to provide such a service - such as the City government. If such a bank also possessed equipment like roto-tillers[185] it could be of use to new urban farmers who can't yet afford one. Roto-tiller prices range vary depending on size and its condition. The price can range from approximately $50 for a used heavy-duty mini-tiller up to $900 or more for larger models.

7. The potential for agri-tourism, urban and peri-urban agriculture benefits on tourism need to be seriously examined.

Wayne Roberts[186] the well-travelled director of the Toronto Food Policy Council specifically stated that Kingston has tourism potential on par with northern Italy and southern France. Dr. Roberts may well be referring to the historic legacy that Kingston possesses, its role as the gateway to the Thousand Islands or the United States and as a scenic stop towards other vibrant areas like Prince Edward County. Kingston also lies between several major Canadian cities like Toronto, Montreal and Ottawa, often being used as a weekend getaway by urbanites in larger urban centres. There are also good agri-tourism examples to learn from in Box1 (page 188) and **Box 3** (page 190). One city official made reference to the highly successful Prince Edward County case when the subject of agri-tourism was considered and believed that Kingston could achieve similar success in terms of attracting more tourists to the area through a vibrant local food culture.

8. Increase institutional purchasing for local and sustainable foods.

This is very relevant to public institutions with large buying power such as Royal Military College, Queen's University, St. Lawrence College, hospitals and city government as it is to citizens. Buying more local food through brands like "Eat from Kingston's Countryside" and supporting urban agriculture would significantly help to reduce air pollution and greenhouse gases from long-distance transport and boost local economic prosperity.

If large institutions could allocate even a small amount of their food services budget to local and sustainable foods while increasing it over time it would go a long way to supporting future agriculture in any form. It would be one major step in promoting and cementing an increase in supply. For example, University of Waterloo residences alone have an annual food budget of $75 million dollars[187]. Another example involves a non-profit non-governmental third party certification group called Local Flavours Plus (LFP) that has strong relations of trust with local and sustainable farmers. Through the work of LFP, the University of Toronto required that its corporate caterers use local and sustainable farm products for a small yet increasing portion of meals for most of its 60,000 students[188]. Could you imagine what that might be like in Kingston if the entire university, all the colleges and hospitals purchased locally grown and sustainable food? Of course one should still consider issues of timing in terms of when students are here and when more local food is available.

9. Create opportunities for local urban and peri-urban grown foods to be stocked in well-known retail supermarket outlets.

According to Mike Schreiner[189], the Vice President of Local Flavours Plus and a study done by Ipsos Reid[190], convenience and availability remain one of the largest barriers to getting local and sustainable food into the hands of citizens. Having entire sections in retail outlets devoted to local Kingston food, food from other nearby regions and food from Ontario would be a major part of solving this problem. It would allow Kingston citizens to make informed choices. Even groups like FRILL Community Garden see the merit in this and had wanted to encourage more local and sustainable food in retail stores in the community as part of their visioning. They entertained ideas of persuading big chain food stores like Loblaws/No Frills to go organic and local.

10. Examine the marketing opportunities for urban and peri-urban agriculture products specific to Kingston.

To date there does not appear to be any market research for urban agriculture specific to the Kingston context except for a recent study[191] that looked at the local food shed capacity of the entire KFL&A region. Several things that need to be determined for example is what sort of local demand can be met by "right in your neighbourhood" inner-city urban agriculture and how long it would take to develop that capacity.

11. Recreate the local capability for food processing and storage.

The training, skills and knowledge for processing food and storing it are being lost among the general populace. An important point here is to teach individuals and families life skills. Providing monetary incentives or aid to support processors, microprocessors or related cottage industries might also prove invaluable in terms of food security and local economic development. Re-invigorating this industry would provide additional income and jobs in parallel with agricultural production. Some possible ideas for products include cold pressed oils, jams, preserves and frozen vegetables and fruits. Cold storage for root vegetables would also be a useful idea to consider.

12. Form a UPA Network.

Many of the urban producers in Kingston do not really have open lines of communication between each other or all other sympathetic groups. A local network of community gardens, urban horticulturists, concerned citizens and many others would present a more vocal united front for political change. Such a network would also be able to share knowledge and resources as well as lend strength to one another's causes.

FRILL was one group that wanted to see the creation of a network of community gardens or the generation of a community garden movement within Kingston. This would help to gather more people to the cause and initiate momentum. FRILL hoped to see more community gardens started as well as 'mentoring' or the sharing of advice and support between groups. There are recent attempts in June 2007 by OPIRG Kingston to establish this network.

13. Facilitate the creation of urban CSAs.

CSAs or community supported agriculture are systems where citizens support a local farm by paying in advance for agricultural products. Throughout a growing season, CSA members receive a portion of the farm's harvest on a weekly or biweekly basis. This system allows members and farmers to share in the financial risks and the bounty of the harvest. Members are often encouraged to visit the farm and opportunities to learn and volunteer exist[192]. In the city context, the urban farmer would be utilizing the backyards of its members. This facilitates opportunities for learning and volunteering due to the close proximity of the farmer and their supporters. An urban CSA could be an extension of an existing agricultural business.

5.1.3 Insurance and Financial

14. Provide more "seed" grants to start up grassroots urban agriculture.

The City, banks, economic development agencies and private organizations could offer larger seed grants to help individuals and groups start up an urban agriculture business or a community garden. Currently there are only small, scattered grants ($500 or less) or large grants for only community initiatives – there is nothing focused on urban agricultural business or non-business opportunities. This would partly relieve the initial costs of starting up or establishing growing infrastructure and facilitate access to the economic potential of urban spaces.

Is it viable and worthwhile to do so in the context of conventional mass production? The United States presents a good example of the demand for local urban produce and growing possibilities. The backyard harvest of urban gardening in the US is valued at roughly $17 billion[193]. Since this was only backyards it underestimates the full potential that an urban environment could provide for growing food. Nearly 33% or more of the dollar value of agricultural products was created within urban metropolitan areas in the US leading to a simultaneous increase in the number of local processing or value added agricultural enterprises being established[194]. Another study in the United States indicated that 79 percent of total fruit production, 69 percent of vegetables, and 52 percent of dairy products are grown in metropolitan counties or fast-growing adjacent counties. In 2002, there were ~150 entrepreneurial UA projects in US inner-city areas that encompassed a wide spectrum of activities[195]. According to Dr. Wayne Roberts[196] of the Toronto Food Policy Council and a recent Time Magazine article[197], the demand for local produce is growing rapidly among North Americans and there is insufficient supply to meet that demand[198]. The sale of fresh, locally grown foods in the Americas rose from $4 billion in 2002 to $5 billion in 2005 and could become a $7 billion dollar business in 2011[199].

15. Establish favourable financing for inner-city and peri-urban agricultural farming.

Local inner-city and peri-urban agriculture is generally less risky to finance than typical rural operations due to their smaller size and increased proximity to their destination market. Banking institutions operating in Kingston or government could provide favourable interest rates on loans to urban or peri-urban growers to facilitate revitalization of the City and the countryside.

16. Use urban or peri-urban food production as a means of generating a sustainable revenue stream.

More and more organizations in North America are trying to figure out how to use food production as a powerful revenue-generating stream. This would help to reduce dependence on external grants and donations. As demonstrated by this study's quantitative modeling, tapping into even a fraction of the potential would help to sustain these organizations financially to a certain degree. All that is needed is the knowledge of the methods (which already exists) and the desire to implement them.

Growing Power Inc. based in Milwaukee and Chicago has used their diversified urban agriculture operation to fund education and community development. Fifty percent of their revenue stream is private funding. A good portion comes from sales of produce and other agricultural products. The other fifty percent is government funding from all levels. The local city government sees the urban farm as a highly valued asset that attracts prestige and wealth through the conferences it draws in for example.[200] Growing Power is an organization that is constantly moving towards financial sustainability.

Another organization is Southside Community Land Trust. It runs City Farm in Providence, USA that is able to meet 2/3 of its operating revenue through pre-season plant sales and farmers' markets. City Farm is a typical non-profit agricultural project trying to achieve economic and community redevelopment in low-income American cities. It uses agriculture to create jobs, build community, teach skills, cut down violence at its source and improve the local environment. This blend of social service and entrepreneurial genius allows typical projects to meet 10-87% of their operation costs through plant sales.[201]

A closer to home example is FoodShare, a Toronto urban agriculture and food security group that has managed to achieve 30% of its revenue stream from its own production and sales. It shares many if not all of the goals and activities of City Farm and Growing Power. In all of these cases, their organizational and production methods can be replicated here in Kingston and demonstrate that it is possible to achieve a high level of independence and sustainability through growing food and thus growing resources.[202]

17. Community gardens should consider “umbrella coverage” under a larger organization’s insurance plan.

Risk is something that many large organizations have to deal with on a regular basis. A community garden could consider asking a larger organization to include it under their coverage. Adding a community garden to an organization’s list of risks should have almost no impact on their overall assessed risk and on the cost of their insurance policy. It is more likely to be a political issue of whether the organization supports or does not support the idea of community gardening or urban agriculture[203].

Jack Hale, Director of the Knox Parks Foundation[204] (page 228) states:

> "*Just as group health insurance is much less expensive than individual coverage, insurance purchased by a larger organization to cover a multitude of risks will be less expensive per coverage than the same insurance purchased piecemeal. Therefore, if you are a single garden suffering from sticker shock, the best avenue may be to ask a larger organization that already has liability coverage to sponsor the garden. Such organizations might include community groups, churches, horticultural/agricultural organizations, or anything else that might work in your locale*."

In Kingston, a good organization to approach might be OPIRG for example. Some groups however may opt not to do so in order to retain their independence or to avoid any political entanglements or affiliations beyond being just a "community" group.

18. Community gardens should be insured as social service programs due to their positive impacts on communities if insurance is required.

It is a good idea for UPA initiatives like community gardens to find an insurance agent who will insure them as social service programs. Premiums will be much lower than if a garden were insured as a vacant lot. This disparity often stems from the fact that insurance agents may never have insured a garden before. This may be one way of dealing with high insurance costs for community gardens both in Kingston and elsewhere [205]. Please see page 228 for more information.

5.1.4 Production Level Innovations

19. Facilitate the adoption of ecological agriculture methods.

The environmental benefits of urban agriculture need to be promoted and adoptive action taken. The use of ecological agriculture methods would avoid many of the negative effects that conventional farming could cause in an urban setting. It would also avoid and even help reverse the degradation of environmental services and functions that chemical industrial agriculture leaves behind and is one essential component to inner-city or peri-urban agriculture. Considering the current ecological crises discussed in Chapter 1 it will be necessary to try and preserve the rapidly vanishing ecosystem services which our food, health and economy depend on. Training youth, citizens and farmers of any age should be considered an integral part of education whether it's for urban horticulture, small-scale farms or general knowledge.

20. Promote more local urban fruit and berry production.

According to previous research[206], pears ranked third among the top ten GHG emitting imports into Kingston (**Table 33** – 1890 tonnes). Imported pears generate 430 times more emissions than locally produced pears – demonstrating a need to increase local fruit production in some way to offset such emissions. This could reflect a need to foster more urban agroforestry especially in relation to fruits and berries.[207]

21. Make organic waste collection and re-use a priority.

According to the City of Kingston[208], ~56% of the garbage stream is organic by weight. Of that portion, ~24% was vegetable and ~15% was animal food waste[209]. Recent Statistics Canada data[210] shows that input prices (i.e. chemical fertilizers or pesticides, feed) have continued to rise over recent years. Simultaneously food waste continues unabated - research indicates that 30% of North American waste is organic matter. There is also a need to decrease reliance on expensive chemical fertilizers that have to be imported into the region and which degrade the environment. Putting these problems together tells us that it might be a good idea to make local composting a serious priority - not only to reduce waste but also to support local urban, peri-urban and rural agriculture in the area. Guelph demonstrates that urban centres of any size can achieve high landfill diversion targets while creating high-quality compost that could be used for a variety of purposes including food production. Its "Wet-Dry" system was the first in North America and received global recognition[211]. Unfortunately, the roof of the facility collapsed and recent political changes have prevented its repair. The City of Kingston performed a waste audit in 2002[212] and there are signs that it may be implementing a new system to separate and collect organic and inorganic waste. The City should promote applied research to determine how many urban and peri-urban farmers could be supported by this valuable resource both now and in the future.

22. Assess inner-city and peri-urban land available for cultivation and create an inventory.

Remote sensing, GIS analysis or survey techniques could be used to determine the area available for agriculture or gardens of any type. A more accurate analysis of suitable rooftop and vertical surface space through these methods should also be included in such an inventory. An inventory would help to establish UPA in suitable areas depending on its nature (i.e. community garden, horticultural therapy, commercial).

a. Promote intensive container gardening.[213]

Intensive container gardening can occur on balconies, walls, shelves and suitable rooftops or backyards. The plant varieties can range from herbs to even small trees. The containers can vary from baskets, tin cans to large pots or vases - recycled materials are also possible limited only by one's imagination. Facilitating this practice among children and adults who live in apartment buildings and condominiums should be a priority. Providing gardening containers, materials, inspiration and education for such a program at little or no cost could help even low-income individuals achieve some measure of food security wherever they live. The key here is to establish relationships, build confidence, and expose people to new ideas about space use and self-sufficiency.

b. Use parks for urban agriculture especially for food security reasons.

Parks are an easily accessible land resource that can give citizens the opportunity to grow their own food - especially if they have no green space of their own or where buying food is difficult such as in the North Kingston food desert. In the Rideau Heights area, parks are mere minutes away compared to the nearest supermarkets - all 45-60 minutes by walking or a $9-$10 taxi ride. Innovative growing techniques capable of increasing productivity with little energy on any surface exist[214] and a proportion of this production could also be used to provide a livelihood as well.

In addition, the yearly costs of maintaining a city park space are often higher than the cost of maintaining an urban garden. Where community groups, non-profits or other party pays the costs of their own cultivation activities and the upkeep of the land on which it is located, the City saves 100 percent on maintenance costs[215]. Examples can be found in **Box 3** (page 190).

c. Use brownfields and vacant lots for urban agriculture.

Brownfields (and vacant lots) can create health and safety issues if people use them for dumps or if they are contaminated by toxic waste. Brownfields however also have great potential to be used for urban food production if wise care, caution and good management are used. They are often located in low-income urban areas and can be reclaimed as part of urban regeneration becoming attractive areas or productive enterprises. One way involves various remediation methods in order to recover the unused land and then devote it to urban food production and ecological greening. The Food Policy Council of Portland, Oregon has used compost as part of their remediation initiatives[216]. This path is often far too costly for municipalities, NGOs and especially community groups to do alone without working with each other or another sector. Another method involves innovation and making temporary or permanent use of the brownfields through operations that do not involve using contaminated soil at all – in order to avoid health risks to farmers and urban citizens. This could involve raised beds like those used in Cuba (organoponicos) or enclosed mobile greenhouses or hydroponic operations. In Cuba, areas of rubble and old building sites have been utilized for this purpose. As long as there is enough compost available to create a sizeable growing medium, the possibilities are limited only by one's imagination[217]. In North America there are already fine examples demonstrating that brownfields can be productive areas of food production (**Box 4**, page 192).

This idea is also gaining increased attention from academic research institutions. Rutgers University (NJ) and the Brooklyn Botanic Garden (NY) have teamed up to create the Centre for Urban Restoration Ecology (CURE) whose mission involves efforts to turn abandoned dumps (landfills), brownfields and other blighted landscapes into “urban productive landscapes”. CURE's research includes a Liverpool UK dump, an abandoned Australian mine, and the Staten Island NY landfill (which is the world's largest to date).[218]

d. Assess the possible use of rooftops for urban agriculture.

Green roofs (and as an extension of that rooftop gardens) have been one of the more well studied and occasionally implemented forms of alternative urban greening in North America if not worldwide[219]. Jurisdictions should recognize green roofs as development options to reduce stormwater pollution effects, promote energy efficiency or climate protection (i.e. Cambridge, Massachusetts, Chicago, Los Angeles). Germany - the current leader in using this technology - charges maximum utility fees to owners of conventional roofs to cover stormwater management. Incorporating a green roof reduces the fee by 20-50%. Developers can also use green roofs to partially substitute for open space provisioning[220]. In Tokyo, Japan, any new construction of greater than 10000 square feet must provide 20% of the area as green space. In Portland, green roofs can be used to meet building stormwater pollution legal requirements[221].

There are direct environmental benefits from the simple presence of plants on rooftops (more so during the summer perhaps when crops have been planted) such as increased energy efficiency – possibly around 10-30% based on various studies (including those using green roofs) through altered albedo[222] and countering the urban heat island effect[223]. It should be noted that when this is combined with shading and wind breaking from trees (fruits trees and other types of urban agroforestry), the energy savings could range from 10-50% for cooling and 14-22% for heating depending on the circumstances [224]. Other environmental benefits include producing oxygen, reducing air-borne pollutants (i.e. GHG, VOCs, particulate matter)[225], moisture regulation, increasing stormwater retention[226] and ambient noise[227]. These positive changes to the urban environment have been shown to reduce smog[228], heat-related death[229] and electricity demands from heating-air conditioning as well as improving respiratory health and fertility – especially for vulnerable populations[230]. In cities like Sacramento, California, these greening efforts are estimated to be able to lower its energy costs by ~ $26 million USD/year and reduce peak ozone concentrations by ~6.5%[231]. In Toronto, initial savings of $313 million and $37 million annually are possible through the use of extensive green roofs (i.e. rooftop gardens)[232]. Rooftop gardens have also been known to increase property values and reduce tenant turnover – yet another positive aspect[233].

Rooftop gardens also come with their own set of challenges – primarily concerning[234]:

- The large expense necessary to incorporate a green roof into a new building (and many owners are not interested in payback periods of greater than 5 years). Government could help to lower this expense through favourable financing or tax incentives.
- The large expense of retrofitting an existing rooftop especially if it is sloped. Flat roofs are best however a roof with a minimum pitch of 10-20% is preferred to encourage proper drainage.[235]
- The expense and difficulty of getting insurance coverage[236].
- Access to a rooftop garden for those with mobility issues can be a problem unless there is elevator access.
- The technical difficulties of retrofitting an existing rooftop if the green roof is too heavy. Most roofs only account for snow load and not snow and total green roof weight. An engineer has to analyze the building to determine if its design allows it to support a rooftop garden and snow. Otherwise the building would require structural reinforcement to support the roof. Temporary container rooftop gardens during the summer remain an option, as they can be re-located when winter comes.[237]

The ideal situation would be to integrate green roof design into any new buildings that are constructed in Kingston. There are however businesses in Toronto and elsewhere that both retrofit existing roofs and construct whole new ones - two of which actually focus on rooftop garden designs[238]. Taken on the whole, there seems to be excellent possibilities for local rooftop food production – providing secure and accessible land tenure for urban farmers (since most city activities do not compete for roof space) and it gives citizens another pathway to accessible food and a better environment[239].

e. Assess the possible use of vertical surfaces or structures for urban agriculture.

Vertical surfaces are probably one of the least considered and underused spaces within an urban area. Of the many possible production options, this one may be the most difficult to use without giving into creative imagination and innovative thinking. Urban walls have been mentioned as a potential venue for greening and food production in the literature[240] and there has been little research into actually putting this area to use in recent memory – except perhaps by the Minimum Cost Housing Group out of McGill University[241] and Elevated Landscape Technologies[242]. The direct environmental benefits of vertical crop production are also similar to those of green roofs/rooftop gardens.

Vertical planting columns are additional infrastructure that can be designed into new apartment buildings. Further engineering research however could find a way to create modular units to install onto current apartment buildings especially if low cost or recycled materials are used (or be setup in a fashion similar to fences or trellises – see below). During the growing season, vegetables can be served fresh (i.e. salads, crudités) to save on cooking energy[243]. Living walls are also another new technology that could be used for food production. The living wall concept has been incorporated into the TFPC Urban Agriculture Strategy[244]. Currently, City Farmer in Vancouver, BC is experimenting with living walls as a gardening medium. They used lettuce for a recent trial (which grew very well) and will continue to see how subsequent crops perform over time (**Figure 6**) [245]. In Toronto, at 401 Richmond, vertical gardens designed by Brad Peterson have been recently constructed to complement the existing rooftop garden[246]. Various herbs make ideal candidates for this growing method – i.e. parsley, dill and cilantro.

Trellises[247] can be used with container gardening (i.e. pots, troughs, hanging baskets, tires) in *order to easily utilize existing walls and roofs*. Fences or growing walls, existing or newly built, can also serve as a very easy method to grow more food (increasing potential production area significantly) (**Figure 7**). This is especially true for vine type plants such as peas, beans, tomatoes and grapes for example. This sort of "vertical" production is theoretically very feasible *without advanced or costly infrastructure* especially in the case of external vertical surfaces (though the idea could apply to indoor vertical surfaces given sufficient light conditions). A trellis can be constructed out of existing or recycled materials[248] in and around urban areas and would be a way of utilizing residential external walls. It is certainly also easy to turn the numerous existing fences within Kingston towards food production simply by using pots, polyethylene bags, burlap grain sacks and troughs to avoid contaminated soil. Constructing simple fences with containers in brownfield areas could be useful for turning even heavily polluted brownfields into productive land for certain crops suitable for cultivation in urban areas. Calculating the existing area, possible yield, ecological and economic value offered by fences currently in Kingston could be something that is looked at in the future – fences are not accounted for in the current vertical production estimations nor is there an estimation of how many vertical fences could be effectively placed within a specified horizontal growing area for efficient growth.[249]

f. Assess the possible use of basements for mushroom urban agricultural production.

Using basements to grow organic mushrooms could be is simple to do but runs into issues of cultural acceptance. All it requires is the establishment of incentives, training, extension, education and support to make it a truly viable option in the future – perhaps as a commercial opportunity for small business entrepreneurs. Presently, there are many private enterprises beginning to appear worldwide that make use of unused buildings and parts of buildings (i.e. basements and other 'dark' places) to grow edible mushrooms[250]. From an economic viewpoint, the gourmet mushroom industry is a potentially lucrative market – in the UK for example, over 99% of the demand is met by imports[251]. From a food security viewpoint, mushroom cultivation is a space-confined technology that requires relatively little capital input (therefore cost effective) and could be suitable for the nutritional supplementation and income prospects of low-income families with no land[252] within an urban area. The extra income could help them buy better food[253]. From a health viewpoint, a good variety of mushrooms are an excellent food supplement since they contain minerals and vitamins.

In addition there has been a lot of research into suitable and different varieties which are available and that could be adapted to the local context of Kingston[254]. In Glasgow, Scotland for example there has been a small-scale pilot project to help deprived areas of the city using mushroom production[255]. Nanjing, China and Kampala, Uganda are other locations that are known to grow mushrooms both in and outdoors[256]. Greater Toronto Area statistics have shown that 33% of the 4621 farms in 2000 were linked to greenhouse, equine or *mushroom* farming[257]. The Toronto Food Policy Council also included mushroom operations in its Urban Agriculture Strategy[258]. An innovative not-yet-implemented design thesis by Lang[259] also includes urban mushroom growing in its plan to provide people with education and fresh, seasonal, local foods in San Francisco through the "FoodSpace" concept.

From an environmental viewpoint, ecologically grown mushrooms in unused urban spaces means less intensive agriculture and less extensive land-use. Compost is also a good growing medium or substrate for mushroom production and thus this production form could be yet another reason to support organic waste recycling. In one method, mushrooms can be grown on multi-story stacking shelves using compost from agricultural wastes like straw for example[260]. In addition, rare and wild mushrooms can be grown in order to preserve their existence and provide variety[261] instead of favouring only the most profitable and common oyster and shiitake species.

There may be health concerns with growing mushrooms in one's basement such that it might be best implemented only for areas specifically designed to do so - likely as a commercial operation with proper regulations and inspections to meet a high standard. It may even be possible to design a low cost, low energy device or system to grow mushrooms in one's basement without any health risks and may warrant further study.

23. Promote urban "small plot intensive farming" (SPIN).

This would allow new businesses, labour income and jobs to be created which utilize any sort of untapped space and surplus food similar to what an urban CSA would do. In this case, the urban farmer would seek out and rent land from willing landowners giving them a small share of produce in return - the landowner would not need to pay anything. This is another means of using the large amount of unused backyard space in Kingston for commercial or food security purposes[262].

24. Promote the creation of "farmer-citizen co-operatives".

A system developed in Austria[263] entails peri-urban farmers leasing out sub-plots of land to citizens with adequate transportation who wish to do some farming of their own. It allows individuals to merge traditional horticulture methods with ideas of permaculture[264], sustainable land-use and participatory farming. The farmer acts as an advisor in this scenario. A good local variant of this idea might be Vegetables Unplugged a CSA that operates on Wolfe Island on a portion of land from Windkeeper Sanctuary farm. There are a lot of hobby farms in the peri-urban region of Kingston. Many of these individuals have a small amount of acreage that could be rented out or used for free. These sorts of co-operatives could require a third party agency to help facilitate as not every farmer has time to find suitable horticulturists or vice versa.

25. Promote urban greenhouses that are heated by methane fuel produced in landfills or wastewater treatment plants and excess waste heat from activities such as baking or composting.

Typical greenhouses are very energy intensive and this creates a very large ecological footprint. Using waste heat from other sources can reduce it. Urban greenhouses could use methane gas produced in landfills or from wastewater treatment plants to reduce the amount of energy needed to heat a greenhouse especially through the winter. There are some examples of this thinking. A baker in New York reinforced the roof of his bakery and installed a greenhouse to make use of the excess heat[265]. Growing Power, an urban farm in Milwaukee uses large piles of compost to radiate warmth in their green houses[266].

5.1.5 Policy

26. Integrate inner-city, peri-urban and rural-agriculture considerations into city policy and planning. Agriculture should be integrated into the City's Official Plan (COP), into its brownfield development policy and the urban growth strategy. The interviews indicate that there is no significant support for inner-city agriculture. It is uncertain at this point in time what sort of considerations for rural and peri-urban agriculture is being considered for the COP. Without supportive city policies, there may be no way to access the possible benefits of urban agriculture.

27. Create a framework or process to guide the establishment of urban agriculture.

The lack of a framework or application process, precedent or policy to guide the establishment of community gardens or other urban agriculture initiatives was a problem for new community gardens in Kingston like Sunnyside Garden. The experience of Sunnyside Community garden is a good example of how a framework could avoid delays and frustration for all parties involved. There are good templates or precedents to be found in the US from Providence[267], Detroit[268] and Portland[269] to name a few. The City of Victoria in BC also has a good set of guidelines specific to community gardens that would be useful[270].

28. Specific land tenure should be guaranteed at the outset of a UPA establishment process and should be longer than 5 years.

The case of FRILL Community Garden (page 182) demonstrates the anxiety that can occur from short-term leases. Having land tenure longer than 5 years can provide greater incentives and opportunities to use and maintain a space for urban agriculture.

29. The City should consider usufruct arrangements for putting unused land to productive use.

Municipalities could grant the legal right to use public or private land for urban agriculture as long as it is maintained well. It would greatly facilitate the clean up and use of vacant lots as well as reduce maintenance costs for park space. This sort of arrangement is used successfully in Cuba[271].

30. The City should provide water to support current and future inner-city agricultural operations.

This recommendation mainly applies to community gardens and any future inner-city farming businesses. Water can be one of the highest operating costs for an urban initiative. As the FRILL case study shows (page 182), operating on private land without access to water can make life difficult for gardeners with limited physical ability. The City could provide a friendly service of refilling water storage containers that a community garden might have in situations where water access is limited.

5.1.6 Public Education

31. Create workshops or public education series that train people about urban agriculture, food politics, and job and life skills.

Agencies and NGOs such as Peterborough Public Health and Toronto's FoodShare have created programs that teach people how to cook in collective kitchens and how to grow their own food as a life skill or as a business. People need to understand how easy and convenient it is to prepare fresh food[272]. The City, OPIRG, community NGOs, higher learning institutions, public health and urban farmers could work together to provide these courses for free to the public.

32. Create community gardens, demonstration gardens or another form of urban agriculture on teaching institution grounds.

Having such visible manifestations would provide an area for food and agriculture lessons to occur as well foster continued exposure of students to ideas of where their food comes from. One of the original pioneers for this food and schoolyard education was Alice Waters who started this revolution in the United States[273].

33. Marketing and public outreach on issues of local food, urban and peri-urban agriculture must occur on a regular basis through media outlets.

The possibilities and alternatives that urban and peri-urban agriculture can provide need to be prominently communicated on a regular basis to citizens from every walk of life through newspapers, radio and television. Having a regular radio show on local stations that discusses local food, urban, peri-urban and rural agriculture has been a tried and true method of raising awareness and creating a successful local food movement in western Massachusetts and urban agriculture movement in North West Sydney, Australia.[274]

There are also additional media sources that local citizens could be made aware of in terms of learning about local food issues. These include *Deconstructing Dinner* - a weekly radio program discussing the impacts of our food choices out of British Columbia[275], BBC Radio 4's Food Programme[276] - both available online and to a lesser extent the Food Channel.

34. Establish an agriculture extension and research service that also covers urban agriculture in its mandate.

The City, research institutions and other relevant stakeholders could establish an agricultural extension centre for the Kingston region that would deal with applied research for urban, peri-urban and rural agriculture. It would disseminate information to citizens, new farmers and old farmers through outreach, classroom and online courses as well as training sessions. Such a service would help to facilitate the adoption of ecological agriculture practices.[277] There are numerous extension services in the United States that could serve as an example.

35. Create a Food Policy Council.

Such a council would perform research on food issues, facilitate public involvement, support local food projects, jump start programs and bring the concerns of all relevant stakeholders from across departments and walks of life to the table. Open discussions of urban and rural agriculture, community, health and food security would be some of the topics that would be addressed. This sort of council and its coordinators need to be given free reign to act and speak on issues that concern the community and food sovereignty. Work is already underway by the *Food Down the Road* initiative to make this food policy council or its equivalent a reality (**Box 5**, page 192).

5.2 Limitations

One of the aims of this study was to create a suitable foundation for further academic and action research. It was not meant to be exhaustive in its scope or conclusions. With that in mind, there are a few limitations of this study that should be mentioned.

The estimation of ecosystem service values are based on price valuation from a human-centric viewpoint which fluctuate and likely underestimates the true or inherent value of these services to the Kingston environment. Ecosystem services become more valuable as they become scarce which is often another problem when using human valuation methods.[278]

The health costs calculated for heart disease, diabetes and cancer are probably underestimates. Prevalence data only exists up to 2005. The direct and indirect healthcare costs were based on 1998 data from Health Canada[279] and are likely higher nearly a decade later due to rising medical expenses. The incidence of diabetes and cancer are known to be increasing as was explained in Chapter 4 and thus the estimates given here are a snapshot in time - they will increase as the population ages and these diseases occur more frequently. The health cost estimates do not reflect psychosocial costs or impacts on quality of life in terms of poor self-image, depression or other mental ailments that might result from the diseases linked to poor diet.

The method of determining the area in the model does not account for all possible factors. The main purpose is to provide an indication of what is possible. Considering the space requirements for equipment and infrastructure, it is unlikely that the maximum possible area can be used in every case of urban cultivation. It is possible however to achieve some fraction of the urban agriculture potential that has been demonstrated in this study.

5.3 Future Directions

The qualitative research indicates that citizens are aware of the aesthetic, educational and direct environmental benefits of urban and peri-urban agriculture. The quantitative modeling addressed issues of health, food security and economics that did not appear to be prominent in the minds of the study's participants. Both aspects of the research show us that there is potential for Kingston to utilize urban agriculture to achieve environmental, community, health and economic sustainability. This study also points out that food security in terms of fresh fruits and vegetables is achievable from the production side.

There are some future research needs that should be addressed that build on or enhance this study.

Urban and peri-urban agriculture may provide other ecosystem services other than soil formation, nitrogen fixation and waste recycling. For example, peri-urban farms may be large enough to provide habitat/refugia ecosystem services. If there are other services, research will be required to determine what they are and how it can be factored into decision-making. Soil fertility is an integral part of any form of urban agriculture. Food waste can be a key component in addressing soil fertility in the long term. If food waste were used as a compost input would it increase yield? As well, the number of urban and peri-urban farmers who could be supported by this valuable resource both now and in the future needs to be evaluated.

Ecological footprint analysis of the Kingston food system should be undertaken to determine which parts of the system are most energy intensive. A study of food-miles would be one part of this analysis. My previous food-miles work[280] provides a good start to examining the environmental impact of Kingston food system however it only looked at the impacts from farm gate to point of sale. Other segments in the food chain (like production or processing) must be assessed. Having this knowledge will be a key step in finding ways to reduce the impact of the food system in an incremental manner since an abrupt shift to ecological agriculture practices is unrealistic.

Further study is needed to determine if community gardens improve the quality of life in a neighbourhood as indicated by increased rent and mortgage values in the St. Louis Whitmire Study[281]. This could require a local study using contingent valuation methodology. More research is needed into the economic valuation of nutrition, wellness and prevention to improve future health analyses. How much does a dollar spent on nutrition translate into healthcare savings? The monetary value of mental health cost savings that urban agriculture should also be examined i.e. depression or stress prevention or relief. A study of the health costs of diet related diseases or undertaking research into the economic value of nutritional prevention of diseases in the Kingston context would be useful in refining the health estimations. Positive economic externalities in the quantitative analysis concerned only the local multiplier effect. The social and economic potential of urban and peri-urban agri-tourism in the Kingston region has yet to be evaluated.

More research is required to understand the distinct possibilities and needs of peri-urban agriculture and inner-city urban agriculture. This study only begins to examine the potential of these spatial regions. There may be a pressing need to assess the level of bioenergy, pharmaceutical or nutraceuticals crop production that may occur in the Kingston peri-urban region in the future - especially corn-based ethanol production. An increased substitution of energy, pharmaceutical drugs or genetically modified nutrient delivering crops instead of food for human consumption could undermine some aspects of Kingston's future food security.

Finally, a more rigorous survey of the Kingston population using random sampling would be useful for reinforcing the results that were found for citizens. Objective and measurable indicators of progress need to be identified and used for evaluation of any urban agriculture activities that occur in the City.

5.4 Conclusions

Urban and peri-urban agriculture have been shown to have a great deal to contribute in terms of achieving sustainability in the Kingston region. Well-managed UPA provides ecosystem services as well as reducing greenhouse gases from food production and transport by up to 14000 tonnes or more. Citizens demonstrated awareness of these direct benefits on the environment. UPA has value in strengthening the social bonds and feeling of community that exists in Kingston. Urban and peri-urban food production also provides a potential avenue to meet 76% or more of fresh fruit and vegetable needs to provide better health and self-sufficiency for citizens. Agriculture in urban and peri-urban regions can enhance Kingston’s future economic prosperity through a local economic multiplier effect that could be as high as $730 million.

Are there challenges? Absolutely! Limited space perceptions, limited resources and limited knowledge about the importance of food and agriculture all present barriers to the establishment of urban and peri-urban agriculture. There are ways for the determined to overcome them as was outlined in this chapter. This is a time period of crises, scarcity and change at global, regional and local levels. Solutions like urban agriculture may play an increasingly important role in the future for positive cultural change and adapting to the new state of affairs resulting from climate change and degraded natural resources.

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Appendix A
Project Method Summary

This was the procedure originally used for the questionnaires and interviews with any changes made being outlined on pages 11 and 108. The questions from the actual questionnaires are included for the citizen and local community advocate category. In the case of the interviews (with all other categories), the questions listed afterwards were simply used as guidelines – the interviews themselves were very open and unstructured. There was a strenuous effort however to obtain quantitative information for the estimation tool that I created for this study – mostly about the size of plots, amount produced, how much was eaten, etc. Ethics approval from GREB was obtained before the survey and interviews were conducted.

1. Citizens:

Information collection goal: This group of participants will be surveyed to determine the level of support for, and barriers to using UPA.

Participant selection process: These individuals will be selected at the Kingston farmers' market and the Kingston bus terminal. Individuals at grocery retail stores will only be solicited as last resort if store managers grant permission. In all cases they will be asked if they wish to participate in the survey. They will be provided a letter of information if they agree.

Information gathering process: These individuals will be interviewed using a short questionnaire. We estimate that the whole survey will take 5-15 minutes to answer.

Actual Questions from the Citizen Questionnaires

Do you, or does anyone in your household grow food (i.e. vegetables, fruit, berries, nuts or herbs) in your yard, on your balcony or in a community garden? Who does most of the gardening in your household? [List/Point Form]

If you do grow food, do you have any specific reasons for doing so (list a few)? If you don't, what are your reasons (list a few)? [List/Point Form]

How much food do you usually grow? (Please estimate/guess the lbs)

What's the rough value of the vegetables you've grown? (Estimate in $)

What's the area of your garden (Please estimate in m^2 or ft^2)?

What percentage (%) of the vegetables you eat is grown from your garden?

Do you use fertilizers?

Do you use pesticides?

Would you be interested in seeing Kingston have more gardens (i.e. backyard/ community/pot/roof gardens) for growing food? Any particular reasons? [List/Point Form]

How or in what ways do you see urban agriculture, urban gardening (i.e. community, backyard, etc.) and other ways of growing food in the cities as helping Kingston improve the environment? [List/Point Form]

2. Urban Producers:

Information collection goal: We need to survey urban producers to determine the current land usage and sales (or size of operation), and also any other potential uses of their space in the future.

Participant selection process: Urban producers are defined for purposes of this study as anyone producing vegetable and fruit products at a commercial or community-scale. The producers that will be contacted include:

5 community gardens

1 commercial urban producer

2 penitentiary institutions: there was a failure to contact the agricultural manager for one penitentiary so an estimation of its operation size was based on what was learned from the other and information from the Planning and Development department[282] (City of Kingston 2000).

1 ecological preservation group (non-profit)

Producers will be contacted by phone, and asked if they would participate in the research.

Information gathering process: Producers will be interviewed in person. We will contact up to 20 producers to ask them about their operations in terms of acreage/size and the vegetables they grow. We will also ask them how they generate income if any. A letter of information will be provided when the interview occurs.

Possible Questions for Urban Producer Interviews

How much food do you usually grow? (Please estimate/guess the lbs)

What's the rough value of the vegetables you've grown? (Estimate in $)

How much land is devoted to growing food? (Estimate/guess in terms of m^2 or ft^2)

Do you use fertilizers?

Do you use pesticides?

Who does most of the work of growing these vegetables?

What sort of vegetables, medicines or other plants do you grow?

Do you have any specific reasons for growing vegetables and fruits or gardening?

How do you grow these vegetables? (What sort of inputs, methods are used?)

What sort of difficulties or problems do you have with growing vegetables in the city? Describe/List.

How or in what ways do you see urban agriculture, urban gardening (i.e. community, backyard, etc.) and other ways of growing food in the cities as helping Kingston (how might you rank these if at all?):

Improve environment?

Improve community, city and society in general?

Improve economy?

Improve nutrition and overall health?

What sort of plans and policies should Kingston have regarding urban agriculture, gardening and growing food (vegetables, fruits, nuts, berries) inside the city limits currently (personal or commercial) or in the future? Especially in terms of environmental benefits or impacts?

Would you be interested in seeing Kingston have more gardens (.e. backyard/ community/pot/roof gardens) for growing food? Any particular reasons?

Do you have any additional suggestions, comments or ideas about urban agriculture, city gardening or how we can grow more vegetables, fruits inside of a city?

3. City Officials:

Information collection goal: This group of participants (i.e. politicians, officials, bureaucrats, city planners, etc.) will be surveyed to determine the level of support for including urban agriculture into Kingston's design and what sort of policies are currently in place or might be possible in the future.

Participant selection process: Politicians, bureaucrats and city officials from departments that are linked to public health, environment, city planning and economics will be contacted (in particular Community Development Services, Growth and Sustainability, Kingston Economic Development Corporation, Planning and Development Services). Officials will be contacted by phone, and asked if they would participate in the research.

Information gathering process: City officials will be interviewed in person. We will contact up to 8 local decision-makers and ask about their views on UPA and its role in the city. A letter of information will be provided when the interview occurs.

Possible Questions for City Official Interviews

What is your general view on the place and role of urban agriculture, urban gardening and food production in the city? What comes to mind?

How or in what ways do you see urban agriculture, urban gardening (i.e. community, backyard, etc.) and other ways of growing food in the cities as helping Kingston (how might you rank these if at all?):

Improve environment?

Improve community, city and society in general?

Improve economy?

Improve nutrition and overall health?

What sort of plans and policies should Kingston have regarding urban agriculture, gardening and growing food (vegetables, fruits, nuts, berries) inside the city limits currently (personal or commercial) or in the future? Especially in terms of environmental benefits or impacts?

What is your view on:

having urban planners integrate urban agriculture into Kingston development? i.e. rooftop gardens, integrating garden spaces into development projects or promoting commercial gardening. (Especially in terms of environmental improvement?)

promoting the use of (in some form or another) vacant, underused, derelict lands and/or brownfields for self-contained food growing operations (mobile hydroponic businesses/greenhouse/growing operations – especially raised beds)?

having Kingston authorities find ways to provide subsidies, incentives or credit to promote urban agriculture in Kingston? i.e. rooftop gardens, integrating garden spaces into development projects or promoting commercial gardening.

the major problems of allowing food production (growing vegetables, fruit, nuts and berries) in a city like Kingston to occur?

Do you have any suggestions, comments or ideas about urban agriculture, city gardening or how we can grow more vegetables, fruits inside of a city?

4. Local Community Advocates:

Information collection goal: This group of participants will be surveyed to determine the level of support for urban agriculture in the Kingston urban environment as well as their ideas on the challenges urban agriculture faces.

Participant selection process: We will contact various knowledgeable information sources in the advocate community who will refer other likely candidates who wish to be surveyed.

Information gathering process: The principal investigator will survey the contacted individuals, providing a letter of information, asking the questions from the survey and allowing the individual to make a response that would be recorded. We will interview up to 10 such advocates. We estimate that the whole survey will take 5-15 minutes to answer.

Actual Questions from the Local Community Advocate Questionnaires

Would you be interested in seeing Kingston have more gardens (i.e. backyard/ community/pot/roof gardens) for growing food? Any particular reasons?

How important is it for people to grow their own vegetables and fruits?

How or in what ways do you see urban agriculture, urban gardening (i.e. community, backyard, etc.) and other ways of growing food in the cities as helping Kingston improve the environment?

What do you think are the major problems of growing vegetables and fruit in a city like Kingston?

Do you have any suggestions, comments or ideas about urban agriculture, city gardening or how we can grow more vegetables, fruits inside of a city?

5. Urban Planners:

Information collection goal: This group of participants will be surveyed to determine the level of support for urban agriculture and their views on its integration into the Kingston urban landscape as well as related policies.

Participant selection process: Urban planners from the School of Urban and Regional Planning (SURP) from Queen's University or who are not working for the City of Kingston (but reside in Kingston) will be interviewed. Planners will be contacted by phone, and asked if they would participate in the research by the principal investigator. A letter of information will be provided.

Information gathering process: Planners will be interviewed in person. We will contact up to 5 urban planners if possible and ask about their views on the use of UPA and its possible integration into city planning.

Possible Questions for Urban Planner Interviews

How do you view the place and role of urban agriculture, urban gardening and food production in the city? What comes to mind?

How or in what ways do you see urban agriculture, urban gardening (i.e. community, backyard, etc.) and other ways of growing food in the cities as helping Kingston (how might you rank these if at all?):

Improve environment?

Improve community, city and society in general?

Improve economy?

Improve nutrition and overall health?

What is your view on:

promoting the use of (in some form or another) vacant lands, underused, derelict and/or brownfields for self-contained food growing operations (mobile hydroponic businesses/greenhouse/growing operations – especially raised beds)?

the sort of plans and policies should Kingston have regarding urban agriculture, gardening and growing food (vegetables, fruits, nuts, berries) inside the city limits currently (personal or commercial) or in the future? Especially in terms of environmental benefits or impacts?

What is your view on:

having urban planners integrate urban agriculture into Kingston development? i.e. rooftop gardens, integrating garden spaces into development projects or promoting commercial gardening. (Especially in terms of environmental improvement?)

having the city authorities find ways to provide subsidies, incentives or credit to promote urban agriculture in Kingston? i.e. rooftop gardens, integrating garden spaces into development projects or promoting commercial gardening.

the major problems of growing vegetables and fruit in a city like Kingston?

Do you have any additional suggestions or ideas about urban agriculture, city gardening or how we can grow more vegetables, fruits inside of a city?

6. Case Studies:

Information collection goal: The goal of the case studies is to gain a more detailed look at groups directly involved in urban agriculture at a community grassroots level. We will examine their past (who started it, why and how? Successes and failures.), present situation (membership, current challenges) and future plans (what do they see their role to be? What might be future challenges?). We will also ask them in far more detail (than the urban producer interviews) about their perceptions of urban agriculture especially in terms of environment as well as on policies and practices and its place in Kingston.

We will also document and analyze any successes and challenges these groups encounter over the summer growing season (2006) in order to gain a better understanding of how urban growing and planning activities occur within the city environment.

Participant selection process: Detailed cases studies on the FRILL (Friends Revitalizing Industrial Land Lovingly) and Sunnyside community gardens will be undertaken.

Information gathering process: We will contact and interview various members of the selected community garden groups (Friends Revitalizing Industrial Land Lovingly *(FRILL)* and Sunnyside community garden). The principal investigator will make contact in all cases and a letter of information and consent will be provided. We will interview at most 3 individuals from each community garden group.

Possible Questions for the Case Study Interviews

Past

Who started the garden?

Why was the garden started? What were the reasons?

How did it all begin?

What has the community garden done successfully so far?

What has the community garden failed to achieve?

Present

How many members do you have?

What is the general background and composition of your members in terms of gender, ethnicity and age?

What is the general background and composition of your members in terms of level of knowledge about gardening or agriculture?

What are the current obstacles and challenges to practicing urban agriculture in Kingston? (Especially environmental ones)

Production

What sort of vegetables or fruits does the garden grow in general?

Approximately how much food (vegetables, fruits) is produced by the garden in a growing season?

How much land is devoted to production in terms of size?

Does the garden produce any ornamental plant products? Estimate the amount.

Does the garden produce any medicinal plant products? Estimate the amount.

Are chemical pesticides or fertilizers used?

What is the state of the land used for production?

What sort of inputs is used during production?

Future

What is the future plan for the garden?

What are the most important things that the community garden should do in the future?

What does the garden intend to do to overcome its current obstacles or challenges and to proceed with its plan? (Especially environmental ones)

Views

What are your feelings about urban agriculture and/or community gardening in general?

Why and how important is it to you to grow vegetables and fruits for yourself and/or for your community and/or for the environment around you?

How or in what ways do you see urban agriculture, urban gardening (community or backyard gardening) and other ways of growing food in cities like Kingston as helping the politics, society, economy, health and especially in relation to the environment?

How do you see urban agriculture as helping or strengthening the community? How might this influence environmental stewardship?

Do you have any suggestions, comments or ideas about urban agriculture, city gardening, environmental impacts or how we can grow more vegetables, fruits inside of a city?

Appendix B
Methodology Expanded

In this appendix the goal is to explain the processes and fine details not covered in Chapter 2: Methodology and to give sample calculations. The current situation in the study area is discussed in terms of geography, demographics, production capacity and economics. The interview and survey process is then briefly outlined (see 95 for the original procedure). Following that is an explanation on estimating the value of urban agriculture in Kingston through the quantitative model.

➢ Study Area

▪ Description

Urbanization and Land Use: The Canadian Shield, which is characterized by thin soil with rocky outcroppings making basic rural and peri-urban agriculture difficult (though not impossible) in the land surrounding the City of Kingston[283]. In amalgamated Kingston, construction and building has been steadily increasing since the 1990s. In 2002, total building permits jumped by nearly 100% from approximately $120 million to $230 million. During 2002-2003, land sales were at their highest with 65 acres of land being sold for various developments. Many of the larger industrial parks are being considered for development while its potential for temporary UPA remains untapped. (Also see **Figure 3** for a city map)

Population demographics: Kingston's population[284] has grown from 146838 in 1996 to 152358 in 2006[285]. This follows similar projections for other cities and towns within the Ontario region[286]. Visible minorities represent 5% of the population[287].

Employment demographics: According to the 2001 Census, Kingston CMA has a workforce of 74920 people. The employment rate (61%) is only 1-2% below the provincial and national average and unemployment (~7%) is identical to the provincial and national averages. The top employers are institutions and food retail-service sectors in Kingston. Agriculture and other resource-based industries employ only 1590 people (500 women), which make up 2% of Kingston's total labour force[288].

Income demographics: The median family income in Kingston was $58413 for all census families in 2001, which is lower than the Ontario average and higher than the Canadian average. The median household income of $47979 also followed a similar trend. The average household expenditure for food was $6552 or 10.93%[289] of an average household income of $59964[290]. Unfortunately, these statistics do not accurately portray some of the food security and low-income issues within Kingston[291].

- **Production Capacity**

At a national level, Canada has moved away from direct farm sales to an agri-food system. Meanwhile, traditional rural agriculture has remained on the decline while retail sectors firmly dominate the commodity chains, taking the majority of profits from the other players in the system[292]. The food system components and interactions are no longer confined to rural areas – it has expanded into urbanized areas[293]. This indicates a potential adaptive use of UPA to partly compensate for loss in rural food production or to complement what still exists[294].

Changes to the rural and peri-urban areas around Kingston mostly mirrors what is occurring nationally. A vicious cycle has ensued whereby economic development has focused on service and other sectors (especially food processing and retail) while permitting supposedly "futureless" or "hopeless" rural or peri-urban areas to be further developed and urbanized[295]. It is estimated that farmers within Canada now have a net realized annual income of -$10000 to -$20000 CDN[296]. Essentially farmers have been losing money and subsidizing food production out of their own pockets since the 1980s due to the current skewed global economic system that is currently in place[297]. Ontario and even the Kingston Region is no exception with regards to the impacts[298]. The rural and peri-urban populations have been forced to take on non-farm jobs, which may have fostered some uncertain level of migration to urban areas[299] and perhaps accelerating urban sprawl in a continuous, self-reinforcing cycle in some communities.

The Kingston region has a higher proportion devoted to intensive crop and livestock production (though it has declined somewhat in recent years) than more northerly areas of the province[300]. There has also been a rise in specialty agriculture sectors (in parallel with consumer demand) as evidenced by products such as maple syrup, jams and preserves at the Kingston Farmers' Market demonstrating that expanded opportunities for urban agriculture are possible[301 302].

➢ Questionnaires and Interviews

There were five main groups of participants who were asked about their views, knowledge and experience with regards to the present situation of urban agriculture in Kingston. The details and methods of arranging these interviews are presented on pages 11 and 95. The chosen groups were:

▪ Urban Citizens

During the course of the study, 139 citizens were asked about their current views and experiences of growing food in cities. The rapid and random questionnaires were held at the Kingston Farmers' Market and the bus terminal located at the former Kingston Centre outside of the Loblaws supermarket. The two different areas were used to get a more representative sample of the perspectives of Kingston citizens.

In addition to perceptions and experiences with regards to urban agriculture, I tried to collect information on the size of any garden spaces used as well as the amount yielded. Exact yield data however was too difficult to obtain, as horticultural minded citizens did not keep track of how much they grew – often just eating it or giving it away. The garden space size is used in a preliminary estimate of the amount of UPA currently going on and to predict what sort of potential amount could occur in the future. Since it is a preliminary action, statistical accuracy was not seen as being vital at the present time and would be a future goal in further research into urban agriculture in Kingston. The main point was to give an *indication* both in terms of perceptions and an estimated value of UPA.

- **Urban Producers**

Nine urban producers were interviewed to get their views and experiences on UPA and information on their operation size in order to estimate current economic UPA value in Kingston.

The following urban agricultural producers were studied:

5 community gardens

1 commercial urban producer

2 penitentiary institutions: there was a failure to contact the agricultural manager for one penitentiary so an estimation of its operation size was based on what was learned from the other and information from the Planning and Development department[303 304].

1 ecological preservation group (non-profit)

This list differed from the original project method summary since it included commercial UPA enterprises and the penitentiary operations. No inmates of the penitentiaries were interviewed due to ethic approval challenges – only the institutional manager for the agricultural operations of one of the institutions was questioned about his operations over the phone. An in person interview was not held in that case due to the difficulty of arranging one. Barriefield Rock Garden Project was left out since it was exclusively ornamental agriculture and this study's focus was mainly on food and vegetable producing operations. Friends Restoring Industrial Land Lovingly (FRILL) and Sunnyside Community Garden were also urban producers but were left for later as detailed case studies. There were indications of private 'communal' gardens available to apartment residents in some cases and these were not included due to a difficulty in finding or contacting them all.

- **City Officials**

Six city officials were interviewed during the study. One was part of the Kingston Economic Development Corporation (KEDCO) (which is separate from the official city government). Two of the officials interviewed were part of the Planning and Development department in the Community Development

Services branch of the city government (CDS). Their views were considered particularly important since urban agriculture could be an integral element of land-use planning. Where any of them are cited directly they will all be referred to as city officials.

- **Local Community Advocates**

Five local environment and community advocates were surveyed to find out what opinions and beliefs they held regarding the importance of and challenges to urban agriculture that the everyday citizen or stakeholder might never contemplate or have experienced.

- **Urban Planners**

Only 1 urban planner from the Queen's Urban and Regional Planning department (SURP) chose to be interviewed.

- **Case Studies**

This involved a detailed study of two of the community gardens within the Kingston area that were nearest the downtown area and most accessible to *any* citizen relative to the other existing gardens (see page 95). Two of the main planning representatives behind the Sunnyside Community Garden initiative were consulted. In the case of FRILL Community Garden, the primary investigator directly engaged in the garden's activities, events and planning sessions – gaining first hand experience as well as contributing positively to the initiative. The production information and data for FRILL Community Garden was also included in the quantitative analysis of urban producers.

➢ Quantitative Model: Estimating the Value of Urban Agriculture

The purpose of this part of the study was to provide a tangible estimation of the current production value and quantify the resulting direct and indirect benefits of urban and peri-urban agriculture. First the possible economic value of vegetables, fruits and herbs were estimated for the current situation.

The information below is organized into four broad sections. The first deals with scenario constants such as yield, produce price and other considerations. The second section talks about the model's factors and why they were selected. The third section shows how I calculated area, yield and equivalent economic production value for different urban spaces. The fourth section outlines how I calculated the additional external benefits of UPA above and beyond yield or production value. The benefits in the fourth section include environmental, food security, health and economic dimensions of urban agriculture.

- **Scenario Constants and Other Considerations**

In this section, I state the produce price used and discuss the influence of the seasons on urban agriculture. I then show how I determined the yield for conventional chemical and organic agriculture.

1. Produce Price

For the model all produce was valued at the 2003 average world wholesale value of $1.97 CDN/kg for conventional produce [305]. It is well known that organic produce is generally more expensive than conventionally grown crops – using the lower value however allows for a better comparison. The reason an average value was used was to simplify the process of calculating the economic value. It would have been an enormous amount of work to determine the average price for every possible fruit and vegetable while accounting for day-to-day market fluctuations.

2. Seasonality

The typical growing season was assumed to be around 6 months (May to October). Innovative growing methods such as those used in St. Petersburg, Russia[306] have demonstrated that the growing season can be extended throughout the winter depending on creative designs, the temperature for the region and what areas are used (i.e. basements of apartment buildings for example). Other examples include the efficient low energy, passively heated greenhouses of David Cohlmeyer and Cookstown Greens (GTA)[307] that runs from April to November. In New York, there is a bakery that recycles its waste heat for the greenhouse on its reinforced roof[308]. Michigan (USA) has unheated CSA "hoop houses" that cultivate FFV for 48 weeks per year[309] while Milwaukee, Wisconsin (USA) is home to Growing Power, an urban farm capable of aquaponic and innovative cultivation methods nearly year round[310]. Research and modeling indicates that the climate may grow progressively milder in Canada, which may extend the growing season in the long term with a resulting increase in yields as long as there is some way to mitigate unforeseen negative weather fluctuations (some estimates point to +80-90% yield)[311]. Light availability is an aspect however that has to be considered. It is assumed that even if higher temperature conditions were to occur, the amount of light would still remain a constant limiting factor on the amount of growth that could occur and the potential to grow year round. There is a 4-6 week period where there is insufficient light for plant growth (from mid December to mid January). Some farmers are able to compensate by growing enough produce in large enough quantities before this light deficiency period to meet demand during this time. Another way to do compensate would be to use artificial lighting. That can be energy intensive however.

3. Yield

I used an average based on various sources to calculate a value for yields. This value would be used as a constant in calculations for food security and economic production value. I used a blend of organic and conventional yields from North American locations in the same latitudinal band as Kingston for the calculations. The organic yield is 4.6 kg/m^2 [312]. The current commercial yield for non-ecologically grown produce in Ontario is 1.2 kg/m^2. This was calculated for the present situation using information from OPVG[313]. Although urban agriculture yields using ecological methods can range from 5 to 20 times that of conventional industrial agriculture systems or 10-15 times conventional depending on the situation and technologies used. This increased productivity however was not factored into my model.[314]

4. *Determining the Yield.*

The yield for conventional chemical agriculture is calculated first. The yield for organic or ecological agriculture follows.

Kingston

Co-ordinates

Latitude: 44°13'53.54"N

Longitude: 76°28'45.77"W

5. Calculating the Conventional Yield

From OPVG (2004):

Here I explain how I calculated an average conventional yield for Ontario agriculture. The data for this originates from the Ontario Processors and Vegetable Growers. Information was only available for the years 2001 - 2005, was voluntarily disclosed by growers and for the following varieties: green/wax/romano beans, green peas, sweet corn and tomatoes. The only case where information was not disclosed was for 2004 and 2005 for the beans.

Information on tonnage and acreage was used to calculate a yield in tonnes/ha/year. It was then converted to kg/m^2/year. This was done for each year available for each type of crop. Then it was a simple matter to take a median measure of all of these yields (kg/m^2/year) to produce a yield for 1 year (kg/m^2). I will call this value CY2.

A median measure was selected over an average because the average of 3.15 kg/m^2 had a standard deviation of +/- 3.8 – the minimum value was 0.36 kg/m^2 and the maximum value was 9.79 kg/m^2. The reason for this skew was due to the high yield for tomatoes and the low yield for all other crops. For this reason I opted to use the median which simply chooses the yield nearest to the centre of the distribution.

then CY2

= [Yield from Conventional Agriculture for a Single Year (kg/m^2)]

= median (Y1, Y2, Y3, ..., Yn)

= 1.2 kg/m^2

= ~1.2 kg/m^2

6. Calculating the Organic Yield

I calculated an approximate organic yield from three documents by Cleveland (1997) and Bellows *et al.* (2005).

3.1.3.a.ii.1. From Cleveland (1997):

This article stated that the general ecological growing productivity for the United States was between 1.2-6.5 kg/m^2. I used the average of those 2 endpoints.

where OY1 = [Organic Yield #1 (kg/m^2)] = ~3.85 kg/m^2

3.1.3.a.ii.2. From Bellows *et al.* (2005):

In this source, it was stated that community gardens in Newark, NJ could produce a large amount of fresh vegetables. In one year, 12.1407 ha of community gardens produced $915000 USD worth of produce. In this case I only had an area and an economic production value to work with so I had to do some reverse calculations - converting an economic production value into a yield. I selected this source because Newark was also in the same latitude band as Kingston. It is assumed that the yield represents a single growing season.

Co-ordinates

Latitude: 40°43'54.98"N

Longitude: 74°10'26.94"W

OY2 = [Organic Yield #2 (kg/m^2)]

= D / f / a

where D =

[Value of Inner-City Community Garden Production in Newark, NJ ($CDN)]

= b * c

= $1,029,466.50 CDN of inner-city Community Garden production in Newark, NJ

where b = [10 Aug 2006 US to Canadian Exchange Rate] = $1.1251 CDN/$1 USD

where c = [Economic Production Value of Inner-City Community Garden Production in Newark, NJ ($USD)] = $915,000.00 USD

where f =

= [Average Price of Produce ($CDN/kg)]

= $1.97 CDN/kg {see Produce Price section on page 111}

where a =

[Area of Inner-City Community Garden Production in Newark, NJ (m^2)]

= [12.1407 ha] * [10000 m^2/ha]

= 121407 m^2

then OY2 =

[Organic Yield (kg/m^2)]

= D / f / a

= [$1,029,466.50 CDN] / [$1.97 CDN/kg] / [121407 m^2]

= 4.31 kg/m^2

3.1.3.a.ii.4. Final Calculation

The final calculation for the organic yield was:

[Average Organic Yield (kg/m^2)]

= average (OY1,OY2)

= 4.1 kg/m^2

= ~4.1 kg/m^2

The standard deviation was +/- 0.3 kg/m^2.

▪ Scenario Factors

This section outlines the reason why the five following factors were considered in the quantitative model (see page 19). The only factor that was variable in this part of the modeling exercise was the percentage of food that remains local. All other factors were held constant. The percentage of local food was changed to demonstrate the impact of growing more food for local consumption through UPA. There may well be many more factors that need to be included that have not been considered. Further research will be required to improve the model. (Table 9)

Table 9. The five factors (percentage of local food, percentage of ecological agriculture, percentage of food used for human consumption and percentage of food waste) in the model in four different scenarios with percentage values for each scenario.

Scenario	Increased Area Relative to 2006-2007 (%)	Percentage of Food That Remains Local (%)	Percentage of Ecological Agriculture (%)	Percentage of Food Used for Human Consumption (Not Animal Feed) (%)	Percentage of Food Waste (%)
1	0	7	8.3	18	32
2	0	25	8.3	18	32
3	0	50	8.3	18	32
4	0	100	8.3	18	32

Increased Area Relative to 2006-2007: This factor was built into the model to allow changes in the amount of area used for urban and peri-urban production relative to the current situation in 2006-2007. This factor is for future consideration by other researchers only and was not changed in the modeling exercise.

Percentage of Food That Remains Local: The percentage of food that remains for local consumption influences health outcomes, food security (edibles that could be used to feed vulnerable local populations are instead shipped elsewhere) and economic prosperity. In the citizen backyard and community garden situations, it was assumed that all food would remain for local consumption and was unaffected by changes in this factor. In the peri-urban farming situation, a value of 7% was used in calculations to reflect the percentage of food that remains for local Kingston consumption according to a recent agricultural study[315]. Changes in this factor as seen in Table 9 affected only peri-urban farming.

Percentage of Ecologically Sustainable Agriculture: This factor was included because current chemical intensive agriculture does not increase the provision of ecosystem services (physical or social). In fact it degrades these vital support services as explained in previous chapters. Also ecological agriculture appears to have higher yields than chemically aided agriculture[316], which may in turn influence the possible percentage of food that contributes to better health and food security. From the questionnaires, at least 76% of citizens used ecologically friendly growing methods (n = 39). In this study that means no chemicals. The value of 76% was used to adjust citizen backyard and community garden calculations to reflect the percentage of ecological agriculture being practiced. Statistics Canada[317] found that the proportion of farms selling uncertified, transitional or certified organic products in all Canadian CMAs was 8.3%. This 8.3% value was used for the peri-urban situation where it would apply.

Percentage Used For Human Consumption (Not Animal Feed): This relates to the percentage of food used for human consumption as opposed to being used as feed for livestock. In the citizen backyard and community garden situation it was assumed that 100% of any food grown would be used for human consumption. According to Statistics Canada, the amount of grains and corn being used for feed is ~70%. Only 18% of grains and corn are being used for human consumption. The remaining 12% of supply is lost during handling. The value of 18% was used for peri-urban agriculture[318].

Percentage of Food Waste: This factor was selected since one third of edible food is typically wasted in North America and the UK[319]. This factor is likely to be greatly influenced by education and fostering a greater sense of value about food and agriculture. After all, North Americans spend only 10% of their incomes on food - we have the cheapest food in the world and we're paying for it in other ways. A value of 32% was used for all urban and peri-urban calculations.

- **Production Analyses**

This section deals with several parts of the model. The first part summarizes the calculation procedure for the total area, yield and equivalent economic production value for the present situation in 2006-07. The total area, yield and production value remained constant throughout the four scenarios when the percentage of local food increased. The second section show calculations for area utilized, yield and equivalent economic production value for citizen backyards and urban producers. In this study, citizens were considered as individuals or families who grew food on their own in their yards for mostly personal consumption. Urban producers were considered to be any individual or group of citizens who grew food in quantities greater than what a single household would produce for mostly personal consumption. The third part shows how I calculated the maximum potential area useable, yield and equivalent economic production value for parks, brownfields, rooftops, vertical walls and basements if only ecological agriculture methods are used.

- **Area**

The total area of urban agriculture in 2006-07 was the sum of inner-city (citizen backyards, community gardens) and peri-urban land being used for production (Table 10). The individual calculations that comprise the total area are explained in the remaining sections after page 120. There are several calculations directly linked to area. Soil formation and nitrogen fixation ecosystem service calculations (page 143) and the food security land analysis on page 151 were all dependent on area. All yields and equivalent economic production values were ultimately derived from area (see 119 and 120).

Table 10. The 2006-07 estimated area of fresh fruit and vegetable UPA in Kingston.

		Area (ha)	Area (acres)
Inner-City Urban Agriculture	Citizen	14	35
	Producer	1	3
	Sub-Total	*15*	*38*
Peri-urban Agriculture	*Total*	*8,600*	*21,000*
Total		**~8,600**	**~21,000**

- **Yield**

The total yield of urban agriculture in 2006-07 was the sum of inner-city (citizen backyards, community gardens, producers) and peri-urban yield (Table 11). The individual calculations that comprise the total yield are explained in the remaining sections after page 120. Deriving a yield involves multiplying a calculated area (m^2) by the organic yield (~4.1 kg/m2) or conventional yield (~1.2 kg/m^2) depending on the form of agriculture. The nutritional food security analysis (see page 151) was directly linked to yield values.

Table 11. The 2006-07 estimated total yield of fresh fruit and vegetable UPA in Kingston.

		Yield (tonnes)
Inner-City Urban Agriculture	Citizen	480
	Producer	45
	Sub-Total	*525*
Peri-urban Agriculture	*Total*	*120,000*
Total		**~120,000**

- **Equivalent Economic Production Value**

The total equivalent economic production value of urban agriculture in 2006-07 was the sum of inner-city (citizen backyards, community gardens) and peri-urban production values (Table 12). The individual calculations that comprise the total production value are explained in the remaining sections after page 120. Direct mention of total economic production value for current UPA in Kingston can be found on page 34. Calculating an economic production value involved multiplying a calculated yield (kg) by the average price of produce ($1.97 CDN/kg) regardless of production method. Calculations of the local multiplier effect, labour income and jobs generated (See page 168 and 173) were directly linked to economic production values.

Table 12. The 2006-07 estimated gross economic production values if all Kingston UPA produce were sold wholesale. The derived labour income and number of jobs that could be supported are also included.

		Equivalent Economic Production Value ($CDN)	**Equivalent Labour Income Value ($CDN)**	**Equivalent Number of Jobs Supported (#)**
Inner-City Urban Agriculture	Citizen	$940,000	$350,000	12
	Producer	$90,000	$34,000	1
	Sub-Total	*~$1,000,000*	*~$380,000*	*13*
Peri-urban Agriculture	*Total*	*$250,000,000*	*$92,000,000*	*3,100*
Total		**~$250,000,000**	**~$92,000,000**	**~3,100**

- **Citizen Backyards.**

This section is broken down into two parts. The first part determines what the current production area, yield and economic production value of citizen backyard gardening is occurring at the present time (2006-

07). The second part determines the maximum possible area, yield and value of gardening if all available citizen backyards were used. The results of the second part were used on page 36 and Table 7, Table 13.

- Citizen Backyard Calculations for the Current Situation in 2006-07

For all scenarios, in the case of citizen backyards, the percentage of food that remains for local Kingston consumption in the inner-city is assumed to be 100%. The surveyed citizens were asked if they gardened and to provide an estimated or actual size of their growing area if they grew any food. It should be noted that the vast majority of citizens did not keep track of how much he or she grew in a year and this lead to asking only for plot size during the survey. Production was estimated from that information. These quantitative values were used to determine the median plot size that might be available to Kingston households[320]. I calculated the median yield (kg) and value ($CDN) as seen below. This part of the analysis determined the extent of production only for the current fraction of households that garden in Kingston (~28% according to questionnaires). (Table 10)

♦ Area.

This section explains how I calculated the area of backyards used by citizens for growing food in the current 2006-2007 situation (Table 10). The percentage of food that remains for local Kingston consumption is assumed to be 100% in inner-city areas and is not affected by percentages in Table 9.

[Area of Citizen Backyard Horticulture in 2006-2007, Business as Usual (m^2)]

= a * b * c

where a =

[# of Urban Households in Kingston City in 2006][321]

= 53,838

where b =

[Median Backyard Area Used By Citizens (m^2)]

{this was determined by the questionnaires when I asked them about the size of their garden space}[322]

= 9.3 m^2

where c =

[% of Kingston Citizens Who Grow Food in their Backyards (%)]

{determined from the questionnaires}

= 28%

then

[Area of Citizen Backyard Horticulture in 2006-2007, Business as Usual (m^2)]

= a * b * c

= ~140000 m^2 of citizen backyards in Kingston are used to grow food

- Yield

This section explains how I calculated the yield from backyards used by citizens for growing food in the current 2006-2007 situation. The percentage of food that remains for local Kingston consumption is assumed to be 100% in inner-city areas. (Table 11)

[Yield of Citizen Backyard Horticulture in 2006-2007 (kg)]

= Q+R

where Q =

[Yield of Citizen Backyards Using Ecological Growing Methods (kg)]

= e*f*g

= 430,000 kg

where e =

[Area of Citizen Backyard Horticulture in 2006-2007, Business as Usual (m^2)]

= 140000 m^2 of citizen backyards in Kingston are used to grow food

where f =

[Organic Yield (kg/m^2)]

= 4.1 kg/m^2

where g = [Proportion Using Ecological Agriculture (%)] = 76%

where R =

[Yield of Citizen Backyards Using Conventional Growing Methods (kg)]

= n*m*r

= 41000 kg

where n =

[Area of Citizen Backyard Horticulture in 2006-2007, Business as Usual (m^2)]

= 140000 m^2 of citizen backyards in Kingston are used to grow food

where m =

[Conventional Yield (kg/m^2)]

= 1.2 kg/m^2

where r = 100% - [Proportion Using Ecological Agriculture (%)] = 24%

then

[Yield of Citizen Backyard Horticulture in 2006-2007 (kg)]

= Q+R

= ~480,000 kg

- Economic Production Value

This section explains how I calculated the economic production value of yield from backyards used by citizens for growing food in the current 2006-2007 situation. The percentage of food that remains for local Kingston consumption is assumed to be 100% in inner-city areas. (Table 12)

[Economic Production Value of Citizen Backyard Horticulture in 2006-2007 ($CDN)]

= j * k

where j =

[Yield of Citizen Backyard Horticulture in 2006-2007 (kg)]

= 480,000 kg

where k =

[Average Price of Produce ($CDN/kg)]

= $1.97 CDN/kg

then

[Economic Production Value of Citizen Backyard Horticulture in 2006-2007 ($CDN)]

= j * k

= ~$940,000 CDN of FFV grown in citizen backyards

- Citizen Backyards: What If We Used All Available Backyard Space?

This section details how I generated the theoretical situation where we used every bit of backyard space for all residents who do not live in apartment or condominium high rises. Data was obtained from Statistics Canada[323]. High-density residential households were classified as detached/duplex or multi-storey apartment buildings. I determined the maximum area available and then calculated the organic yield and economic production value. The results of this calculation are found in Table 13, Table 7 and on page 36.

- Area

This section explains how I calculated the area of backyards used by citizens for growing food in a situation where all available space is used (Table 13). The percentage of food that remains for local Kingston consumption is assumed to be 100% in inner-city areas and is not affected by modifications in Table 9.

[Maximum Possible Area of Citizen Backyard Gardening (m^2)]

= a * b * c

where a =

[# of Urban Households in Kingston City in 2006][324]

= 53,838

where b =

[Median Backyard Area Used By Citizens (m^2)]

{this was determined by the questionnaires when I asked them about the size of their garden space}

= 9.3 m2

where c =

[% Of Kingston Households Living in High Density Residential (%)]

= 27%

then

[Maximum Possible Area of Citizen Backyard Gardening (m^2)]

= a * b * c

= ~370,000 m^2 of citizen backyards in Kingston could be used to grow food

- Yield

Using the area from the preceding section, I calculated the organic yield.

[Maximum Possible Yield of Citizen Backyard Gardening (kg)]

= Q*R

Where Q =

[Maximum Possible Area of Citizen Backyard Gardening (m^2)]

= a * b * c

= 370,000 m^2 of citizen backyards in Kingston could be used to grow food

Where R = [Organic Yield (kg/m^2)] = 4.1 kg/m^2

Then

[Maximum Possible Yield of Citizen Backyard Gardening (kg)]

= Q*R

= ~1,200,000 kg of maximum yield from citizen backyards in Kingston

- Equivalent Economic Production Value

Using the yield from the preceding section I calculate the gross equivalent economic production value.

[Maximum Possible Equivalent Economic Production Value ($CDN)]

= T*U

Where T =

[Maximum Possible Yield of Citizen Backyard Gardening (kg)]

= 1,400,000 kg of maximum yield from citizen backyards in Kingston

Where U = [Average Price of Produce ($CDN/kg)] = $1.97 CDN/kg

Then

[Maximum Possible Equivalent Economic Production Value ($CDN)]

= T*U

= ~$2,400,000 CDN gross equivalent economic production value

- **Urban Producers**

This calculates the production area, yield and equivalent production value for both inner-city and peri-urban producers. Inner-city producers include community gardens and commercial operations that are larger than 9 m^2 (the median size of a citizen backyard garden that was found in the questionnaires). Peri-urban producers are those who cultivate crops in the peri-urban region on plots of land that are larger than 9 m^2 for commercial purposes. The analysis for producers was sub-divided according to whether the producer was in the inner-city or the peri-urban fringe (**Figure 3**). Producers were further sub-categorized by the use of conventional chemical and ecological agriculture methods – these mainly impacted yield calculations (on page 131). The results of this analysis are found in Table 10, Table 11 and Table 12.

- Area

The total area of cultivation by urban producers was the sum of the inner-city production area and peri-urban production area. Inner-city urban producers were asked to provide information on the size of their plots or it was determined through observation. The information was used for yield and economic production value calculations. One peri-urban commercial producer who was interviewed declined to release the size of their production area for business security reasons and a similar design was substituted in its stead in the calculations[325].

In the following two sub-sections, I explain how I determined the production area for inner-city producers and the peri-urban producers.

- Determining the Area Under Production for Inner-City Producers

This section illustrates how I determined the total area of inner-city urban producers for the year 2006-2007 (business as usual). *All of the information for these inner-city calculations comes from the research interviews*. The inner-city producer category includes commercial operations and community gardens. The classification of whether a producer used conventional methods or ecological was determined from interviews. One producer used chemical fertilizers and not pesticides - I chose to classify them as "conventional chemical". To be classified under "ecological agriculture", they had to be using no fertilizers or pesticides at the minimum. I found that *there were a total of 8 inner-city producers in Kingston at the present time*. One of the eight inner-city urban producers was classified as following conventional chemical growing methods.

- Example

In this example I show how I calculated the approximate production area of all 8 inner-city urban producers in 2006-07 (business as usual). Inner-city urban producers include community gardens and commercial operations.

[Total Area of All Inner-City Urban Production 2006-2007, Business as Usual (m^2)]

= a + b

where a =

[Area of the Conventional Chemical Inner-City Urban Production 2006-2007 (m^2)]

= [Area of the Only Inner-City Urban Producer Using Conventional Chemical Methods (m^2)]

= 151.62 m^2

= ~150 m^2

where b =

[Area of Ecological Inner-City Urban Production 2006-2007 (m^2)]

= sum (J1, J2, J3 to J7)

= 11,113.34 m^2

= ~11,000 m^2

where J1, J2, ... J7 are the areas of the 7 ecological inner-city urban producers

then

[Total Area of All Inner-City Urban Production 2006-2007, Business as Usual (m^2)]

= a + b

= ~11,265 m^2 of inner-city urban production in 2006-2007

= ~11,000 m^2 of inner-city urban production in 2006-2007

♦ Determining the Area Under Production for Peri-urban Producers

Determining the peri-urban area being cultivated in 2006-07 consisted of several steps outlined below. The sub-categorization of ecological and conventional chemical agriculture did not affect the calculation of the total amount of area of peri-urban farming.

- *Step 1*

Two urban producers[326] who were contacted during the interviews were classified as peri-urban. I simply totaled the obtained production area data from these operations. I will call this area P1.

- *Step 2*

I then analyzed a map from the recent Kingston Agricultural Study[327] (**Figure 3**). I converted the digital map into an overlay for Google Earth and then measured out the approximate area of every land parcel that was classified fruit orchard, nursery/greenhouse or field/vegetable crop. I wanted only parcels that were likely to be growing fresh fruit and vegetables. I totaled all of these areas to get a rough estimate of the amount of fruit and vegetable agriculture that was occurring in 2006-2007. I will call this area P2.

- *Step 3*

[Total area of peri-urban production in 2006-2007 (m^2)] (Table 10)

= P1 + P2

= 86507396.11 m^2 of peri-urban production in 2006-2007

= ~86,000,000 m^2 of peri-urban production in 2006-2007

♦ Example

In this example I show how I determined the amount of peri-urban agriculture in 2006-2007 (business as usual) that was devoted to ecological agriculture.

[Area of Ecological Peri-Urban Agriculture in 2006-2007, Business as Usual (m^2)]

= q * r

where q = [Percentage of Peri-Urban Ecological Agriculture 2006-2007 (%)] = 8.3%[328]

where r =

[Total Area of Peri-Urban Agriculture 2006-2007 (m^2)]

{see below Area (Peri-Urban) Step 3}

= 86507396.11 m^2

= 86000000 m^2

then

[Area of Ecological Peri-Urban Agriculture in 2006-2007, Business as Usual (m^2)]

= q * r

= 7,180,114 m^2 of ecological peri-urban agriculture

= ~7,200,000 m^2 of ecological peri-urban agriculture

- Yield

This follows the same process as the Citizen Backyards case. I multiplied the preceding calculated area (m^2) by the organic yield (4.1 kg/m^2) or conventional yield (1.2 kg/m^2) depending on the form of agriculture. A total yield used for the next step of calculating economic production value would just be the sum of organic yields and conventionally grown yields. (Table 11)

♦ Example

This example shows how I calculated the peri-urban yield in 2006-07 (business as usual).

[Total yield for all peri-urban production in 2006-07, Business as Usual (kg)]

= PC + PE

Where PC =

[Total yield of conventional peri-urban production in 2006-2007 (m^2)]

= H*I*J

= 95,657,504 kg yield from conventional peri-urban production in 2006-2007

= ~96,000,000 kg yield from conventional peri-urban production in 2006-2007

Where H = [Total Area of Peri-Urban Production (m^2)] = 86,507,761 m^2 = ~86,000,000 m^2

Where I = [Percentage of Conventional Peri-Urban Agriculture] = 100% - [Percentage of Peri-urban Ecological Agriculture in Kingston CMA (%)] = 100% - 8.3% = 91.7% = ~92%

Where J = [Conventional Yield (kg/m^2)] = 1.2 kg/m^2

Where PE =

[Total yield of ecological peri-urban production in 2006-2007 (m^2)]

= L*M*N

= 29,294,988 kg yield from ecological peri-urban production in 2006-2007

= ~29,000,000 kg yield from ecological peri-urban production in 2006-2007

Where L = [Total Area of Peri-Urban Production (m^2)] = 86,000,000 m^2

Where M = [Percentage of Ecological Agriculture in Kingston CMA (%)] = 8.3%

Where N = [Organic Yield (kg/m^2)] = 4.1 kg/m^2

Then

[Total yield for all peri-urban production in 2006-07, Business as Usual (kg)]

= PC + PE

= 124,952,492 kg

= ~125,000,000 kg

- Equivalent Economic Production Value

Once you have the yield you simply multiply that by the average price of produce ($1.97 CDN/kg) regardless of production method. See the Citizen Backyards example. (Table 12)

- Example

This example shows how I calculated the peri-urban economic production value in 2006-07, business as usual.

[Total equivalent economic production value for ALL peri-urban production in 2006-07, Business as Usual ($CDN)]

= G * H

Where G =

[Total yield for all peri-urban production in 2006-07, Business as Usual (kg)]

= 125,000,000 kg

Where H = [Average price of produce ($CDN)] = $1.97 CDN/kg

Then

[Total equivalent economic production value for all peri-urban production in 2006-07, Business as Usual ($CDN)]

= G * H

= $246,156,410 CDN

= ~$250,000,000 CDN

The remaining sections were all discussed on page 36.

Table 13. ***Maximum value*** **for potential area useable, yield, potential economic effects and potential ecosystem service contributions for citizen backyards, parks, brownfields, basements, rooftops and vertical walls in Kingston. [LME = local multiplier effect]**

	Potential Area Useable		**Potential Yield**
	(ha)	(acres)	(tonnes)
Citizen Backyards	37	91	1200
Parks	680	1,700	28,000
Brownfields	72	180	2,900
Basements	540	1,300	22,000
Rooftops	2,100	5,300	88,000
Vertical Walls	2,100	5,300	88,000
Total	~5,600	~14,000	~230,000

	Potential Economic Effects			
	Equivalent Economic Production Value	**LME**	**Labour Income**	**Jobs Supported**
	($CDN)	($CDN)	($CDN)	(#)
Citizen Backyards	2,400,000	7,000,000	920,000	31
Parks	55,000,000	160,000,000	21,000,000	700
Brownfields	6,000,000	17,000,000	2,200,000	73
Basements	43,000,000	130,000,000	16,000,000	550
Rooftops	170,000,000	510,000,000	65,000,000	2,200
Vertical Walls	170,000,000	510,000,000	65,000,000	2,200
Total	~450,000,000	~1,300,000,000	~170,000,000	~5,700

	Potential Value of Ecosystem Services	
	Soil Formation	**Nitrogen Fixation**
	($CDN)	($CDN)
Citizen Backyards	330	1,300
Parks	6,200	24,000
Brownfields	660	2,500
Basements	0	0
Rooftops	20,000	76,000
Vertical Walls	20,000	76,000
Total	~46,000	~180,000

- **Parks**

  - Area

I obtained information from the Public Works department on all of the parks in the City. The information included a listing of area, address, and relative location within the city, comments and classifications. I used the area data for calculations.

I assessed the total area of parks in Kingston. *This excludes the conservation areas*.

[Maximum Area of Parks (m^2)]

= sum (P1, P2 ... P207)

= 6,833,319.41 m^2 is the total area of all parks in Kingston

= 6,800,000 m^2 is the total area of all parks in Kingston

Where P1, P2 ... P207 = area of individual parks (excluding conservation areas)

- Yield

This follows the same process as the Citizen Backyards case. I multiplied the preceding calculated area (m^2) by the organic yield (4.1 kg/m^2). (Table 13)

[Maximum Yield of Parks (kg)] = 27,868,488.56 kg = ~28,000,000 kg

- Equivalent Economic Production Value

Once you have the yield you simply multiply that by the average price of produce ($1.97 CDN/kg) regardless of production method. See the Citizen Backyards example. (Table 13)

[Maximum Equivalent Economic Production Value ($CDN)] = $54,870,964CDN = ~$55,000,000 CDN

- **Brownfields**

  - Area

According to the City of Kingston[329] the municipality has a total of 201.2 ha of brownfield land in the city. I decided that urban agriculture would be more likely to occur on what were classified as "vacant lots" (72 ha) - through raised beds, mobile greenhouses or simple hydroponics operations for example. Seventy-two hectares translates into 720,000 m^2. (Table 13)

[Maximum Area of Brownfield UPA (m^2)] = 720,000 m^2

  - Yield

This follows the same process as the Citizen Backyards case. I multiplied the preceding calculated area (m^2) by the organic yield (4.1 kg/m^2). A total yield used for the next step would just be the sum of organic yields and conventionally grown yields. (Table 13)

[Maximum Yield of Brownfield UPA (kg)] = 2,937,600 kg = ~3,000,000 kg

  - Equivalent Economic Production Value

Once you have the yield you simply multiply that by the average price of produce ($1.97 CDN/kg) regardless of production method. See the Citizen Backyards example. (Table 13)

[Maximum Equivalent Economic Production Value of Brownfield UPA ($CDN)] = $5,787,072 CDN = $5,800,000 CDN

- **Rooftops**

  - Area

The majority of non-residential Canadian rooftops are designed to accommodate snow load and could support intensive, stacked or shelved container gardens without great difficulty during summer periods.[330] (Table 13)

♦ Determining the Maximum Roof Space Available for Urban Agriculture

City of Kingston data[331] was used to estimate the total area of the urban inner-city of Kingston in 2006-2007. Suitable rooftop space for horticulture in urban centres ranges from 15-30%[332]. From that range, I generated an average value of 22.50%. This was used to determine the amount of suitable space.

[Maximum Area of Rooftop Urban Agriculture in Kingston (m^2)]

= A*B

where A =

[Urban Area of Kingston in 2000 (m^2)] = 9,559 ha = 95,590,000 m^2

{I am not assuming that the entire urban area is covered in rooftops.}

where B =

[Proportion of Maximum Urban Space Available for Rooftop Agriculture (%)] = average (15%, 30%) = 22.50%

{This proportion reflects the amount of urban space that has suitable rooftops[333].}

then

[Maximum Area of Rooftop Urban Agriculture (m^2)]

= A*B

= 21,507,750 m^2

= ~21,000,000 m^2

- Yield

This follows the same process as the Citizen Backyards case. I multiplied the preceding calculated area (m^2) by the organic yield (4.1 kg/m^2). (Table 13)

[Maximum Yield of Rooftop Urban Agriculture (kg)] = 87,751,620 kg = ~88,000,000 kg

- Equivalent Economic Production Value

Once you have the yield you simply multiply that by the average price of produce ($1.97 CDN/kg) regardless of production method. See the Citizen Backyards example. (Table 13)

[Maximum Equivalent Economic Production Value of Rooftop Urban Agriculture ($CDN)] = $172,870,691 = ~$170,000,000

- **Vertical Surface Area**

- Area

In the case of vertical surface calculations there was no attempt to account for the possibility of using indoor walls or free standing fences for food or plant production. The direction the wall was facing was not considered either. (Table 13)

- Determining the Maximum Vertical Space Available for Urban Agriculture

Here is how I calculated the area that could be used for vertical surface agriculture in Kingston.

[Maximum Area of Vertical Surface Urban Agriculture (m^2)]

= M*N*O

where M =

[Urban Area of Kingston in 2000 (m^2)] = 9,559 ha = 95,590,000 m^2

where N = [# of Walls of a Building Suitable for Cultivation] = 1

{It was assumed that only south facing walls would be suitable for cultivation.}

where O = [Proportion of Urban Area in Kingston With Suitable Vertical Space for UPA (%)] = 22.50%

{This value was assigned based on variable B in the rooftops analysis. The urban area with suitable roofs for intensive gardens is likely to be just as good candidates for vertical gardens.}

then

[Maximum Area of Vertical Surface Urban Agriculture (m^2)]

= M*N*O

= 21,507,750 m^2

= ~21,000,000 m^2

- Yield

This follows the same process as the Citizen Backyards case. I multiplied the preceding calculated area (m^2) by the organic yield (4.1 kg/m2). (Table 13)

[Maximum Yield of Vertical Surface Urban Agriculture (kg)] = 87,751,620 kg = ~88,000,000 kg

- Equivalent Economic Production Value

Once you have the yield you simply multiply that by the average price of produce ($1.97 CDN/kg) regardless of production method. See the Citizen Backyards example. (Table 13)

[Maximum Equivalent Economic Production Value of Vertical Surface Urban Agriculture ($CDN)] = $172,870,691 = ~$170,000,000 CDN

- **Basements**

- Area

Data from my previous food-miles study and a Waterloo food-miles study[334] allowed me to estimate the possible amount of mushroom imports into the KFL&A region. This was ~108 tonnes of mushrooms annually. It is theoretically possible to use basements to grow mushrooms to reduce this import (Table 13). The health and safety concerns were discussed briefly on page 64.

- Determining the Maximum Basement Space Available for Urban Agriculture

Here I show the calculation for the maximum area of basements that could be used for urban agriculture. This would likely be mycoculture (i.e. mushroom cultivation). Other forms of fruit and vegetable based agriculture would likely require energy for artificial light. There are commercial possibilities that could be tapped.

[Maximum Area of Basement Urban Agriculture (m^2)]

= J*K*L

where J =

[Urban Area of Kingston in 2000 (m^2)] = 9,559 ha = 95,590,000 m^2

where K = [Proportion of Basements Used for UPA (%)] = 25%

{An individual would likely devote no more than 1/4th of their basement to cultivation if they were doing it for dietary supplementation or self-sufficiency. It is likely that a commercial operation would not limit its growing area this way.}

where L = [Proportion of Urban Area in Kingston That Has Buildings with Suitable Basements (%)] = 22.50%

{This value was assigned based on variable B in the rooftops analysis - the number of buildings with suitable roofs for intensive gardens are likely to be just as good candidates for basement cultivation.}

then

[Maximum Area of Basement Urban Agriculture Useable (m^2)]

= J*K*L

= 5,376,938 m^2 of useable basement area

= ~5,400,000 m^2 of useable basement area

- Yield

This follows the same process as the Citizen Backyards case. I multiplied the preceding calculated area (m^2) by the organic yield (4.1 kg/m2). (Table 13)

[Maximum Yield of Basement Urban Agriculture Useable (kg)] = 21,937,907 kg = ~22,000,000 kg

- Equivalent Economic Production Value

Once you have the yield you simply multiply that by the average price of produce ($1.97 CDN/kg) regardless of production method. See the Citizen Backyards example. (Table 13) As was discussed previously (see page 64), it is highly unlikely that all available basement space would be utilized for mushroom production. In addition, the amount that can be sold and consumed locally is also a limiting factor.

[Maximum Equivalent Economic Production Value of Basement Urban Agriculture Useable ($CDN)] = $43,217,676.87 = ~$43,000,000 CDN

- **Externality Analyses**

The aim of this portion of the study was to give an estimate of the indirect benefits generated by urban agriculture. Unfortunately I have only been able to use available data and indicators for this section. More research is needed to develop a more inclusive and representative model.

In the environment section first I outline the estimation method for physical ecosystem services that UPA could contribute. Second, I assess the potential for the reduction of greenhouse gases through decreased food-miles and better agricultural practices. I then find the equivalent amount of cars that would be taken off the road because of those reductions.

In the food security section I illustrate the methods used to determine the number of people whose fresh fruit and vegetable needs could be met by UPA.

In the health section, I display the calculations used to estimate the healthcare costs of heart disease, diabetes and cancer in Kingston as the diseases have been linked to a poor quality diet. Using UPA to increase nutrition could be part of a strategy to lower these costs.

In the final section, I show how I calculated the extra economic benefits of urban and peri-urban agriculture. The local multiplier effect on the economy is determined. The theoretical value of greenhouse gas reductions in a carbon trading emissions scenario like Kyoto was generated. The method by which I determined potential labour income and job generation is also explained.

At this point we proceed to the first section, Environment.

- **Environment**

- Estimated Physical Ecosystem Service Contribution of UPA

Urban agriculture appears to provide at least three ecosystem services (Table 14). These are soil formation, nitrogen fixation and waste recycling. How they were integrated into the model is discussed below. The results of this section were used on page 25 and 36. It was assumed that only ecological agriculture would contribute such ecosystem services while conventional agriculture would not.

Table 14. Estimated minimum value of physical ecosystem services that urban and peri-urban agriculture provides Kingston in 2006-07. The waste recycling value is what could be provided if all organic waste in Kingston was used as compost for urban and peri-urban food production. [335]

Ecosystem Service	Estimated Value ($CDN/yr)
Soil formation	$9,000
Nitrogen fixation	$34,000
Waste recycling	$1,800,000
Total	**~$1,800,000**

- Soil Formation Ecosystem Services

According to Pimentel *et al.* (1997), it was estimated that approximately 1 tonne/ha/year of topsoil is formed by the presence of soil biota such as earthworms and invertebrates. This topsoil could be valued at $12 USD per tonne[336]. In my calculations I assumed that the topsoil would be valued at an equivalent Canadian dollar value. Based on this information, I determined that the value of this formed topsoil per square metre per year as $0.00120 CDN/m^2/yr. Using any area in m^2 multiplied by $0.00120 CDN/m^2/yr would yield a value in $CDN/yr for soil formation services. Multiplying the value by the percentage of ecological agriculture would modify the value (i.e. 76% if the it's inner-city agriculture or 8.3% if it's peri-urban agriculture). This yields a final value of ~$9300 (Table 14) that approximates the ecosystem service that urban or peri-urban agriculture provides in the Kingston context at present.

- Nitrogen Fixation Ecosystem Services

Using information from Pimentel *et al.* (1997) I determined an approximate value for nitrogen fixation services in $CDN/ha/yr for urban, peri-urban or rural agriculture. In my calculations I assumed that the nitrogen fixation services would be valued at an equivalent Canadian dollar value.

Using any area in hectare units multiplied by "*Nitrogen Fixation Value Per Kilogram Per Year*" and "*Nitrogen Fixation Rate of Soil Microbes*" (see below) would yield an annual value in $CDN for nitrogen fixation services. The percentage of ecological agriculture for the situation also modified the value (i.e. multiply by 76% if the it's inner-city agriculture or 8.3% if it's peri-urban agriculture). This yields a final value of ~$36000 (Table 14) that approximates the ecosystem service that urban or peri-urban agriculture provides in the Kingston context at present.

[Nitrogen Fixation Value Per Kilogram Per Year]

= Q/R

= [$90,000,000,000.00 CDN]/[155 million tonnes of atmospheric nitrogen/yr] {these values were obtained from Pimentel *et al.* (1997)}

= $580.65 CDN/t/yr

= $0.85 CDN/kg/yr

= ~$0.8 CDN/kg/yr

where Q

[Global Value of Nitrogen Fixation] = $90 billion CDN = $90,000,000,000.00 CDN

where R

[Global Nitrogen Fixation] = 155 million tonnes of atmospheric nitrogen/yr

[Nitrogen Fixation Rate of Soil Microbes] = 80 kg/ha

♦ Waste Recycling Ecosystem Services

Using information from the City of Kingston[337], I determined that the amount of wet and dry organic waste being generated in the city. It was found that households produced roughly 336 kg of organic waste per household annually. Multiplying this value by the number of households in Kingston CMA for 2006-07 produces a net amount of 23,000,000 kg/yr (or ~23,000 tonnes). From Pimentel *et al.* (1997), the $0.02 USD/kg value of decomposer waste recycling was based on the cost of disposal in one location in New York State. Pimentel *et al.* (1997) used that as their global value. I decided that since I had information on the 2002 Kingston waste disposal fees I would use that to determine the value of waste recycling ecosystem services per kg. The disposal fee in 2002 was $76.66 CDN/tonne of waste. I converted that to $0.08 CDN/kg.

In the following section I demonstrate how I calculated the total value of waste recycling ecosystem services that could potentially occur if Kingston's organic waste was used as inner-city and peri-urban agricultural compost. (Table 14)

[Total Value of Waste Recycling Ecosystem Services]
= A*B

where A
[Value of Waste Recycling Services] = $0.08 CDN/kg

where B
[Total Percentage of Organic Waste Generated in Kingston Annually] = 23,521,008.00 kg/yr

then

[Total Value of Waste Recycling Ecosystem Services]

= A*B

= $1,803,120.47 CDN in waste recycling ecosystem services by decomposers

= ~$1,800,000 CDN in waste recycling ecosystem services by decomposers

- Reducing Long Distance Transport of Food ("Food Miles") into Kingston Region

My previous food-miles study was completed with the intention of including it in this thesis[338]. Some of the conclusions were:

- Imports of 58 common FFV, animal products that could be grown locally in Kingston travel an average of 4700 km. On average, each kilogram of imported product generates 1.3 kg of GHG emissions.
- Kingston could gain a yearly potential reduction in greenhouse gases of ~20000 to 21000 tonnes. That would be the equivalent of taking off ~6600 to 6700 cars from Kingston roads annually.
- Kingston would reduce household greenhouse gas emissions by ~0.3 tonnes annually. This would have been nearly 1/3 of what was needed for Canadian citizens to reach the 1 tonne goal in the One Tonne Challenge.

The results, conclusions and links to urban agriculture were briefly discussed on page 25. The summary of this analysis for 39 common fruit and vegetable products are repeated in Table 15. The full study is found on page 206. My food-miles study did not account for GHGe reductions due to reduced packaging, food swapping and shipping back and forth for processing. It was intended as an initial estimate subject to future refinement.

The more food that remains for local consumption the less reliance on imports there would be. That in turn would translate into greater GHGe reductions. Approximately 99% of the reductions would be due to shifting more peri-urban production towards local consumption – inner-city production only comprises ~0.4% of total yield at the present time (Table 11).

- Example

This example examines GHGe reductions when the *percentage of food that remains for local use is 50%*. I am trying to show that GHGe reductions increase as the amount of FFV from local sources increase. All other factors that were explained in on page 116 remain unchanged.

[Percentage of GHGe Avoided Through Reduced Long Distance Imports of FFV in the case where the Percentage of Food That Remains Local is 50%, Year 2006-07 (tonnes of CO2 equivalent GHGe)]

= e * d

where e =

[Percentage of GHGe Avoided If All Long Distance Imports Were Eliminated for FFV (tonnes of CO2 equivalent GHGe)]

= sum {annual GHGe for 39 common vegetable products that are imported yet could be grown locally – see page 206}

= 13924 tonnes of CO2 equivalent GHGe

where d =

[Percentage of Food That Remains Local is 50%, Year 2006-07 (%)]

= 50%

then

[Percentage of GHGe Avoided Through Long Distance Imports of FFV in the case where the Percentage of Food That Remains Local is 50%, Year 2006-07 (tonnes of CO2 equivalent GHGe)]

= e * d

= 6962 tonnes of CO2 equivalent GHGe avoided

= ~7000 tonnes of CO2 equivalent GHGe avoided

Table 15. A summary of the amount of GHGe reductions through better agricultural practices and reduced long-distance imports of 39 common fresh fruit and vegetable products that can be grown locally in Kingston.

Percentage of Food That Remains Local	GHGe Reduction Through Better Agricultural Practices When Cultivating FFV (CO2 equivalent tonnes/yr)	GHGe Reduction Through Reduced Long Distance Edible Plant Imports (CO2 equivalent tonnes/yr)	Total GHGe Reduction (CO2 equivalent tonnes/yr)*
Business as Usual	370	980	~1,300
25%	370	3,400	~3,800
50%	370	7,000	~7,400
100%	370	14,000	~14,000

* This is the total of columns two and three.

- Reducing Greenhouse Gas Emissions Through Better Agricultural Practices

Better agricultural practices through peri-urban and inner-city urban agriculture could be one way of adapting to climate change impacts and mitigating our continued contribution to climate change. This was discussed on page 25 and the summary of the analysis can be found in Table 15. Information from Biocap (2005) was used to calculate how urban agriculture could mitigate climate change by preventing the emissions of greenhouse gases - specifically nitrous oxide. Nitrous oxide[339] is released when soil microbes break down nitrogen products like fertilizers. This is considered a minimum, low bound estimate since the research only dealt with reducing the amount of excess fertilizer while avoiding any loss to yield through best management practices. If ecological agriculture practices were used, you would be able to prevent greater levels of nitrous oxide from being released by not using manufactured chemical fertilizers at all. This however was not accounted for in the calculations.

It was assumed that only ecological agriculture was able to meet the 0.5 tonne CO2 equivalent/ha reduction in nitrous oxide. It is likely that ecological agriculture would meet and exceed such a reduction[340]. Calculations concerning the equivalent number of cars that would be taken off the road if these reductions were achieved were also made. See the next section, Comparison to Cars for additional information.

The amount of greenhouse gas reduction stays constant throughout the various scenarios where the percentage of local food increases (Table 3, Table 15) since we assume that the percentage of ecological agriculture remains the same as it does in 2006-07 (76% for inner-city production and 8% for peri-urban agriculture). As the percentage of local food increases, the urban and peri-urban production is being shifted towards crops for local consumption and use. Whether those crops are being produced through ecological or conventional chemical means were not being examined at this time. The model however has the capability to factor in shifts to different production methods.

- Calculating a nitrous oxide reduction

This is an example where I determine the amount of greenhouse gases that are avoided through the reduction of nitrous oxide through peri-urban agriculture at the present time. Of the factors on page 116 only the current percentage of ecological agriculture in the Kingston CMA is considered in the calculation.

[Amount of Greenhouse Gases Avoided Through the Reduction of Nitrous Oxide for Ecological Peri-Urban Agriculture in 2006-07 (CO2 equivalent tonnes of GHGe)]

= A*B

where A =

[Nitrous oxide reduction through best management practices]

= 1.8 kg CO2 equivalent tonnes/ha

= 0.5 CO2 equivalent tonnes/ha

where B =

[Area Used for Ecological Peri-Urban Agriculture in 2006-07 (ha)]

= c * d

= 7,180,114 m^2

= ~718 ha

= ~720 ha

where c = [Total Area of Peri-Urban Agriculture (m^2)] = 86,507,761 m^2

where d = [Proportion of Ecological Peri-Urban Agriculture in Kingston CMA (%)] = 8.30%

then

[Amount of Greenhouse Gases Avoided Through the Reduction of Nitrous Oxide for Peri-Urban Agriculture in 2006-07]

= A*B

= 359 CO2 equivalent tonnes of GHGe are avoided through reduced nitrous oxide emissions

= ~360 CO2 equivalent tonnes of GHGe are avoided through reduced nitrous oxide emissions

- Comparison to Cars

Fuel economy data for a typical compact vehicle was obtained from a calculator on the National Resources Canada website[341]. An average annual driving distance of 18,000 km[342] was input into the calculator, and the average ratio of city to highway driving was assumed to be 50-50. The fuel economy number was then used to calculate GHG emissions per litre of fuel by referring to Environment Canada's Greenhouse Gas

Inventory[343], which reports on the GHG emissions per litre of fuel burned in light-duty gasoline-powered vehicles.[344]

The average emission of a typical compact vehicle was determined to be 3.06 tonnes of GHGe annually. To determine the number of cars taken off the road, one would divide the emissions value by 3.06 tonnes. Using the information from the previous section, a reduction of 360 tonnes of GHGe would translate into taking off approximately 120 cars off the road.

- **Food Security and Sovereignty**

There were two analyses that were undertaken in this part of the model. Both analyses were only in terms of production and did not address distribution, access and availability of produce. It should be stressed that issues of annual production capacity, seasonality, storage and processing capacity will reduce the number of people whose FFV needs can be met. I have not integrated those factors into my calculations. The process is detailed below. (This topic was examined on page 31)

- How many people would meet their fresh fruit and vegetable needs if we increased the amount of local food in different scenarios?

The following three sub-sections show how I analyzed area and yield to determine the number of people whose sufficient fresh fruit and vegetable needs could be met. Sufficient fresh fruits and vegetables were considered to be at least 5 servings per day. The results of this analysis are summarized in Table 16 and detailed in **Table 23**, **Table 24**, **Table 25** and **Table 26**.

Table 16. The number of people whose minimal fruit and vegetables servings can be potentially met through urban and peri-urban agriculture in Kingston. The Kingston CMA population is 152,000 people and Kingston city population is 117,000 in 2006-07.

	Area Analysis		Yield Analysis	
Percentage of Food That Remains Local	# Of People Whose Minimal FFV Needs Can Be Met (#/yr)	% Of Kingston CMA Population	# Of People Whose Minimal FFV Needs Can Be Met (#/yr)	% Of Kingston CMA Population
Business as Usual	11,000	7.2%	15,000	9.7%
25%	31,000	21%	43,000	28%
50%	60,000	49%	83,000	54%
100%	120,000	76%	160,000	110%

- The General Area Analysis

From many information sources consulted I determined the minimum amount of area necessary to meet 1 individual's fresh fruit and vegetable needs in a year. This was approximately 34 m^2/person[345] on average using ecological agriculture techniques. You would essentially divide the area devoted to either ecological or conventional production by 34 m^2/person (ecological)[346] or ~110 m^2/person (conventional) respectively to get the number of people whose fresh fruit and vegetable needs were met subject to modifications as outlined on page 116.

- Generating the minimum amount of area necessary to meet 1 individual's fresh fruit and vegetable needs in a year through ecological agriculture

- From LA4 (1999):

The source states that 400 sq. ft. through intensive gardening techniques can provide 1 person with an annual supply of vegetables and fruits. The value after conversion from square feet to m^2 = 37.16 m^2/person.

- From Thomsen (2006):

The source generally states that 24 m^2 is sufficient production space for one person. The value used is 24 m^2/person.

- From Van Bers (1991):[347]

Van Bers makes estimates based on yields from intensive organic gardening and the assumption that four hectares of open space per 1,000 people can be devoted to growing food (equal to 15% of open space in a large, typical Canadian urban centre). I assume that it can be applied equally well to this study for either conventional or ecological agriculture. In reality however it is likely that conventional chemical agriculture would require more area per person in order to meet their FFV needs. Regardless, I convert 4 hectares to m^2 and divide that area by 1000 people to obtain a value of 40 m^2/person/year.

- Final Calculation:

I assume that all of these sources were based on studies where ecological agriculture was used. I average all the values from the preceding sources

[Average Minimum Area Needed to Meet FFV Needs Through Ecological Agriculture Methods (m^2/person/year)]

= 33.7 m^2/person/year

= ~34 m^2/person/year

- Generating the minimum amount of area necessary to meet 1 individual's fresh fruit and vegetable needs in a year through **conventional chemical agriculture**.

In the following section I determine an approximate minimum area required for conventional agriculture to meet FFV needs (at least 5 servings).

[Average Minimum Area Needed to Meet FFV Needs Through Conventional Chemical Agriculture Methods (m^2/person/year)]

= A* B

where A = [Yield Difference Between Ecological Agriculture and Conventional Chemical Agriculture]

= [Ecological Agriculture Yield (kg/m^2)]/[Average Commercial Yield (kg/ m^2)] (see Introduction to this section)

= [4.1 kg/m^2]/[1.2 kg/m^2]

= 3.38 times difference between ecological and conventional yields

where B =

[Average Minimum Area Needed to Meet FFV Needs Through Ecological Agriculture Methods (m^2/person/year)]

= 33.7 m^2/person/year

then

[Average Minimum Area Needed to Meet FFV Needs Through Conventional Chemical Agriculture Methods (m^2/person/year)]

= A* B

= [3.38]*[33.7 m^2/person/year]

= 113.906 m^2/person/year

= ~110 m^2/person/year

I have not accounted for the fact that conventional chemical agriculture is often mono-crops that may not provide sufficient variety to meet FFV needs. I have also not accounted for the fact that conventional chemical agriculture is a factor in eroding ecosystem services as was explained in Chapter 1 and is losing the capacity to generate sufficient yields over time.

- Example

In this example, I determine the number of people whose fresh fruit and vegetable needs could be met in a year by analyzing only area. This was for the peri-urban production situation where the "Percentage of Food That Remains Local is 50%".

[Number of People Whose FFV Needs Would Be Met Using Peri-Urban Agriculture in the case where the Percentage of Food That Remains Local is 50%]

= (A + D)*G*H*I

where A =

[Number of People Whose FFV Needs Would Be Met Using Conventional Peri-Urban Agriculture in the case where the Percentage of Food That Remains Local is 50%]

= b/c

= 696,431 people

= ~700,000 people

where b =

[Area of Conventional Peri-Urban Agriculture in 2006-07 (m^2)]

= 79,327,647 m^2

= ~79,000,000 m^2

where c =

[Average Minimum Area Needed to Meet FFV Needs Through Conventional Agriculture Methods (m^2/person/year)]

= 113.906 m^2/person

= ~110 m^2/person

where D =

[Number of People Whose FFV Needs Would Be Met Using Ecological Peri-Urban Agriculture in the case where the Percentage of Food That Remains Local is 50%]

= e/f

= 212,933 people

= ~210,000 people

where e =

[Area of Ecological Peri-Urban Agriculture in 2006-07 (m^2)]

= 7,180,114 m^2

= 7,200,000 m^2

where f =

[Average Minimum Area Needed to Meet FFV Needs Through Ecological Agriculture Methods (m^2/person/year)]

= 33.7 m^2/person

= ~34 m^2/person

where G = [Percentage that Remains Local (%)] = 50%

where H = [Percentage for Human Consumption Not Animal Feed (%)] = 18.22%

where I = [Percentage of Food Not Wasted (%)] = 100% - [Percentage of Food Waste (%)] = 100% - 32% = 68%

then

[Number of People Whose FFV Needs Would Be Met Using Peri-Urban Agriculture in the case where the Percentage of Food That Remains Local is 50%]

= (A + D)*G*H*I

= 56,333

= ~56,000 people whose FFV needs would be met if the percentage of food that remains for local consumption is 50%

- The Nutritional Yield Analysis

Using information from Hamm (2006) I determined the amount of fresh fruit and vegetables needed to meet the Canada Food Guide's 5 recommended daily servings. This was approximately ~98 kg/person/year. You would essentially divide the yield from urban agriculture by 98 kg/person/year to get the number of people who could meet the 5 daily servings of FFV. This was modified by the factors detailed on page 116. The best way to understand the rest of the process is to look at the following examples.

- Determining the Average Mass of 5 Servings of Fresh Fruits and Vegetables

Hamm (2006) stated that as the average US citizen ate only 3.1 servings of FFV per day that meant they were falling 100 lbs short of the recommended daily intake of 5 FFV per year. In their study this translated to an annual shortfall of ~78000 acres of production. For Michigan's situation, this became a 12 million acre short fall for FFV production in total. Other sources that I examined did not provide a mass of both fresh vegetables and fresh fruits. This is why I used this calculation.

From this information I derived the mass of 5 recommended servings of FFV or ~98 kg/person/year (19.6 kg/serving/person/year).

[Mass of 5 Recommended Servings of FFV (kg/person/year)]

= x*J

where x

= 100b/(b-a)

= 100(5)/(5-3.1)

= 500/1.9

= 263.1578947 lbs/person/year is the mass of 5 recommended servings of FFV

= ~260 lbs/person/year is the mass of 5 recommended servings of FFV

where a = [# of FFV Servings the Average US Citizen Consumes] = 3.1 servings

where b = [# of Recommended FFV Servings] = 5

where x = [Mass of 5 Recommended Servings of FFV (lbs)]

where (x-100) = [Mass of 5 Recommended Servings of FFV (lbs/person/year)] - 100 lbs = [Mass of # of FFV Servings the Average US Citizen Consumes (lbs/person/year)]

where J

= [Conversion Factor from lbs to kg] = 0.373241722 lbs/kg

thus

[Mass of 5 Recommended Servings of FFV (kg/person/year)]

= x*J

= 98.2 kg/person/year

= ~98 kg/person/year

- Example

In this example, I determine the number of people whose 5 servings of fresh fruits and vegetables could be met in a year by analyzing only yield. This was for peri-urban production in the case where the "Percentage of Food That Remains Local is 50%". All other factors on page 116 remain constant.

[Number of People Whose Recommended 5 FFV Intake Would Be Met Using Peri-Urban Agriculture in the case where the Percentage of Food That Remains Local is 50%]

= (A/B)*G*H*I

where A =

[Yield of Peri-Urban Agriculture (kg) in the case where the Percentage of Food That Remains Local is 50% (kg)]

= 124940332.6 kg

= ~120000000 kg

where B =

[Mass of 5 Recommended Servings of FFV (kg/person/year)]

= 98.2 kg/person/year

= ~98 kg/person/year

where G = [Percentage that Remains Local (%)] = 50%

where H = [Percentage for Human Consumption Not Animal Feed (%)] = 18.22%

where I = [Percentage of Food Not Wasted (%)] = 100% - [Percentage of Food Waste (%)] = 100% - 32% = 68%

then

[Number of People Whose Recommended 5 FFV Intake Would Be Met Using Peri-Urban Agriculture in the case where the Percentage of Food That Remains Local is 50%]

= (A/B)*G*H*I

= 79,203

= ~79,000 people whose 5 FFV intake would be met

- **Health**

According to Jobin (2006), 80% of heart disease, 90% of diabetes and 30% of cancers can be linked to a poor quality diet. Fresh fruits and vegetables grown through urban and peri-urban agriculture could contribute to reductions in the prevalence, incidence and costs of these diseases. According to Health Canada[348], direct costs consist of hospital care, drug, physician care, other institution care and additional direct health expenditures. Indirect costs include mortality and morbidity due to short and long-term disability costs. Many of the studies and Statistics Canada data that I consulted[349] do not account for psychosocial or quality of life costs like stress or depression from these conditions. Likewise my calculations do not reflect those costs either.

In this section, I show how I calculated the current health costs that can be attributed to poor diet for each disease in terms of whatever costs were available - most of the studies I consulted calculated only direct costs to healthcare except for the 1998 study by Health Canada[350]. The summary of these costs from page 33 is repeated in Table 17. The health cost data comes from Health Canada[351], which is nearly a decade old and may not reflect the higher direct or indirect healthcare costs incurred today as a result of these diseases. The purpose of these calculations is to provide an idea of the magnitude of the problem and the potential role that urban agriculture could play in reducing these costs through improved nutrition. Improved nutrition will not resolve all of these complex health issues since there are also many other factors involved.

To provide some context to the calculations below, the direct and indirect healthcare cost expenditures in Canada for 1998 were $84 billion CDN and $159 billion CDN respectively[352].

Table 17. Estimated annual minimum health costs of current heart disease, diabetes and cancer cases in Kingston CMA that can be linked to a poor quality diet.

Disease	**Health Costs Attributed to a Poor Quality Diet ($CDN/yr)**
Heart Disease	$100,000,000
Diabetes	$7,500,000
Cancers	$25,000,000
Total	**~$130,000,000**

- Heart Disease

From Health Canada information[353], I found the direct and indirect healthcare costs of cardiovascular diseases. This was used to determine an approximate average health cost per capita.

Calculating the health cost of heart disease attributed to a poor quality diet in the Kingston case.

♦ Heart Disease Cost Per Capita.

[Heart Disease Cost Per Capita ($CDN/capita]

= K/P

where K

[Total Cost of Heart Disease in 1998 ($CDN)]

= D1+D2

= $25,290,900,000.00

where D1 =

[Total Direct Costs for Heart Disease in 1998 ($CDN)] = $6,818,000,000.00 CDN

where D2 =

[Total Indirect Costs for Heart Disease in 1998 ($CDN)] = $18,472,900,000.00 CDN

where P

= [Population of Canada 1998] = 30157082

{Statistics Canada. Table 051-0001 - Estimates of population, by age group and sex, Canada, provinces and territories, annual (persons)(1,2,6)}

then

[Heart Disease Cost Per Capita ($CDN/capita]

= K/P

= $838.64 CDN/capita

- Health Costs of these Heart Disease Cases in Kingston That Could Be Linked to Poor Diet.

[Health Costs of Heart Disease Cases in Kingston That Could Be Linked to Poor Diet ($CDN)]

= M*N*O

where M =

[Heart Disease Cost Per Capita ($CDN/capita]

= $838.64 CDN/capita

where N =

[Population of Kingston CMA 2006-07]

= 152,358

where O =

[Proportion of Heart Disease Costs Linked to Poor Diet (%)] = 80% = 0.8

then

[Health Costs of Heart Disease Cases in Kingston That Could Be Linked to Poor Diet ($CDN)]

= M*N*O

= $102,218,668

= ~$100,000,000 CDN

- Diabetes

From Health Canada data [354], I found the direct and indirect healthcare costs of diabetes. This was used to determine an approximate average health cost per capita.

Calculating the health cost of diabetes attributed to a poor quality diet in the Kingston case.

- ♦ Diabetes Cost Per Capita.

[Diabetes Cost Per Capita ($CDN/capita]

= K/P

where K

[Total Cost of Diabetes in 1998 ($CDN)]

= D1+D2

= $1,646,900,000

where D1 =

[Total Direct Costs for Diabetes in 1998 ($CDN)] = $385,000,000 CDN

where D2 =

[Total Indirect Costs for Diabetes in 1998 ($CDN)] = $1,261,900,000 CDN

where P

= [Population of Canada 1998] = 30157082

{Statistics Canada data}

then

[Diabetes Cost Per Capita ($CDN/capita]

= K/P

= $54.61 CDN/capita

Modeling by Ohinmaa *et al.* (2004) indicates that the cost per capita could be three times the value I calculated here. In this case I am using 1998 cost data relative to information used in Ohinmaa *et al.* (2004). I opted for the lower value to be conservative.

- Health Costs of these Diabetes Cases in Kingston That Could Be Linked to Poor Diet.

[Health Costs of Diabetes Cases in Kingston That Could Be Linked to Poor Diet ($CDN)]

= M*N*O

where M =

[Diabetes Cost Per Capita ($CDN/capita]

= $54.61 CDN/capita

where N =

[Population of Kingston CMA 2006-07]

= 152,358

where O =

[Proportion of Diabetes Costs Linked to Poor Diet (%)] = 90% = 0.9

then

[Health Costs of Diabetes Cases in Kingston That Could Be Linked to Poor Diet ($CDN)]

= M*N*O

= $7,488,342

= ~$7,500,000 CDN

- Cancer

From Health Canada information[355], I found the direct and indirect healthcare costs of cancer. This was used to determine an approximate average health cost per capita.

Calculating the health cost of cancer attributed to a poor quality diet in the Kingston case.

- Cancer Cost Per Capita.

[Cancer Cost Per Capita ($CDN/capita]

= K/P

where K

[Total Cost of Cancer in 1998 ($CDN)]

= D1+D2

= $16,682,800,000 CDN

where D1 =

[Total Direct Costs for Cancer in 1998 ($CDN)] = $2,462,400,000 CDN

where D2 =

[Total Indirect Costs for Cancer in 1998 ($CDN)] = $14,220,400,000 CDN

where P

= [Population of Canada 1998] = 30157082

{Statistics Canada data}

then

[Cancer Cost Per Capita ($CDN/capita]

= K/P

= $553.20 CDN/capita

- Health Costs of these Cancer Cases in Kingston That Could Be Linked to Poor Diet.

[Health Costs of Cancer Cases in Kingston That Could Be Linked to Poor Diet ($CDN)]

= M*N*O

where M =

[Cancer Cost Per Capita ($CDN/capita]

= $553.20 CDN/capita

where N =

[Population of Kingston CMA 2006-07]

= 152,358

where O =

[Proportion of Cancer Costs Linked to Poor Diet (%)] = 30% = 0.3

then

[Health Costs of Cancer Cases in Kingston That Could Be Linked to Poor Diet ($CDN)]

= M*N*O

= $25,285,185

= ~$25,000,000 CDN

According to Roberts (2007b), the proportion of cancer that could be linked to poor diet was 60%. I opted for the lower 30% figure stated by Jobin (2006) in order to remain conservative.

- **Economy**

The analysis in this section generated the results found on page 34. A summary of the results is repeated below in Table 18 and detailed in **Table 27**, **Table 28**, **Table 29** and **Table 30**. The results of labour income and job analyses for the current situation can be found on page 179 and theoretical situations in Table 13.

Table 18. Economic benefits generated when the percentage of food produced through Kingston UPA remains for local consumption in four different scenarios. (LME = local multiplier effect) The 2003 Kyoto carbon emissions trading value of reduced GHGe is included.

Percentage of Food That Remains Local	**LME (million $CDN)**	**Relative to Current Situation in 2006-7 (times)**	**2003 Kyoto Value *($CDN/yr)***
Business as Usual	$54	1	$16,000
25%	$180	3	$46,000
50%	$370	7	$88,000
100%	$730	14	$170,000

- Local Multiplier Effect and Kingston.

Using information from Ward and Lewis (2002), Blay-Palmer (2007b), Hamm (2006) and Boyde (2001), I generated a local economic multiplier value (LM). Each dollar spent on locally grown food through urban agriculture contributes ~$2.95 to the local economy through the local multiplier effect (LME). Since urban agriculture can be a local commercial enterprise or just used to earn some income, I estimate the economic value urban agriculture could contribute to the economy of the City of Kingston through the local multiplier effect.

- Determining the Local Multiplier (LM)

  - From Ward and Lewis (2002):

“We recently compared the multiplier effects of shopping for fruit and vegetables in a supermarket and from a local organic ‘box scheme’ (CSA). The results showed that every £10 spent with the box scheme was worth £25 for the local area, compared with just £14 when the same amount was spent in a supermarket.”

Using the information from Ward and Lewis (2002) I created a unit less multiplier of 2.5 by dividing £25 by £10.

  - From Blay-Palmer (2007b):

Blay-Palmer (2007b) indicated that Ontario farmers' markets put back $2.70 into the local economy for every $1 spent in them. I created a multiplier by dividing $2.70 by $1 to create a unit less value of 2.70.

  - From Schumilas (2006):

Schumilas (2006) indicated that the local multiplier effect for agriculture in Waterloo was: $1 spent on local agricultural products was multiplied into $4 for the local Waterloo economy

From that I created a unit less multiplier of 4 that would be used in the final LM calculation.

- From Boyde (2001):

"A UK study found that every dollar spent on a local organic food box created $2.59 in value for the local economy, while spin-off from supermarkets is only $1.40...”

Using the value of $2.59 (value for the local economy) divided by $1 (spent locally - in this on an organic food box), I created a unit less multiplier of 2.59.

- The final calculation to determine the “local multiplier” (LM):

The final value for the LM was the average of all of the multiplier values from the preceding sources.

[Final Local Multiplier (LM)]

= average (2.5, 2.7, 4, 2.59)

= $2.9475 CDN to the local economy/$1 spent on buying local foods

OR

for every $1 spent on locally produced food products it generates ~$3 for the local economy.

The standard deviation was +/- $0.7 CDN to the local economy/$1 spent on buying local foods.

- Example

Using the generated LM, I calculate the local multiplier effect on the Kingston economy in the theoretical case of park production using the maximum possible area (Table 7, Table 13).

[Local multiplier effect on the Kingston economy for park urban agriculture using maximum possible area ($CDN)]

= a*b

where a =

[Economic Production Value for Park Urban Agriculture ($CDN)]

= [Maximum Area of Park Production in Theory (m^2)] * [Organic Yield (kg/m^2)] * [Average Price of Produce ($CDN/kg)]

= [6,833,319.41 m^2] * [4.1 kg/ m^2] * [$1.97 CDN/kg]

= $54,870,964

= ~$55,000,000

where b = [Local Multiplier (LM)] = $2.95 CDN to the local economy/$1 spent on buying local foods

then

[Local multiplier effect on the Kingston economy for park urban agriculture where maximum area is used ($CDN)]

= a*b

= [$54,870,964] * [2.95 $CDN to the local economy/$1 spent on buying local foods]

= $161,732,166

= ~$160,000,000 goes to the local economy from the production and purchase of urban agriculture produced foods

- Kyoto: Valuing Reduced Emissions.

From Hill (2003), an initially suggested figure of $12 CDN/tonne was used to determine the value of greenhouse gas emissions if the Kyoto Protocol had been ratified in Canada at that time as part of a global carbon emissions trading scheme. According to Zenghelis (2007), the current pricing estimates vary from $15 to $30/tonne of carbon dioxide equivalents. If all measurable impacts (such as those examined in the Stern Review) were accounted for the price of a tonne of carbon could be as high as $80/tonne or more.

Thus my valuation of greenhouse gas reductions is very conservative. The figures generated for this section represent the value of avoided greenhouse gas emissions due to reduced long-distance imports of food and avoiding nitrous oxide emissions through better agricultural practices. This information was used on page 34.

- Example

This example pertains to the value of reduced GHGe from ecological peri-urban agriculture in the case where the Percentage of Food That Remains Local is 50% (where the percentage of food that remains for local use is 50%). I chose it since reduced GHGe from better agricultural practices are relevant to peri-urban agriculture around the inner City of Kingston. GHGe reductions and the associated carbon trading value were assumed to be only possible for ecological agriculture as was discussed in the Environment section (p.148).

[Value of Avoided GHGe for Peri-Urban Agriculture in the case where the Percentage of Food That Remains Local is 50% ($CDN of carbon emissions trading value)]

= A * B

where A =

[Avoided GHGe from All Peri-Urban Agriculture (tonnes)]

= [Area of Peri-Urban Agriculture (ha)] * [Reduced GHGe Per Unit Area (tonnes of CO_2e equivalents/ha)] * c

= [718 ha] * [0.5 tonnes of CO_2e equivalents/ha] * [8.3%]

= 359 tonnes of avoided GHGe due to better agricultural practices through nitrous oxide reduction

where c = [Percentage of Peri-urban Ecological Agriculture (%)]

= 8.3%

where B =

[Proposed 2003 Kyoto Value for Carbon Emissions Trading Units ($CDN/tonne)]

= $12 CDN/tonne

then

[Value of Avoided GHGe for Ecological Peri-Urban Agriculture in the case where the Percentage of Food That Remains Local is 50% ($CDN of carbon emissions trading value)]

= A * B

= $4,308 CDN

= ~$4,300 CDN which would have been the value of Kyoto carbon emissions trading scheme credits in 2003

- Labour Income and Job Generation

In this section I explain how I determined the labour income and number of jobs generated from a calculated gross economic production value. The process is outlined below. In both cases the multiplier generated to determine labour income from gross production value and jobs generated from labour income are unit-less.

♦ Determining the Gross Sales to Labour Income Ratio (GSLIR).

The GSLIR was used to translate gross sales values of urban agriculture products into labour income. The GSLIR was based on three studies that were all discussed in a report prepared by Krouse and Galluzo (2007). From these studies I set out to create an approximate average ratio that could be used in any situation.

➢ From Swenson (2005) in Krouse and Galluzo (2007):

"Because most of the fruits and vegetables consumed in Iowa come from outside the state, growing one-quarter of the produce Iowans consume would have a large impact on the economy. In the final analysis, Swenson found the net added value to the Iowa economy attributable to the scenario would be almost $140 million in sales, $54 million in labor incomes and 2,031 jobs."

From this information:

where G = gross sales value = $140 million

where L = labour income = $54 million

then G1 =

= G/L

= $140 million/$54 million

= $2.59 gross sales value contributes $1 labour income (2.59:1)

- From Swenson (2006) in Krouse and Galluzo (2007):

Swenson (2006) completed a follow up study to Swenson (2005) one year later, which "analyzed the potential net economic impacts that could accrue to the state under various scenarios".

Business as Usual: "This study still supposed 25 percent of the 37 primary fruits and vegetables consumed annually by Iowans would be grown by Iowa producers, but rather than being fully marketed by farmers to consumers, half would be sold to wholesale distributors to distribute through grocery stores. When all the changes in marketing were considered, the researchers found the net value added to the Iowa economy would be $92 million in sales, $33.5 million in labor incomes and 1,183 jobs."

From this information:

where H = gross sales value = $92 million

where I = labour income = $33.5 million

then G2 =

= H/I

= $92 million/$33.5 million

= $2.75 gross sales value contributes $1 labour income (2.75:1)

The other 2 scenarios that were looked at in this analysis included a consumption goal in addition to the 25 percent production goal.

Scenario 2:

"... all Iowans would follow a diet including five servings of fresh fruits and vegetables a day, and for three months of the year, 100 percent of those servings of fruits and vegetables would be grown by Iowa farmers. Since fewer than 20 percent of Iowans now consume this many serving of fruits and vegetables each day, this diet would create a significantly larger demand for produce among Iowa food retailers and direct marketers."

"This scenario would require production of 382 million pounds of produce and would require nearly 31,800 acres of crop land. Gross receipts to farmers would be over $100 million and gross retail receipts would be almost $430 million. In the final analysis, this change in both consumption and production of fruits and vegetables would add $302 million in total sales, over $112 million in labor income and 4,094 new jobs."

From this information:

where J = gross sales value = $302 million where K = labour income = $112 million

then G3 =

= J/K

= $302 million/$112 million

= $2.70 gross sales value contributes $1 labour income (2.70:1)

Scenario 3: "... the consumption goal increased to seven daily servings of fruits and vegetables ... Under this scenario, Iowans would generate a net increase in economic activity of $429 million in sales, almost $160 million in labor income and 5,616 new jobs."

From this information:

where O = gross sales value = $429 million

where P = labour income = $160 million

then G4 =

= O/P

= $429 million/$160 million

= $2.68 gross sales value contributes $1 labour income (2.68:1)

- From Otto and Varner (2005) in Krouse and Galluzo (2007):

This study looked at the economic impacts of Iowan farmers' markets. It was a survey during the 2004 market season where an estimated 135000 citizens and 1600 vendors gathered for at least one of 180+ markets in the state. The large survey asked demographic and market participation questions to both groups.

In the final analysis, "... the researchers estimated there was $20 million in sales during the season. This amount was used to estimate the total economic impact. The model demonstrated the 2004 Iowa farmers' market season resulted in $31.5 million of gross sales and $12.2 million of personal income directly or indirectly related to farmers' market activity and over 140 full employment positions indirectly attributed to farmers' market activity."

From this information:

where Q = gross sales value = $31.5 million

where R = labour income = $12.2 million

then G5 =

= Q/R

= $31.5 million/$12.2 million

= $2.58 gross sales value contributes $1 labour income (2.58:1)

- Final Calculation of the GSLIR.

After all of the interim values from the previous studies were calculated, I took an average of all of them to determine the GSLIR that I would use.

Gross Sales to Labour Income Ratio (GSLIR)

= Average (G1,G2,G3,G4,G5)

= $2.66 gross sales value contributes $1 labour income (2.66:1)

= ~$2.70 gross sales value contributes $1 labour income (2.70:1)

- Example

In this example, I use the GSLIR to determine the amount of labour income that could be theoretically generated by using all park space for urban agriculture. I chose parks because it offered an easy and accessible means to provide a livelihood to marginalized or low-income individuals especially in the Rideau Heights/North Kingston area. Any urban agriculture in the inner-city was assumed to be using ecological agricultural methods.

[Labour Income Generated by Park Urban Agriculture Using Maximum Area ($CDN)]

= D/GSLIR

where D =

[Economic Production Value of Park Urban Agriculture]

= a * b * c

= $54,870,964 CDN of park produced FFV

= ~$55,000,000 CDN of park produced FFV

where a = [Maximum Area of Park Urban Agriculture (m^2)] = ~6,833,319 m^2

where b = [Organic Yield (kg/m^2)] = 4.1 kg/m^2

where c = [Average Price of Produce ($CDN/kg)] = $1.97 CDN/kg

where GSLIR = $2.66 gross sales value contributes $1 labour income

then

[Labour Income Generated by Park Urban Agriculture Using Maximum Area ($CDN)]

= D/GSLIR

= $20,630,498CDN

= $21,000,000 CDN of labour income generated by park urban agriculture using maximum possible space

- Determining the Labour Income to Jobs Ratio (LIJR).

From 2001 census data[356], the average Kingston income was $29,602. This value was used to determine the number of jobs given a specified labour income amount [LIJR]. Essentially every $29,602 of labour income supported 1 job in this case. I did not factor in the possibility that this income might be insufficient given today's costs or inflation rates.

Continuing with the preceding example from p. 173:

[Jobs Supported By Park Urban Agriculture (# of jobs)]

= X / [LIJR]

where X =

[Labour Income Generated by Park Urban Agriculture ($CDN)]

= $20,630,498 CDN of labour income generated by park urban agriculture using maximum space possible

where [LIJR]

= Labour Income to Jobs Ratio

= $29,602 of labour income supports 1 job

then

[Jobs Supported By Park Urban Agriculture (# of jobs)]

= X / [LIJR]

= 697 jobs

= ~700 possible jobs could be supported by park urban agriculture using maximum possible space

Appendix C
Supplementary Material

This section contains the case studies and additional boxes, figures and tables that were not included in the main text due to space constraints. The final section of this appendix contains the results of the visual analysis (page 205) of all survey and interview responses as was discussed from page 17 onward.

Case Study: Sunnyside Garden

Sunnyside Garden is one example of the challenges that urban farmers and gardeners face when trying to establish a new garden within an urban area. There are difficulties in accessing land. There are bureaucratic hurdles, by-laws and policies that make establishing a community garden difficult[357].

Location: Sunnyside Garden is at the intersection of MacDonnell and Brock Street.

Past History

Sunnyside Garden's roots can be traced to the Block D international peace garden project that became a community garden in the 1970s[358]. Approximately 2 years ago, the Block D site had been slated for development and the Block D gardeners had to find another place to go. The Parks and Recreation department at the time agreed to help the Block D gardeners to find a new home. Many sites were suggested during the original consultation process and they eventually settled on Victoria Park[359].

The garden organizers circulated petitions that showed that the Victoria Park neighbourhood was in favour of the initiative. They did the research, created a report and crafted a proposal. They held a promotion at a local worker co-op restaurant[360] and the BBQ party where officials attended and gave the go ahead signal. Then the City came back in 2005 and said it was not a good site at all, delaying the process. This impasse continued to the point that the group missed another growing season and still had no specific cultivation space.

Views

Urban agriculture was considered to be a positive benefit to Kingston. The gardeners believed it was important to actively grow food in the city even if a sustainable food system was a long way off. The gardeners maintained that growing food locally was seen to help reduce food-miles and long-distance transportation of food. They felt that urban agriculture made people more conscious of the importance of growing food. Urban agriculture reconnects humans to the land while nurturing community spirit and "awareness of sustainable food systems".

Community gardens were considered a nice way to meet people. To the gardeners it was a real example of a true group project where everyone actually works together and in unison for a common, worthy cause while throwing fun celebrations, forging friendships and initiating discussions about politics and food. The gardeners maintained that urban agriculture had the "potential to help low income individuals". Depending on the context they explained, it was often the privileged that have good access to food. Urban agriculture helps to fix this unequal access by allowing people to grow their own affordable, healthy, nutritious and organic food - something that is often too expensive for struggling households. Land access or provisioning issues however would still have to be dealt with.

Challenges

Kingston is behind cities like Toronto and Montreal in terms of an establishment process for urban gardening initiatives according to gardeners. The lack of a framework or application process, precedent or policy to guide the establishment of community gardens was the largest obstacle that the garden faced. One of the gardeners stated that a significant problem was the absence of community gardens in the City Official Plan (COP). The gardeners felt that Kingston had a long way to go to advance community gardening and urban agriculture relative to cities like Toronto, Ottawa and Montreal, which have hundreds of gardens whereas Kingston only has fewer than a dozen. There was a desire for the City of Kingston to demonstrate leadership. It was felt that the City had no concept for how urban agriculture or community gardens really work. The history of delays was seen as "discouraging" likening this to running up against a "brick wall".

Present Situation

Sunnyside Garden had been trying to establish itself for the last 2 years. In early 2006, the new government administration gave the garden another site three blocks west of Victoria Park at the intersection of MacDonnell and Brock St. The garden undertook another democratic consultation process. During the second consultation, they discovered someone who lived right beside the proposed garden site had their house for sale. The owner became alarmed when the newspapers proclaimed that it was a certainty and foregone conclusion. This led to opposition that delayed the garden from being established until March 2007. At that time, the City helped to create 12 ft by 6 ft garden plots allowing the group to finally create an edible landscape.

Case Study: FRILL Community Garden

FRILL (Friends Revitalizing Industrial Land Lovingly) Community Garden is a rare example of an established urban agricultural initiative on private land with insecure land tenure[361]. The possibility of one day being asked to re-locate – thereby losing the investment in social, environmental and economic capital invested into the Garden and the immediate community is an ever present issue.

Location and Size: 38 Charles Street near the corner of Charles and Bagot Street. It has slightly more than 1480 square feet of growing space. There is a central pizza garden and roughly 14 member plots. There is also a long perennial flowerbed and three circular beds.

Past History: The garden[362] was started in May 2004 by the Grade 2 class at Mulberry School[363] and Carone Beaucage as a cleanup project. The original area was a vacant lot that had been "sprinkled with broken glass and trash. Graffiti covered the nearby warehouse…" Carone had moved into a house across the street and had said that she did not want her children to have to view such an unsightly "mess". The community (teachers, students and parents) was invited to help out – creating ornamental, fruit and vegetable garden plots with trucked in soil. Kingston businesses also donated soil, lumber and plants during this early period. Ultimately, the group "FRILL" (Friends Revitalizing Industrial Land Lovingly) was born of this cohesive project and included families of the students at the school, people in the neighbourhood and Kingston citizens who grow food for low-income families.

FRILL has run into some interesting twists and turns in their history however. In 2005, Loblaws, a major Canadian food distributor and supermarket chain decided to renege on its original written agreement with FRILL and evict them. The group was given until Oct 17 and then Oct 31 in order to harvest the remaining vegetables. FRILL elicited much publicity and media coverage resulting in the local newspaper (Kingston Whig Standard) making contact with the corporate executives who had apparently decided by that time to extend FRILL's usage for another year.

Membership: It is difficult to determine the 'actual' membership. There are approximately 14 plot gardeners as of 2006 though the membership could also be extended to the planning team members without plots (2-3) and numerous communal gardeners and supporters. The size of their mailing list was 78 at last count in September 2006.

Backgrounds: The membership is composed of people from various professions and walks of life – from carpenters to church archivists to retired academics. A large proportion of the members are women and most members are young or middle aged. The experience of members range from minimal to fairly competent – one member was even working towards being a master gardener. Members of the communal garden plot may have no experience whatsoever at the outset.

Challenges

The main challenges that FRILL Garden faced are detailed below.

Land insecurity: this is the most subtle, pervasive issue for FRILL and is apparent for any garden that is on private property. The owner has the option to evict anyone using the land. For members of FRILL, this is always in the "back of their minds". As of September 2006, Loblaws had allowed the garden to exist at its current location for another year, which has granted temporary mental relief to the group for which they have been thankful.

Funding: another pressing issue is finding the monetary resources to pay for liability insurance, fund its community outreach programs and other projects as well as obtaining useful garden tools, implements, etc. The lack of formal structure or official non-profit organization status has also hindered efforts to get funding in most cases.

Participation: FRILL finds it difficult to get the "input" of the entire community for planning and important projects (i.e. the accessible raised garden bed - ARG). Volunteering takes time and members' schedules may not fit with the schedule FRILL follows meaning that it's difficult to achieve fully democratic and effective decisions that benefit everyone all the time. Recently, it has also been difficult to get gardeners to tend their plots and take care of them – prompting the need for a designated garden coordinator. That however brings them back to funding issues.

Inputs: this is closely linked to funding, as monetary resources are required to get new tools, soil or building materials for projects. A large recurring problem for the FRILL community garden is water access. FRILL installed rain barrels with only a moderate degree of success. Water access is an area that the City could play a role in helping out with and FRILL is working to develop some friendly relations with Public Works. FRILL has been trying to convince the city to come along to fill its rain barrels to avoid some less physically able gardeners having to haul water a long-distance away or buying it in bulk from the No Frills supermarket across the street. In June 2007, the City generously filled the three existing rain barrels. They were eager to help in emergencies though made no long-term commitments.

Production: FRILL garden allows only organic and ecological methods of cultivation – meaning no agrochemical pesticides or fertilizers. The actual area devoted to food is roughly 1480 square feet (14 of 10 x 10 ft beds and a circular bed of 80 ft) and the amount of produce is estimated to be half a ton per season.

Ornamental plants are also grown in the garden – some are native and some are perennial. The soil was all originally trucked in and is of moderate quality with room for further nutrient improvement.

Present Situation: Since being granted the additional lease on life, FRILL has continued with numerous activities – mostly involving community building activities and fundraising. Another major issue that FRILL shares with other community gardens are funding – in its case the insurance premium is itself the single biggest annual expense that FRILL has to deal with[364]. So far FRILL has been raising money through concerts, holiday and gift card sales, plant sales and garage sales – with positive success. It should be noted that FRILL's publicity and history has garnered continued community support, which has helped its activities.

The initiative FRILL was working on since the spring of 2006 was their accessible raised bed gardening (ARG) project[365]. The aim was to create a symbolic demonstration. The ARG, one of the first of its kind in Kingston, would allow people of differing or limited mobility to experience the joys and benefits of gardening. Roughly half the desired funding was provided by the Community Foundation of Greater Kingston (CFGK), which spurred further fundraising and demonstrated the need for greater financial support of these initiatives.

Future Plans and Views:

Local food access – FRILL wants to encourage more local, organic food in local stores and in the community. They have even entertained ideas of persuading big chain stores like Loblaws/No Frills to go organic and local. FRILL also hoped that the garden site could serve as a CSA (community supported agriculture) drop off point for neighbourhood individuals.

Effective organization – FRILL envisions organizing itself into an elected board and applying for non-profit status in order to gain access to better funding opportunities. This however has yet to happen as some planning team members have expressed a certain preference for the informal, open and friendlier decision-making situation that currently exists. In addition, FRILL had hoped to create a newsletter that would serve to both educate and notify members of events. As of early 2007, they released their first newsletter to its members and the Kingston community.

Urban-rural connections – FRILL hopes to make more partnerships and friendships with local farmers in the area. This was mainly seen as part of a creating a strong local food movement and foster solidarity. Currently, the group as a whole has not approached very many of the farmers to achieve this goal. Many individual members however may have relationships with specific farmers through the Kingston Farmers' Market or affiliations to the National Farmers' Union for example.

Education – FRILL hopes to create partnerships with school boards to bring gardening and food system issues into kids' classrooms and curriculum. The group had also wanted to set up a regular set of workshops and programs. In this regard, FRILL has begun to provide workshops on various activities ranging from craft making to practical skills like canning to talks on current global environmental issues. FRILL also allows groups like Future Quest and H'Art Studios to make use of the garden – the former to gain leadership and community service experience and the latter to allow developmentally challenged young people a chance to garden and create art inspired by their plants.

Garden network/movement and partnerships – Another goal that FRILL wants to see realized is the creation of a network of community gardens or the generation of a community garden movement within Kingston in order to gather more people to the cause and initiate momentum. FRILL hopes to see more community gardens started as well as 'mentoring' or offering advice and support to other gardens. They also desire a stronger partnership to Heirloom Seed Sanctuary, which is a repository of a very diverse and very genetically resilient seed reserve with lines dating back from the 1700s.

City support and partnerships – FRILL hopes to convince the City one day to fully support community garden initiatives. A community garden staff person within the City political structure and close cooperation is something FRILL believes strongly in.

Building community and social capital – This is an extension of a desire for greater community cohesion. More community events like 'harvest festivals', celebrations and dancing is seen as a great way to bring people of various backgrounds, ages and ability together to socialize and build relationships.

Comfortable and safe meeting place – FRILL hopes to turn the garden into a space where gardeners, supporters and visitors can sit, meet and socialize. In this regard, FRILL recently built benches and a large harvest table and has noted that visitors have made use of it on occasion. FRILL envisions a community that allows people to move through the neighbourhood with physical freedom and safety. FRILL sees community gardens as a way to partly provide that through the presence of watchful, supportive neighbours and gardeners being present at the site.

Urban Environment, Farming and Biodiversity – FRILL wants to increase the diversity within the garden ecosystem and habitat and has recently set out to create a native plant garden. The group also continues to strive for a mixture of plants, flowers and herbs – though strictly medicinal ones have yet to be grown in the garden. They envision one day including ponds to serve as a grey water catchment to draw more flora and fauna (i.e. like birds and insects).

Increasing community involvement – FRILL also hopes one day to get the majority of the Kingston community involved with community gardens in order to increase social diversity and inclusiveness. This not only includes visible minorities but also people of different physical abilities and different ages. They hope to join the experience of the older individuals in the community with the younger generation as well as learning from different cultures.

Food security programs – FRILL would like to see citizens growing all of their food organically in various locales. They see knowledge as seed saving, preservation and drying and other basic skills – skills that are being lost in successive generations – as vital to creating community self-sufficiency and more skilled individuals able to take care of themselves. They one day hope to create permanent displays in the garden about how to compost, collect rainwater and how to use seeds to grow plants and flowers.

Permanent space – FRILL really believes that private firms like Loblaws or the City of Kingston could really help in guaranteeing and providing permanent spaces for community gardens like FRILL and Sunnyside Garden that have good soil and no contamination. They envision year round gardens and greenhouses like those in cities such as New York. Before they were granted another year of gardening, FRILL had tried to get a rooftop garden proposal prepared to pitch to Loblaws should they decide on a new building development at the site. Securing the steady aid of an urban planner or architect however has proven difficult as well as getting the time of everyone who would be important to the proposal's creation. FRILL has also played with the idea of setting down 'roots' on land near the old Kingston Whig-Standard building. The owner had gladly and willingly offered the space and FRILL has yet to find the time and resources to act on the invitation – the current site is the one they love most. As part of their desire for a community garden movement however they would love to see either some gardeners from their membership or a new group of gardeners make use of that space.

Figure 1. May Day 2006 - May Pole Celebration at FRILL Community Garden (38 Charles St) [366]

➢ Boxes

Box 1: **Innovative Urban Farmers**[367]

Around the world urban farmers are starting to notice the needs of cities as well as anticipating future changes in the local, regional and global situations. They are coming up with novel responses to urban citizen demands.

What are some of the things they are doing or offering?

1. *Fresh food*: through direct marketing or farmer cooperatives in many cases.

2. *Employment*: the extra income earned can be used to hire more labour.

3. *Training*: agricultural and new job skills to meet a changing world.

4. *Recreational services*.

5. *Educational services* (school milk/meals, environmental education).

6. *Health services* (on-farm medical care, remedial activities for people with psychological or physical problems).

7. *Nursery facilities* that grow ornamental plants and tree seedlings for urban home gardens, streets and parks.

8. *Scenic tourism*: in China, Northwest Sydney (Australia), Mexico City[368] and Hanoi (Vietnam), agrotourism is a booming and successful business[369].

9. Fostering *cultural exchange* within and among diverse communities.

10. *Promoting health and nutrition* by facilitating access to fresh, local fruits and vegetables for all income levels.

Real economic and environmental efficiency would be gained by combining the multiple functions that UPA can provide instead of dividing them up into specialized processes as we have done in the past. Certainly all of these benefits are relevant to the developed world and Canadian situation.

Box 2. Rideau Heights, Food Deserts and Parks: Growing Self-Sufficiency

A side assessment was made for the Rideau Heights neighbourhood since it was a high priority area. It was classified part of the food desert in North Kingston[370] (**Figure 4**). It has a population of 6095[371] where only 28.6% actually own a home and another third of the community rent their dwellings. Single women parents are 86% of all lone parent families in the area.[372] Analyzing the possibility of using parks to address the lack of fresh nutritious food, calculations indicated that using 27% of 6 park spaces around Rideau Heights (Belle, Max Jackson Memorial, Compton/Headway, Marker Crescent, Shannon and Star Reid Park) was sufficient to provide the minimum amount of fresh fruits and vegetables necessary for the Heights population. The parks ranged in size from 0.85 ha (Star Reid) to 48.16 ha (Belle Park). Using ~34% of the area of Belle Park alone would already meet the residents' fresh fruit and vegetable needs. Raised bed and container gardening are certainly prime possibilities.

It should be said however that using urban agriculture in this manner is only a stopgap measure. The root causes such as poverty, hunger and access[373] must also be addressed for urban agriculture to be viable. What about providing a sustainable livelihood? If all 6 parks (60 ha) were to be utilized completely they could yield 2700 tonnes of fresh produce within a single growing season valued at $5.4 million dollars. With re-developed food processing, storage capacity and training in preservation skills that food could alleviate some hunger in the winter months. If all that produce was sold it could provide up to $2 million in labour income and support 69 jobs. Are there possibilities for empowering individuals and providing the ability to feed themselves and earn a living? It certainly would seem so.

Box 3. Urban Agriculture in Parks: North America and Elsewhere

These are examples where urban agriculture has played an integrated role in park design, maintenance and use.

- The citizens of Jakarta, Indonesia transformed former pubic parks into food gardens during the continuing economic crisis that occurred after 1997[374].
- In Rosario, Argentina the city launched its Urban Agriculture Programme (UAP) and one of its results were the creation of 'garden parks': they integrated different activities and users, minimizing construction and maintenance costs while providing ecological services vital to city environments[375]. This blend of urban landscape design and productive use provides land security (to urban farmers), education and leisure space[376].
- In Amsterdam, Netherlands, their parks have been converted into urban gardens covering 300 ha in a city whose density often exceeds 20000 people/km^2 in some areas[377].

- Parks, lakes and horticultural gardens are part of the Hanoi landscape – serving to attract thousand of tourists[378].
- The floating gardens of Xochimilco serve as an integral part of family and popular ceremonies in the heart of Mexico City[379].
- Parks in Vancouver are helping to drive composting of grass, leaves, tree trimmings and plant debris that can serve as an input for UPA in the same areas[380].
- Some parks in Beijing, China are helping to drive their large-scale agrotourism industry through sightseeing – this includes forest parks[381].
- Havana, Cuba has a master plan that also includes provisions for municipal parks and increased green space creation – one such park is Parque Metroplitano de la Habana (PMH). The Havana Master Plan has also created a greenbelt of green areas and parks around Havana, which has served as the focus point for peri-urban production of mostly produce and livestock[382].
- London, England (UK) has a few community food growing projects in its parks, often located near management buildings[383].
- Community gardens can also be found in parks in Toronto, Ontario and Montreal, Quebec[384]. There were indications of over 10000 or more such public allotments in each[385].
- Cockington, Torquay, Devon (UK): The Torbay Coast and Countryside Trust (TCCT) (the equivalent to conservation authorities here) has established farming on the conservation park property (with animals in the barn for people to see), a farm gate store, a farmers' market of 12 vendors and attracts people and tourists to their trails on their land. Even the municipal government supports the initiative by establishing a shuttle bus to and from the farm. This is an excellent example of a successful multiple land-use initiative with political, business and community support. It also demonstrates that socioeconomic development can go hand in hand with environmental conservation.[386]
- The Toronto Regional Conservation Authority (TRCA) has recently agreed to have farmers use its conservation land for urban production along lines similar to the TCCT in Devon, England. [387]
- Grant Park, Chicago hosts an educational, artistic edible garden that was created by Growing Power Inc.[388]

Box 4. Brownfields and Urban Agriculture: North American Examples

These are examples of brownfields being put to active, green and innovative uses within the western hemisphere.

A project in Buffalo, New York in the US granted full time jobs to former welfare users and the combined, synergistic hydroponic-aquaculture (aquaponic) operation was built on a brownfield site[389].

Another case in Philadelphia (USA) is Greensgrow Farm (**Figure 8**), which is constructed on an abandoned brownfield in an economically disadvantaged neighbourhood[390]. This farm has a dual role as an education model for urban consumers about food and as a distribution node for rural growers and local food (especially for low income neighbourhoods that are ignored by larger grocery chains) in addition to acting as a CSA and directly supplying high-end gourmet greens to restaurants. The advantage of Greensgrow is that it can provide services to the community that rural farms cannot because they are already in the city. As part of their goal as a UPA information clearinghouse, they also provide information on alternative growing systems and reusing brownfield land for green use.

In Milwaukee and Chicago, Growing Power Inc. has successfully grown food in paved schoolyards and raised surfaces demonstrating that gardening can occur in any location, avoiding any legacy of contamination[391].

Box 5. Food Down the Road: Toward a Sustainable Local Food System for Kingston and Countryside

Background

Food Down the Road is an NFU initiated project that was kick started by existing local food marketing initiatives[392]. The initiative sought to engage farmers and a broad range of stakeholders in a long-term effort to create markets that support farming, processing and distribution of locally grown food within 100 km of Kingston. The project is partly funded by the federal and provincial government through the Agricultural Management Institute program under the Agricultural Policy Framework.[393]

Present Situation

Food Down continues to build a local network of stakeholders with interests in local and sustainable food. That was partly accomplished by the four-part Spring Speakers Series that they ran from February-May 2007. The first event dealt with how Kingston could set up a successful local food campaign. The second event drew farmers and the general public to discuss issues of climate change and expensive energy. The third event attracted anyone interested in how local food systems could help deal with health problems and fair access to nutritious foods. The fourth event drew together people from all walks of life to learn about what sort of policies would be needed to create a local food system in Kingston. The series served to build awareness and support for a local sustainable food system among the general Kingston community. Food Down the Road also works to keep interested parties aware of the project's activities. Realizing that a concerted research effort was lacking, Food Down the Road helped to form a local Kingston research network.

Future Actions

After the completion of the Spring Series, Food Down the Road's volunteer planning team (SOS or Support Our Summit), the community council (a multi-organizational steering committee representing stakeholders from all sectors of the food system) and the two paid coordinators began organizing a Local Food Summit for fall 2007. The attendees would assess the opportunities, barriers, assets and gaps linked with the development of key components of the local Kingston food system. It was hoped that the conference would give rise to a framework for an organizational structure like a local food network or food council that would implement the conference outcomes. This could lead to a food charter or other development projects. Considering the positive trends towards local and sustainable food and the efforts of groups like Food Down the Road and the National Farmers' Union Local 316, there has already been considerable movement towards changing perceptions and realizing the potential of urban agriculture in the Kingston context.

➢ Figures

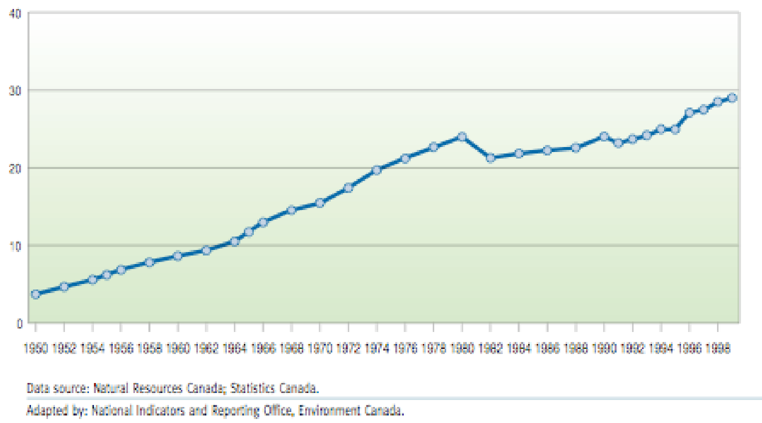

Figure 2. Fuel use by automobiles, vans and light trucks in billions of litres of gasoline. [394]

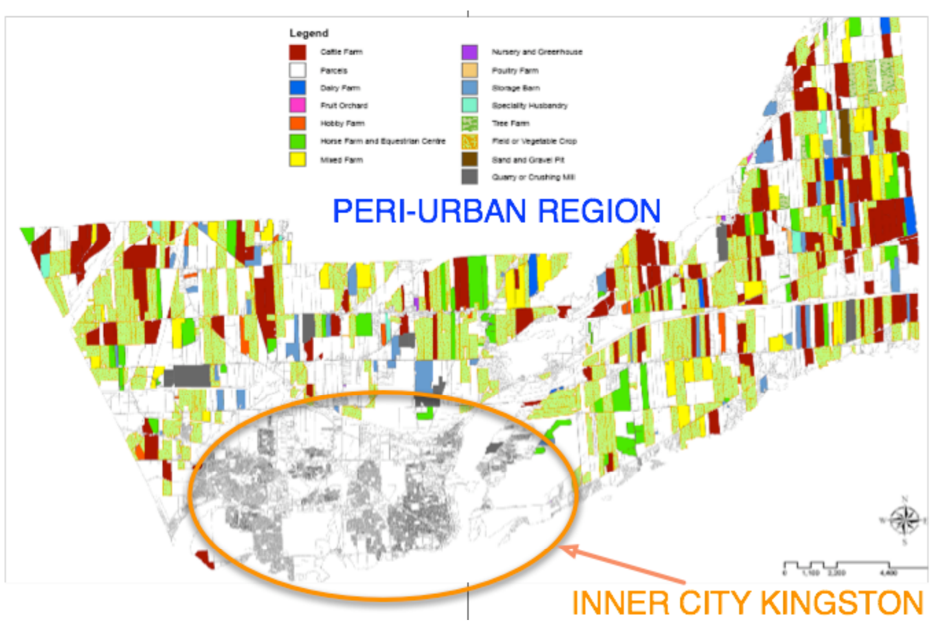

Figure 3. 2006 Agricultural Study used to delineate the inner-city and peri-urban regions of the official City of Kingston that were defined for this study. [395]

Figure 4. Grocery store distribution (No Frills, Food Basics), taxi fare and walking times to grocery stores from the food insecure Rideau Heights North Kingston area (shaded). The IGA supermarket is no longer present. [396]

Figure 5. An intern holding organic carrots grown in FoodShare's Sunshine Garden.[397]

Figure 6. Living wall panel being used to grow lettuce in Vancouver, British Columbia. [398]

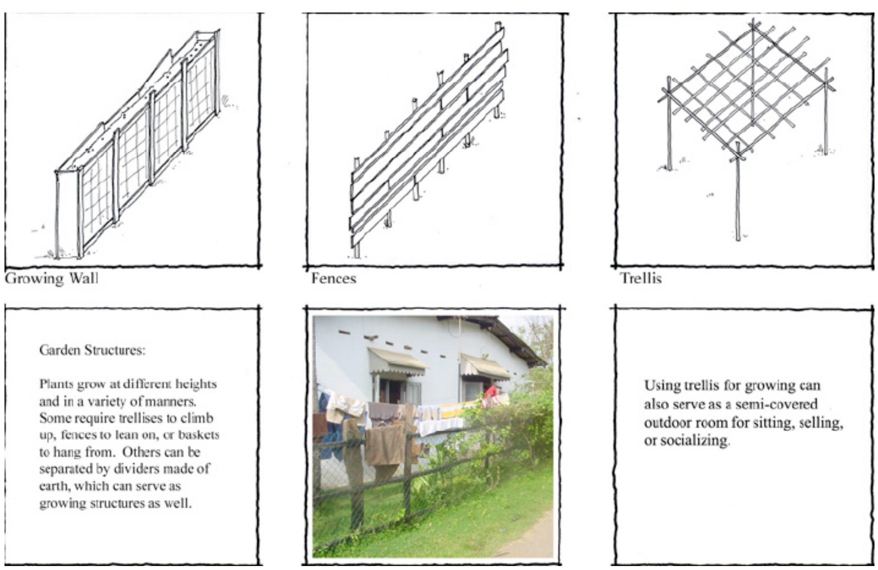

Figure 7. Vertical structures can help to utilize even the smallest of spaces and expand urbn production. [399]

Greensgrow Farm in Philadelphia has a hydroponic lettuce operation in a former abandoned lot.

Figure 8. Greensgrow Farm in Philadelphia.[400]

➢ Tables

Table 19. The 20 largest parks in Kingston with name, street, size, *maximum* estimated organic yield and equivalent economic production value if all produce was sold. All parks in 'central' Kingston are shaded. [401]

City Park Name	Street Name	Street #	Location	Acre	Hectares (ha)	Metres (m2)	Yield (kg)	Yield (tonnes)	Value ($ Cdn)
Cataraqui Park A,B & Golf Course	Belle Park Dr	348	Central	350	140	1,400,000	5,700,000	5,700	11,000,000
Arbour Ridge Park	Tanner Dr	588	West	250	100	1,000,000	4,100,000	4,100	8,100,000
Belle Park Fairways	Montreal St	713	Central	120	48.15811	480,000	2,000,000	2,000	3,900,000
Woodbine Park	Woodbine Rd	1180	West	54	21.85326	220,000	900,000	900	1,800,000
Grass Creek Park	Hwy 2	2991	East	51	20.63919	210,000	840,000	840	1,700,000
Lake Ontario Park	King St. West	920	Central	34.6	14.00227	140,000	570,000	570	1,100,000
Whitmount Estates Park	Channelview Rd	1334	East	27.4	11.08851	110,000	450,000	450	900,000
Kingston Memorial Centre	York St	303	Central	23.6	9.550684	96,000	390,000	390	770,000
City Park A & B	Bagot St & King St.	33	Central	20.5	8.296145	83,000	340,000	340	670,000
Shannon Park A&B	Wilson St	199	Central	19.3	7.810517	78,000	320,000	320	630,000
Cecil Graham Park	Aragon Rd	201	West	18.4	7.446296	74,000	300,000	300	600,000
Ridgewood Park	Safari Dr	830	West	16.7	6.758323	68,000	280,000	280	540,000
Cloverdale Park(Cataraqui Arena)	Sunnyside Rd	1030	West	16.3	6.596447	66,000	270,000	270	530,000
Trillium Ridge Park	Waterloo Dr	341	West	16.2	6.555978	66,000	270,000	270	530,000
Katings - Megaffin Parks	Montreal St	407	Central	15.1	6.110819	61,000	250,000	250	490,000
Cataraqui Woods Park	Cataraqui Woods Dr	805	West	14.5	5.868005	59,000	240,000	240	470,000
Grenadier Park	Grenadier Dr	41	East	14	5.66566	57,000	230,000	230	450,000
Lions Civic Gardens	Gardiners Rd	875	West	14	5.66566	57,000	230,000	230	450,000

Table 20. The 2006-07 values of soil formation ecosystem services for fresh fruit and vegetable UPA in Kingston are shown for inner-city and peri-urban agriculture.

		Ecosystem Service Value ($CDN/yr)
Inner-City Urban Agriculture	Citizen	$128
	Producer	$10
	Sub-Total	*$138*
Peri-urban Agriculture	*Total*	*$8,600*
Total		**~$8,700**

Table 21. The 2006-07 values of nitrogen fixation ecosystem services for fresh fruit and vegetable UPA in Kingston are shown for inner-city and peri-urban agriculture.

		Ecosystem Service Value ($CDN/yr)
Inner-City Urban Agriculture	Citizen	$490
	Producer	$40
	Sub-Total	*$530*
Peri-urban Agriculture	*Total*	*$33,000*
Total		**~$33,000**

Table 22. Annual greenhouse gas reductions through better agricultural practices of fresh fruit and vegetable UPA in Kingston are shown for inner-city and peri-urban agriculture.

		GHGe Reduction (tonnes)	Equivalent Number of Cars ($CDN)	Emissions Trading Value ($CDN)
Inner-City Urban Agriculture	Citizen	5	2	$64
	Producer	0	0	$5
	Sub-Total	*6*	*2*	*$69*
Peri-urban Agriculture	*Total*	*360*	*120*	*$4,300*
Total		**~370**	**~120**	**~$4,400**

Table 23. The 2006-07 estimation of the number of people whose minimum fresh fruit and vegetable needs could be met in a business as usual scenario. The percentage of food that remains for local Kingston consumption is 7%.

		AREA ANALYSIS		YIELD ANALYSIS	
		Number of People Whose Minimal FFV Needs Are Met (#)	**Proportion of Kingston CMA Population (%)**	**Number of People Whose Minimal FFV Needs Are Met (#)**	**Proportion of Kingston CMA Population (%)**
Inner-City Urban Agriculture	Citizen	2,800	1.9	3,700	2.4
	Producer	230	0.1	360	0.2
	Sub-Total	*~3,000*	*2.0*	*~4,100*	*2.7*
Peri-urban Agriculture	*Total*	*7200*	*4.8*	*11,000*	*7.5*
Total		**~10,000**	**6.8**	**~15,000**	**~10**

Table 24. The estimation of the number of people whose minimum fresh fruit and vegetable needs could be met where the percentage of food that remains for local Kingston consumption is 25%.

		AREA ANALYSIS		YIELD ANALYSIS	
		Number of People Whose Minimal FFV Needs Are Met (#)	**Proportion of Kingston CMA Population (%)**	**Number of People Whose Minimal FFV Needs Are Met (#)**	**Proportion of Kingston CMA Population (%)**
Inner-City Urban Agriculture	Citizen	2,800	1.9	3,700	2.4
	Producer	230	0.1	360	0.2
	Sub-Total	*~3,000*	*2.0*	*~4,100*	*2.7*
Peri-urban Agriculture	*Total*	*26,000*	*17*	*41,000*	*27*
Total		**~29,000**	**~19**	**~45,000**	**~30**
Difference to Current Situation (times): 3					

Table 25. The estimation of the number of people whose minimum fresh fruit and vegetable needs could be met where the percentage of food that remains for local Kingston consumption is 50%.

		AREA ANALYSIS		**YIELD ANALYSIS**	
		Number of People Whose Minimal FFV Needs Are Met (#)	**Proportion of Kingston CMA Population (%)**	**Number of People Whose Minimal FFV Needs Are Met (#)**	**Proportion of Kingston CMA Population (%)**
Inner-City Urban Agriculture	Citizen	2,800	1.9	3,700	2.4
	Producer	230	0.1	360	0.2
	Sub-Total	*~3,000*	*2.0*	*~4,100*	*2.7*
Peri-urban Agriculture	*Total*	*52,000*	*34*	*81,000*	*53*
Total		**55,000**	**36**	**85,000**	**56**
Difference to Current Situation (times): 5					

Table 26. The estimation of the number of people whose minimum fresh fruit and vegetable needs could be met where the percentage of food that remains for local Kingston consumption is 100%.

		AREA ANALYSIS		**YIELD ANALYSIS**	
		Number of People Whose Minimal FFV Needs Are Met (#)	**Proportion of Kingston CMA Population (%)**	**Number of People Whose Minimal FFV Needs Are Met (#)**	**Proportion of Kingston CMA Population (%)**
Inner-City Urban Agriculture	Citizen	2,800	1.9	3,700	2.4
	Producer	230	0.1	360	0.2
	Sub-Total	*~3,000*	*2.0*	*~4,100*	*2.7*
Peri-urban Agriculture	*Total*	*100,000*	*68*	*160,000*	*110*
Total		**~100,000**	**70**	**~160,000**	**110**
Difference to Current Situation (times): 10					

Table 27. The 2006-07 estimated local multiplier effect (LME) of urban and peri-urban agriculture in a business as usual scenario where the percentage of food that remains for local Kingston consumption is 7%.

		LME ($CDN/yr)
Inner-City Urban Agriculture	Citizen	$3,100,000
	Producer	$300,000
	Sub-Total	*$3,400,000*
Peri-urban Agriculture	*Total*	*$52,000,000*
Total		**~$55,000,000**

Table 28. The estimated local multiplier effect (LME) of urban and peri-urban agriculture where the percentage of food that remains for local Kingston consumption is 25%.

		LME ($CDN/yr)
Inner-City Urban Agriculture	Citizen	$3,100,000
	Producer	$300,000
	Sub-Total	*$3,400,000*
Peri-urban Agriculture	*Total*	*$190,000,000*
Total		**~$190,000,000**
Difference to Current Situation (times): 3		

Table 29. The estimated local multiplier effect (LME) of urban and peri-urban agriculture where the percentage of food that remains for local Kingston consumption is 50%.

		LME ($CDN/yr)
Inner-City Urban Agriculture	Citizen	$3,100,000
	Producer	$300,000
	Sub-Total	*$3,400,000*
Peri-urban Agriculture	*Total*	*$370,000,000*
Total		**~$370,000,000**
Difference to Current Situation (times): 7		

Table 30. The estimated local multiplier effect (LME) of urban and peri-urban agriculture where the percentage of food that remains for local Kingston consumption is 100%.

		LME ($CDN/yr)
Inner-City Urban Agriculture	Citizen	$3,100,000
	Producer	$300,000
	Sub-Total	*$3,400,000*
Peri-urban Agriculture	*Total*	*$750,000,000*
Total		**~$750,000,000**
Difference to Current Situation (times): 13		

➢ Qualitative Analysis Results

Table 31. The final results of the qualitative analysis gathered all the responses from Kingston questionnaires and interviews and looked for common themes (n = 163).

ENVIRONMENT

Response Categories	**Number of Responses**
Direct Environmental Benefits	50
Energy, Food Miles	29
Improved Space Usage	21
Biodiversity	18

COMMUNITY

Response Categories	**Number of Responses**
Aesthetics	50
Community Building	32
Recreation, Enjoyment, Exercise	22

FOOD SECURITY

Response Categories	**Number of Responses**
Self-Sufficiency	12

ENLIGHTENMENT, EMPOWERMENT, EDUCATION

Response Categories	**Number of Responses**
Education	61

Appendix D
"Food Miles: Environmental Implications of Food Imports into the Kingston Region"

Food Miles: Environmental Implications of Food Imports to the Kingston Region

Brief Summary of Findings and Comparison to Waterloo Region

Abstract

The rapidly escalating impacts of climate change are quickly making energy and emissions reductions a necessity. One of the biggest contributors is the usage of fossil fuels especially with regards to transport – and it is well known that its usage continues to climb in an energy hungry world with regards to the shipping of items like food. The issue of "*food-miles*" has been examined in the literature previously[402] and one of the more recent Canadian analyses was conducted for food-miles of imports into Waterloo[403]. Using the tool developed by the Waterloo study[404], the food-miles for imports into the Kingston Region are examined relative to scenarios involving regional and local sourcing. In addition, the Kingston case is compared to the Waterloo Region. The 58 studied food items traveled approximately 4685 km[405] from its sources to retailers. It is found that if *all* 58 imports were theoretically sourced locally or regionally, the Kingston Region could reduce greenhouse gas emissions by ~21000 tonnes annually which would be the equivalent to removing ~6700 cars off Kingston's roads (see Table 32 for a breakdown of the number of cars removed for each of the 58 food items). It would also reduce household greenhouse gas emissions by a third of a tonne. When compared to Waterloo, Kingston stands to gain more from local or regional sourcing due to its increased distance from common road shipping routes.

Table 32. Summary of the Number of Cars That Could Be Removed If 58 Common Food Products were Locally Sourced.

Food Product	Equivalent # of Cars Taken Off Road*	Food Product	Equivalent # of Cars Taken Off Road*
Apple Juice	169.0	Mushrooms - fresh	11.1
Apples - dried	3.6	Mushrooms - pres/prep	62.5
Apples - fresh	244.1	Oats/Oatmeal	15.7
Barley	–	Onions	243.8
Beans, Baked	15.7	Peanuts - prepared	–
Beans, White	–	Pears - fresh	618.7
Beef	1948.1	Pears - preserved	19.3
Beef/Pork Wieners	–	Peas - canned	1.6
Blueberries - dried	–	Peas - dried	20.9
Blueberries - fresh	84.4	Peas - fresh	38.6
Blueberries - frozen	1.6	Peas - frozen	3.3
Breakfast Cereals	27.8	Peanuts in shell	156.4
Broccoli	144.6	Peanuts, shelled	38.0
Cabbage	62.5	Peppers - bell, fresh	307.9
Carrots	197.0	Pork	40.6
Cheese	206.8	Pork (Ham)	–
Cherries - fresh	38.0	Potatoes - fresh	335.7
Cherries - prepared	–	Potatoes - frozen	24.2
Chicken	175.4	Pumpkins/Squash	26.5
Corn (Sweet) - fresh	20.3	Spinach - fresh	53.3
Corn (Sweet) – frozen	3.3	Spinach - frozen	3.6
Corn (Sweet) - preserved	4.9	Strawberries - fresh	109.6
Garlic - dehydrated (powders)	–	Strawberries - frozen	24.5
Garlic - dried	–	Strawberry jam	–
Garlic - fresh	41.6	Tomato sauces	61.8
Lettuce (incl. head and leaf)	625.6	Tomatoes - canned	105.0
Milk/Cream - con. or swt.	26.2	Tomatoes - fresh	382.8
Milk/Cream - fresh	0.0	Yogurt	1.0
Mushrooms - dried	–		
		Total # of Cars Off the Road	6746.8

* The 2004 Corolla is used as the reference standard for the average GHGe of a typical car (see also the Appendix, Section 2).

Introduction

Climate change impacts on the environment are being felt rapidly throughout the world. Events predicted to take centuries are already occurring within decades or a mere span of years. The importance of reducing environmental impacts and greenhouse gas emissions are beginning to slowly dawn on the world's population and policy makers. One of the greatest contributions to atmospheric greenhouse gases are from fossil fuels – whose use is rapidly increasing due to increased road transport and freight shipping of items like food (rising by more than 20% in terms of energy use in Canada)[406]. The issue of food-miles has been examined in the literature previously[407] and one of the more recent Canadian analyses was conducted for food-miles of imports into Waterloo[408]. Using the tool developed by the Waterloo study[409], the food-miles for imports into the Kingston Region are examined relative to scenarios involving regional and local sourcing. In addition, the Kingston case is compared to the Waterloo Region. What follows is a brief summary and discussion of the methodology and findings.

Methodology

As mentioned before, the analysis tool that was refined by the Waterloo study[410] was adapted to the Kingston context. Much of the methodology is identical to that study with very few modifications. What follows are the more notable points or changes:

- The population of Kingston Region (which is smaller than Waterloo Region) was 177171 in 2001 for Frontenac, Lennox-Addington and Leeds-Lansdowne[411] (with approximately 70235 households).
- Food items were selected on the basis of whether they could be grown or raised locally; had accessible and reliable import data; reflected a mix of fresh and preserved products and whether they represented a basket of items that Kingston consumers would eat (which was assumed not to differ greatly from most Canadian urbanized regions including Waterloo).
- Food import data that was obtained from Industry Canada's Strategis database by the Waterloo study[412] was also used here (i.e. 2000-2004).

- The radial distance used to define the Kingston Region and SE Ontario Region was 40 and 160 km respectively (unlike the 30 and 250 km used in the Waterloo study) due to the shape of the Frontenac, Lennox-Addington Counties surrounding the City of Kingston.
- Distances from sources of production origin were all calculated from the state and country capitals or the biggest port or airport if not in the same city as the capital. All travel from North American sources was assumed to be by truck.
- Greenhouse gas emissions took into account the mode of transport (g/tonne-km) – be it air, marine, rail or truck using the most recent available data from Environment Canada.
- Food consumption data was assumed to the same as the national average for the most part.
- The tool used only data for the 58 selected food items. The percentage of imports that were actually consumed domestically was accounted for to determine the real GHG impact.

[**Note**: sample calculations for some of the more important measures in this study and expanded explanations are included in the *Appendix*.]

Results and Discussion

The top ten imports that contribute greenhouse gases are listed in Table 33. It was interesting to note that the list order was practically the same as Waterloo except that the lettuce and pears switch positions (lettuce rises to second place and pears drops to third). This isn't totally unreasonable as most people today eat similarly within most Canadian cities. Kingston and Waterloo are also similar in that they are not large multicultural, metropolitan urban cities like Toronto where we might be more likely to see a more different list. The fact that beef imports produce the highest emissions is important to note as it provides yet another reason to develop the local beef market and industry that already exists in the Kingston region. In addition, lettuce and tomatoes are also high emitters of greenhouse gases. Those two popular crops could be grown in greater quantities in local hydroponic greenhouses instead for example[413] but only if the energy trade off of growing those two *specific* crops in an energy intensive greenhouse are still less than importing it[414].

Table 33. Top Ten Imported Food Item Contributors to Greenhouse Gas (GHG) Emissions, Kingston Region

Food Item	Annual GHG Emissions from Kingston Region Imports (tonnes)	Annual Equivalent in # of cars on Road	# of Times more Emissions than Local Product	WASD (km)	WAER (kg of GHG/kg of Food Item)
1. Beef	5954	1948.1	510.5	6039	5.511:1
2. Lettuce (incl. head and leaf)	1912	625.6	102.6	4079	1.107:1
3. Pears - fresh	1891	618.7	427.9	6320	4.62:1
4. Tomatoes - fresh	1170	382.8	114.0	3302	1.231:1
5. Potatoes - fresh	1026	335.7	78.2	3128	0.844:1
6. Peppers – bell, fresh	941	307.9	183.0	3726	1.976:1
7. Apples – fresh	746	244.1	116.4	6126	1.256:1
8. Onions	745	243.8	98.2	4030	1.06:1
9. Cheese	632	206.8	527.0	5448	5.689:1
10. Carrots	602	197.0	105.4	4279	1.138:1
	Average (all studied products)			4685	1.298:1
	Median (all studied products)			4031	1.059:1
Total (all studied products)	20621	6747			

WASD = the average distance traveled by imports of the food item to the Kingston Region.

WAER = the average amount (kg) of GHGs emitted for each kg of food item imported.

Table 34. A Comparison of Imports To Waterloo and Kingston Regions In Terms of WASD, Annual GHG Emissions and WAER for 58 Common Food Items

	Average WASD (km)	Median WASD (km)	Annual GHG Emissions from Specified Region Imports (tonnes)	GHG emissions generated by houses in the Specified Region (%)	Average WAER (kg of GHG/kg of Food Item)	Median WAER (kg of GHG/kg of Food Item)	Distance Travelled Relative to Locally Sourced Food (times)	Distance Travelled Relative to Regionally Sourced Food (times)
Waterloo	4497	3651	51709	5.9	~1.3	~1.0	150	18
Kingston	4685	4031	20621	5.9	~1.3	~1.1	117	29
Percent Difference Relative to WR (%)	4.18	10.41	-60.12	0	0	10	-22	61.11

WASD = the average distance traveled by imports of the food item to the specified Region.
WAER = the average amount (kg) of GHGs emitted for each kg of food item imported.

When comparing imports between Waterloo and Kingston regions, it is interesting to note that on average (even with the median value) imports travel further to get into the Kingston area by about 4-10% (Table 34) (4685 km relative to 4497 km for Waterloo). This would indicate that Kingston is somewhat further from standard road shipping routes relative to Waterloo. Imports to Kingston generate less emissions in total than Waterloo but only because Waterloo Region has a larger population than the Kingston counties (477400 in 2003 compared to 177171 in 2001 respectively – Kingston has an ~62.89% smaller population). Houses in both regions generated the same level of GHG emissions apparently while the average WAER in both regions was approximately the same. If you use the median WAER value however then Kingston produces roughly 10% more kg of GHG per kg of food than Waterloo. The similarity in GHG emissions by household is not entirely unreasonable either due to roughly similar consumption patterns within many Canadian settlements.

Table 35. A Comparison of Emissions For Foods Sourced Locally from Waterloo and Kingston Regions for 58 Common Food Items

	WAER (kg of GHG/kg *consumed* food)	How many times less GHGe generated than imports?	Distance Considered Local (km radius)
Waterloo	0.008	162.5	30
Kingston	0.011	120	40
Percent Difference Relative to WR (%)	37.5	-26	

GHGe = greenhouse gas emissions.

Table 36. A Comparison of Emissions For Regionally Sourced Foods From Waterloo and Kingston Regions for 58 Common Food Items

Region	WAER (kg of GHG/kg consumed food)	How many times less GHGe generated than imports?	How many times more GHGe generated than locally sourced foods?	Regional Distance Considered (km radius)
SW-Ont (Waterloo)	0.067	19	8.375	250
SE-Ont (Kingston)	0.067	29.3	4	160
Percent Difference Relative to WR/SW-ON (%)	0	54.21	-52.24	

GHGe = greenhouse gas emissions.

SW-Ont = Southwestern Ontario.

SE-Ont = Southeastern Ontario.

In Table 35, a comparison of food sourced locally from within Waterloo compared to Kingston shows that Kingston still produces ~37.5% more kg of GHG per kg of consumed food. The higher value is likely to be influenced by Kingston's greater distance from main road shipping lanes (and thus increased GHG emissions). Regardless, locally sourced food items produced far less emissions than imports (120 times less for Kingston).

When we look at regional sourcing of foods (Table 36) however we notice that the amount of GHGe produced per kg of consumed food is practically the same for both the Waterloo and Kingston Regions. What is striking are the differences in terms of GHGe reduction if you switch from imports to regional sourcing – the Kingston Region gains greatly from switching to regional sourcing in that it produces 29 times less GHGe than importing while only increasing its GHG relative to a complete switch to local sourcing by ~4X (relative to what Waterloo stands to gain). Regardless, regional sourcing is still far better than imports in terms of emissions and only somewhat worse than sourcing everything locally (considering the magnitude of differences – see Table 36, Table 37). This would support the idea that it would still be a good to switch to regional sourcing in the foreseeable future in order to make immediate gains in reducing air pollution and greenhouse gas emissions[415]. This greater benefit for Kingston could be due to the fact that our food seems to travel further on average to get to Kingston than it does to get to Waterloo and thus a switch would compensate for this somewhat greater shipping distance.

Table 37. A Comparison of Imports Between Waterloo and Kingston Regions In Terms of Mass, Distance Traveled and GHGe for 58 Common Food Items

	Total Imports of 58 Studied Food Items (kg)	Distance Traveled By Imports Relative to Locally Sourced Food (times)	GHGe Generated By Imports Relative to Locally Sourced (times)	Distance Traveled By Imports Relative to Regionally Sourced Food (times)	GHGe Generated by Imports Relative to Regionally Sourced (times)
Waterloo (SW-Ont Region)	36 million	150	161	18	19
Kingston (SE-Ont Region)	13.4 million	117	142	29	35
Percent Difference Relative to WR/SW-ON (%)	-62.78	-22	-11.8	61.11	84.21

GHGe = green house gas emissions

SW-Ont = Southwestern Ontario.

SE-Ont = Southeastern Ontario.

If *all* total imports (of the 58 selected products) were instead switched entirely to sourcing within the SE Ontario region or within the local Kingston Region then several things could be achieved:

1. We could gain a yearly potential reduction in greenhouse gases of ~21000 tonnes.
2. That would be the equivalent of taking off ~6600-6700 cars from Kingston roads annually.
3. We would reduce household greenhouse gas emissions by ~0.3 tonnes annually. This would have been nearly 1/3 of what was needed for Canadian citizens to reach the 1 tonne goal in the One Tonne Challenge. (The values calculated for Kingston are approximately 37% those of Waterloo and thus proportional to population size.)

It should be said that since the same analysis tool from the Waterloo study[416] was used, the analysis also shares its limitations. It only measures the average source locations of selected imports. It also does not measure the WASD for *all* food items in the Kingston area making it difficult to compare it with other studies like the one done by Pirog for Iowa State [417] [418]. Our studies also do not account for additional environmental externalities caused by food transport and *we do not account for the energy used in production or processing* (i.e. the shipping of inputs or machinery; sending beef across the border for processing and then being shipped back for sale). In addition, both studies do not account for the energy trade offs that might be specific or unique to each food item. The analysis also depends on national data with regards to consumption habits. There may be slight differences between different Canadian urban settlements but likely the assumption that citizens have similar consumption habits should hold for the most part.

Regardless, the conclusion reached for Kingston may not seem like much by itself but if every major urban centre in Canada were to do this then the gains could be significant – in terms of better environment and air quality as well as reducing the impacts of climate change on society (especially in terms of food security and economics). In both the case of Kingston and Waterloo, the significant potential for reduced energy use and greenhouse gas emissions are evident if food is sourced more often from the regional and local areas. Considering the rapid progression of climate change (evident in melting glaciers, disrupted habitats and erratic global weather) and the other environmental impacts of our fossil fuel economy, emissions reductions remain a pressing necessity worldwide.

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Appendix

Sample Calculations

1. Calculating WASD and WAER

Weighted Average Source Distance (WASD): This is the average distance that a food travels from where it is produced to where it is consumed.[419]

$$(km) = \frac{\sum(v * d)}{\sum v}$$

where:

Σ = sum of

v = value ($) of imports from each location of production origin

d = distance (km) from each location of production origin to the point of consumption

using beef imports:

WASD (km)

= ([net value ($/km) x distance traveled for various assorted bovine parts for each location that sources it]+[net value ($/km) x distance traveled for beef for each location that sources it])/net value ($) of imports from each location of production origin

= (7,547,131,291,958 $/km + 2,212,382,413,226 $/km)/1616034623 ($)

= 6,039 km

Weighted Average Emissions Ratio (WAER): This is the average amount of GHG emissions (in kg) created by each kg of a food item in its travel from point of production to consumption.

$$\frac{\sum (v * d * e)}{\sum v}$$

where:

v = value ($) of imports from each location of production origin

d = distance (km) from each location of production origin to the point of consumption

e = greenhouse gas (GHG) emission level (g/T-km) for mode of transport (see next point)

Table 38. GHG Emissions by Transport Mode

Transport Mode	GHG emission levels (g per tonne-kilometre)
Air	1,101.0
Marine	130.3
Rail	21.2
Truck	269.9

The Environment Canada emissions ratios represent the most recent available data of GHG emissions by transport mode in Canada[420].

Figures for greenhouse (GHG) emissions by mode of transport (the "e" variable in the formula to calculate WAER) were obtained from Environment Canada[421]. The levels, shown in Table 38, represent the average amount of greenhouse gas emissions emitted by the four different transport modes in Canada in the years 1990-1999. The GHG emissions are mostly carbon dioxide (CO_2), but also include nitrous oxide (N_2O) and methane (CH_4) converted into equivalent units of CO_2 based on their global warming potential[422].

Using beef imports:

WAER [kg GHGe/kg shipped/km traveled or kg/(kg•km)]

= [{[net value ($/km) x distance traveled (km) x GHGe determined for mode of transport for various assorted bovine parts for each location that sources it (g/tonne-km)]+[net value ($/km) x distance traveled (km) x GHGe determined for mode of transport for beef for each location that sources it (g/tonne-km)]}/ net value ($) of imports from each location of production origin]/(1x10^6 tonne•kg/g•kg)

= [{8,309,391,510,689,530 $•km•g/tonne•km + 597,122,013,329,774 $•km•g/tonne•km}/1616034623 ($)]/(1x$10^6$ tonne•kg/g•kg)

= 5.511 kg/(kg•km)

2. Annual GHGe Generated by a Product Imported into Kingston Region

Annual GHGe Generated By Product (tonnes) = WAER [kg GHGe/kg shipped] x Amount Consumed in Kingston Region in 2003 [kg] x Imports as % of Domestic Consumption)/1000

Using beef imports as our example:

Annual GHGe Generated By Product (tonnes)

= WAER [kg GHGe/kg shipped] x Amount Consumed in Kingston Region in 2003 [kg] x Imports as % of Domestic Consumption)/1000

= (5.511 kg/km x 4,310,428 kg x 25%)/1000

= 5954 tonnes

For the purposes of this report, food consumption in Kingston Region was assumed to be the same as the national average. Overall, we are attempting to *estimate* the actual consumption of food items by Kingston residents. The two data consumption sources were the Statistics Canada's Food Expenditure survey of 2003[423] and 2005 Supply and Disposition data[424].[425]

In the example above, the 25% used for imports as a % of domestic consumption is not a value for all products. Canada imports different things in different amounts. For further illustration, the example used by the Waterloo study[426] is presented here for concentrated or sweetened milk imports into Waterloo:

"… For example, imports of concentrated or sweetened milk to Waterloo Region have a very high WASD (15,701 km – because they come mostly from New Zealand) and WAER (2.168:1 – meaning they produce over twice their weight in GHG emissions). Yet we import only 12% of this stuff in Canada meaning that the impact of imports is less than it would otherwise be..."[427]

Thus one can interpret that percentage as a sort of "weighting" to properly account for the true amount of GHG attributed to Canadian import habits.

In fact, to calculate this import percentage, the underlying tool of both this and the Waterloo study[428] used the supply and disposition data from Statistics Canada[429], taking the total imports as a percentage of the net supply available for consumption.

Fifteen-year (1989-2003) totals were used in making the calculation, using the following formula:

$$\text{Imports as \% of Domestic Consumption} = \frac{\sum \text{Imports (1989-2003)}}{\sum \text{Net Supply (1989-2003)}}$$

Data was not available for all fifteen years for all selected food items: when they were not, the calculation was made for the years for which data were available. For the purposes of this report, the proportion of food consumption in Kingston Region made up by imports was assumed to be the same as the national average. For Kingston (and Waterloo) this does not seem an unreasonable assumption in some ways as discussed previously.

3. Comparison to Cars

This is with regards to Table 32.

Fuel economy data for a typical compact vehicle was obtained from a calculator on the National Resources Canada website[430]. An average annual driving distance of 18,000km[431] was inputted into the calculator, and the average ratio of city to highway driving was assumed to be 50-50. The fuel economy number was then used to calculate GHG emissions per litre of fuel by referring to Environment Canada's Greenhouse Gas Inventory[432], which reports on the GHG emissions per litre of fuel burned in light-duty gasoline-powered vehicles.[433]

Using all this information, the study calculated that a 2004 Toyota Corolla generates 3.06 tonnes of GHG emissions per year, which was used to generate figures for the equivalent number of cars for imports of each selected food.[434]

GHGe Equivalent in Cars = Annual GHGe Generated By Product (tonnes)/GHGe from one year in a 2004 Corolla (tonnes)

Using beef imports as our example:

GHGe Equivalent in Cars

= GHGe Generated By Product (tonnes)/GHGe from one year in a 2004 Corolla (tonnes)

= [(WAER [kg GHGe/kg shipped] x Amount Consumed in Kingston Region in 2003 [kg] x Imports as % of Domestic Consumption)/1000]/3.06 tonnes

= 5954 tonnes GHGe from Kingston Region Imports/3.06 tonnes

= 1948 cars (equivalent)

4. General Formula for Calculating the Percent Difference Relative to Waterloo/SW-Ontario Region

This would apply to Table 35, Table 36 and Table 37. This is simply used to compare some calculated Kingston value from this study to some calculated value from the Waterloo study[435] and to note the difference as a percentage (either it is a positive percentage increase or a negative percentage decrease).

% Difference of a Calculated Kingston (or SE-Ontario Region) Value Relative to a Calculated Waterloo (SW-Ontario Region) Value

= {[Kingston/SE-Ontario Value ÷ Waterloo/SW-Ontario Value] -1} x 100%

Using Table 35, first column:

% Difference of a Calculated Kingston WAER Value Relative to a Calculated Waterloo WAER Value

= {[Kingston value ÷ Waterloo value] -1} x 100%

= {[0.011 kg (GHG)•kg (food)/0.008 kg (GHG)•kg (food)]-1} x 100%

= {0.375} x 100%

= 37.5%

This means that the amount of GHG generated per kg of food consumed locally in Kingston is 37.5% greater than the Waterloo ratio. In this case however, that is due to the fact that the assumed local area for Kingston (40 km) is larger than the assumed distance in Waterloo (30 km).

5. General Method for Determining the Difference Between Imports and the Local or Regional Production

This is simply straight division of one value by another to determine the difference in terms of "number of times". This is just to give a general sense of things.

In terms of distance for example (Table 37, column 2):

Difference (# of times) = Average WASD/assumed KT distance (i.e. region considered local) = 4685 km/40 km = 117.

In terms of greenhouse gases (Table 36, column 2):

Difference (# of times)

= Average WAER of 58 studied food items/SE-Ontario WAER

= 1298 kg/(kg•km) ÷ 0.043184[436] kg/(kg•km)

= ~30

Appendix E
Health Policy in Canada – Where Does Urban Agriculture Fit?

Even in a world-renowned health system like Canada's, there appears to be a serious failure to address the long-term health of citizens. According to Dr. Roberts of the TFPC[437], government spends more money on road repair bills than it does on health care and prevention. There is "no money to be made in prevention" according to Wendy Mesley of the CBC and "Chasing the Cancer Answer"[438]. Higher-level governments, drug, food and biotech companies remain unconcerned about health or food safety. Your "health is considered a commodity to be exploited," stated Pat Mooney, the Director of the ETC Group to the assembled audience at a recent talk in Kingston with reference to the views of large food and drug corporations[439].

One unfortunate result of the present situation is a Canadian healthcare system that has been burdened by the results of poor eating habits. Health costs have been rising steadily in the past decade and are projected to continue doing so. A report by the CIHI in 2006[440] predicted that provincial governments would spend $3000-$4000 per person to pay for health care in 2006-2007 – which was 4.0-4.5% greater than the previous year. Total spending in 2005 for the provinces and territories was ~$98.1 billion and was predicted to rise as high as $104 billion in 2006-2007[441] [442].

According to Dr. Kevin Morgan, a food system researcher at the University of Cardiff[443], future health costs may spiral so far out of control that it will likely bankrupt the healthcare system unless something is done. Dr. Morgan believes this will be one of the crucial factors in forcing food system reform (along with the growing worldwide moral economy surrounding food and the forgotten concept of "duty of care"). According to calculations and information from Morgan[444] (Box 6, page 226), the lifetime cost of just treating the 8.8% of the Ontario population that are diabetics is approximately $1.1 trillion or nearly twice the annual GDP of Ontario - and it continues to rise. According to the WHO, Ontario is 23 years ahead of their projections - a frightening foreshadow of things to come[445].

Preventable diseases related to poor diet and physical inactivity is beginning to overtake even smoking in terms of premature deaths while magnifying the burden on health care[446]. The deaths caused by either of those two sources far exceed (by several times) the deaths caused by any other single and preventable source of premature death. Currently 23% of Canadian adults are obese and the rate has doubled in the last 25 years especially among low-income women. Jobin[447] determined that 80% of cardio-vascular disease, 90% of Type 2 adult diabetes and 30% of cancer could be traced to a low quality diet[448]. Cantrell *et al.* (2006) estimated that poor diet and physical inactivity would lead directly to 20% of the mortality rate in a population from food or diet-related diseases[449].

From an economic viewpoint, this likely adds an extra $4.3 billion dollars of pressure (if not more) on the healthcare system every year[450]. An interesting comparison is Michigan, where health care costs are actually slowing economic growth and job creation in the state! Lowering health costs would reduce losses in terms of lost worker productivity. Fresh, less processed food would be one step in countering these health problems (exercise would be one other). Urban agriculture that produces more nutritious, easily accessible and affordable fruits and vegetables may be part of a long-term strategy to improve eating habits and thereby reduce, prevent and ultimately negate this financial burden.[451]

Box 6. Estimating the Present Lifetime Cost of Diabetes in Ontario

In this section I show how I calculated the lifetime cost of current estimated diabetes cases in Ontario. The lifetime cost of a diabetes case stated by Morgan[452] is in $USD. I chose to use the value in $CDN without currency conversion from $USD in order to be conservative. For comparison purposes, the GDP of Ontario was ~$538 billion in 2005[453].

Net Lifetime Cost of Prevalent Diabetes Cases in Ontario as of 2006 ($CDN)

= D*C

where D = [Prevalent Cases of Diabetes in Ontario in 2006]

= P*O

= 1116451.776

where P = [Population of Ontario in 2006] = 12686952

where O = [Percentage of Ontarians Over Age 20 With Diabetes in 2006 (%)] = 8.8% [454]

where C = [Approximate Lifetime Cost of a Diabetes Case ($CDN)] = $1,000,000 CDN[455]

then

Net Lifetime Cost of Prevalent Diabetes Cases in Ontario as of 2006 ($CDN)

= D*C

= ~$1.1 trillion CDN

OR

= ~$1100 billion CDN

Appendix F
Insurance for Community Gardens

Hale JN. 2007. Re: [Community_garden] Liability Insurance. Online posting by the Executive Director of the Knox Parks Foundation. 04 Jun. American Community Gardening Association Listserve. 11 Jun 2007 <community_garden@list.communitygarden.org>.

Insurance for Community Gardens

For several years, the board of the American Community Gardening Association has been working to provide liability insurance for member gardens. Questionnaires of members suggested that obtaining such insurance was a priority for many gardens. We did provide access to coverage during 1998, but less than a dozen gardens took advantage of the offer. In 1999, the insurance company was unwilling to renew the coverage, and we were unable to find another carrier. Although we continued to seek a carrier, we were unsuccessful. Here is what I have been telling members who are seeking insurance.

1. Liability insurance protects the organization that owns it or some other entity (like a land owner) who is "named as additional insured" on the policy. It protects gardeners or volunteers indirectly only if the insured organization stands between them and a potential lawsuit. It does not protect individuals from legal action, nor does it necessarily pay individuals for injuries or damage that occur at a garden. Most gardens have insurance because they have an organization to protect or because some other entity requires coverage in order for the garden to exist.

2. Usually, individual gardens seeking liability coverage will pay a high price. Just as group health insurance is much less expensive than individual coverage, insurance purchased by a larger organization to cover a multitude of risks will be less expensive per coverage than the same insurance purchased piecemeal. Therefore, if you are a single garden suffering from sticker shock, the best avenue may be to ask a larger

organization that already has liability coverage to sponsor the garden. Such organizations might include community groups, churches, horticultural/agricultural organizations, or anything else that might work in your locale.

3. Often it is a city or town providing land for a garden that is requesting insurance. They usually have a "risk manager" whose job is to protect the municipality against all risk. Whenever the town enters into a relationship, that relationship is passed before the risk manager, and the risk manager almost always says "buy insurance" to protect the town. But towns always have lots of insurance. They engage in lots of risky business. Adding a community garden to their list of risks will have almost no impact on their overall risk and on the cost of their insurance. It becomes a political issue and should be treated as such. If the town wants to support community gardening, the risk is trivial; if the town doesn't want to support community gardening, it is easier to say, "Buy insurance" than "we don't like you." A side issue that arises in some cases is whether the gardens are public. In Berkeley, California, the city wanted to require insurance and also require that the gardens be open to the public. People who don't want to support gardens compare them to parks that are ostensibly open to everybody all the time. They point out that community gardens have fences and gates and private plots. More politics. Perhaps compare your garden to a football stadium. Very risky activity going on there, and fully supported by the town! Anybody can go and watch when there is a game on, but hardly anybody gets to play. Which is more exclusive, a garden or a sports field? Remember that anybody can walk by and look at the garden. You might even schedule some times when the garden is open for public enjoyment. This does suggest, however, that gardeners need to design and maintain their gardens in ways that truly do enhance their neighborhoods.

4. Insurance is a local business, governed to some extent by state law and regulation. Although there is a certain amount of uniformity and insurance companies operate across state lines, your experience with coverage and costs may be quite different from those in a neighboring state. If you have to buy insurance, a creative and responsive local agent can be very important. Remember that there is a good chance they haven't insured a garden before and they will have to figure out how to do it. Here in Connecticut, we

started out with an insurance agent who decided gardens were like vacant lots, which tend to attract inappropriate uses. Premiums were based on street frontage and they were high. Strangely enough, our largest garden, which had no street frontage, was insured for nothing, while one of our smaller gardens on a corner lot carried a high premium. Our current agent, which specializes in insurance for non-profit social service organizations, decided gardens were like social service programs and did a more general analysis of risk. Our premiums are now quite low.

5. If gardeners or garden officers are concerned about personal risk (i.e.-potential for being sued as individuals due to their involvement in a garden), the best solution is probably "umbrella coverage." People can usually obtain this for a relatively small premium as an add-on to homeowner's or renter's insurance. Talk to your agent.

6. I am not an expert on insurance. Don't take this as professional advice from me or from the American Community Gardening Association. At best, this is an indication of insurance issues as they have been faced by community gardens throughout the U.S. (not much info on Canada). You need to work out your own local situation. I will be happy to talk to anyone interested in exploring this further. I will also attempt to respond to questions about the information provided here and specific insurance issues.

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Appendix G
GLOSSARY

Bioenergy: "Bioenergy is energy that is contained in biological materials, mostly plants and animals. It was originally solar energy, which was then converted into organic matter by photosynthesis and other processes. Biomass refers to living or recently living biological material and metabolic byproducts, such as manure from cows, which can be used as energy, fuel or for industrial production. Bioenergy includes things as simple as burning wood for heat and cooking and is the oldest form of energy used by humanity. While oil and coal were biomass, they take millions of years to produce and are not considered a form of bioenergy. One of the main advantages of bioenergy is that it is a renewable resource, as long as the plant or animal matter is produced in a sustainable fashion. Bioenergy can also be carbon-neutral, since the only carbon released is the carbon that was captured from the atmosphere when the biomass was growing. A specific plant or substance used for bioenergy is called a feedstock. Feedstocks are usually converted into a more easily usable form, called a biofuel. Biofuels can be liquid, solid or gas."[456]

Community supported agriculture (**CSA**): It is a system in which consumers support a local farm by paying in advance for agricultural products. This reduces the financial risks for the farmer because consumers cover the costs of seeds and planting crops in advance. Throughout the growing season, CSA members receive a portion of the farm's harvest each week. Members share the financial risks and the bounty of the harvest -- if it is a successful growing season, they receive a lot of food; if there are fewer crops they receive less. Members are also encouraged to visit the farm and some even volunteer there.[457]

Ecological agriculture: This term is used to represent any agriculture that actually uses methods that nurture the land[458] and increase soil fertility. It is also used to avoid the disputed label of "organic" since the co-optation of the branding by agribusinesses has diluted the meanings and practices, creating confusion[459]. Some have coined the term "beyond organic" to avoid the diluted meaning of organic agriculture[460]. Others use the phrase "local" and "sustainable" agriculture.[461] Another phrasing is "good, clean and fair" food production.[462] Also see the definition for "sustainable agriculture".

Ecosystem services: Ecosystem functions refer to the various habitat, biological or system properties or processes of ecosystems. Ecosystem goods (i.e. like food) and services (i.e. waste assimilation) represent the benefits that humans derive, directly or indirectly, from ecosystem functions. In order to keep things understandable, ecosystem goods and services are referred together as 'ecosystem services'.[463]

Edible landscaping: This often involves growing vegetables, fruits, and herbs in combination with annual flowers, in beautiful, untraditional ways as part of the urban landscape.

Externality: Externalities arise when certain actions of producers or consumers have unintended indirect side effects on other people or groups. Externalities can be positive or negative. Positive externality arises when an action by an individual or a group confers benefits to others. A technological spillover is a positive externality and it occurs when an invention not only benefits an individual or group but also enters mainstream culture to benefit society as a whole. Negative externalities arise when an action by an individual or group produces harmful effects on others. Pollution is a negative externality. When a factory discharges its untreated effluents in a river, the river is polluted and consumers of the river water bear costs in the form of health and/or water purification expenses.[464]

Food desert: "Food deserts are neighbourhoods with no or distant grocery stores. They typically have an abundance of fast food restaurants and other retail outlets that offer little or no nutritious food. Public health officials and community advocates have been alarmed by the growing prevalence of obesity, diabetes, cancer, cardiovascular disease and hypertension especially in these disadvantaged communities."[465]

Food-miles: This is the distance that food travels from its source of production to its retail destination. It facilitates the measure of greenhouse gas emissions. It does not account for emissions during production or of people who drive to retailers to get food. It is however a good starting point for factoring in social and ecological impacts of food production into decision-making.[466]

Food policy: It is can be defined as any decision, program or project supported by a group that affects how food is produced, processed, distributed, protected and/or disposed of. It can operate on multiple levels.[467]

Food security: "Food security exists when all people, at all times, have physical and economic access to sufficient, safe, culturally acceptable, and nutritious food to meet their dietary needs (through local non-emergency sources) and food preferences for an active and healthy life."[468]

Food sovereignty: The following definition comes from the recently signed Declaration of Nyeleni [469]. "*Food sovereignty is the right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems. It puts those who produce, distribute and consume food at the heart of food systems and policies rather than the demands of markets and corporations. It defends the interests and inclusion of the next generation. It offers a strategy to resist and dismantle the current corporate trade and food regime, and directions for food, farming, pastoral and fisheries systems determined by local producers. Food sovereignty prioritizes local and national economies and markets and empowers peasant and family farmer-driven agriculture, artisanal fishing, pastoralist-led grazing, and food production, distribution and consumption based on environmental, social and economic sustainability. Food sovereignty promotes transparent trade that guarantees just income to all peoples and the rights of consumers to control their food and nutrition. It ensures that the rights to use and manage our lands, territories, waters, seeds, livestock and biodiversity are in the hands of those of us who produce food. Food sovereignty implies new social relations free of oppression and inequality between men and women, peoples, racial groups, social classes and generations*."

Food swapping: The process where nations transport hundreds of identical food items in opposite directions between each other. It is an artifact of subsidized transport, centralized buying of supermarkets, food manufacturers and trade agreements that set import quotas even for self-sufficient nations.[470] [471]

Food system: All processes related to the growing, harvesting, transformation, packaging, transport, marketing, consuming and disposing of food and food packaging. The system exists within and is influenced by social, political, economic and natural environments.[472]

Inner-city urban agriculture: This is agriculture or gardening that utilizes spaces within built up or developed areas of cities. Possible locations include citizen backyards, front yards, parks, brownfields, rooftops and walls. Also see the definition for "peri-urban agriculture" and "urban agriculture".

Inner-City: For this study, it is defined as all built up or developed areas of a city.

Life cycle analysis: Is a "*tool to assess the environmental impacts of a product, process or activity throughout its life cycle; from the extraction of raw materials through to processing, transport, use and disposal. In its early days it was primarily used for product comparisons, for example to compare the environmental impacts of disposable and reusable products. Today its applications include government policy, strategic planning, marketing, consumer education, process improvement and product design. It is also used as the basis of eco-labeling and consumer education programs throughout the world*."[473]

Local multiplier effect: (also called the *local economic multiplier effect*) If a business has a multiplier of 1, then it is re-spending none of the money it's earning in the local area. The higher the multiplier is above 1, the better the business is for the local economy, because more money is being re-spent locally. So the multiplier effect allows you to judge the impact of different economic activities on your area. This potentially leads to more jobs and income. For the local multiplier effect to work money has to be spent within the local economy. Supporting businesses (even if they are locally based) that do not spend a greater percentage of their money within the local area does not help as much as supporting any businesses that spend more locally. Urban agriculture that produces for local markets and gets its inputs locally is something that would keep money within the local economy. [474]

Nutraceutical: Nutraceutical is a combination of the words "nutrition" and "pharmaceutical". It refers to foods that may have a medicinal effect on human health. It can also refer to individual chemicals present in common foods. Many such nutraceuticals are phytonutrients. Dr. Stephen Defelice coined the name in 1989.[475] In addition, scientists can also genetically engineer plants (often crops like corn or rice) to produce certain nutrient compounds or more of a specific nutrient (like vitamin A or iron).

Peri-urban agriculture: Peri-urban agriculture is agriculture on the edges of cities in the indistinct interface between rural and developed urban areas. It is a dynamic and expanding zone characterized by rapid land-use changes and changing livelihoods[476]. The exact definition of what is peri-urban or peri-urban agriculture can be difficult to pin down[477]. For this study the peri-urban region begins where the inner-city ends and stops at the official boundaries of the city of Kingston[478] (Figure 3). Also see the definition for "urban agriculture" and "inner-city urban agriculture".

Sustainability: "*At the heart of the concept of sustainability is a fundamental, immutable value set that is best stated as parallel care and respect for the ecosystem and for the people within it. From this value set emerges the goal of sustainability: to achieve human and ecosystem well being simultaneously. It follows that the 'result' against which the success of any project or design should be judged is the achievement of, or the contribution to, human and ecosystem well being together. Seen in this way, the concept of sustainability is much more than environmental protection in another guise. It is a positive concept that has as much to do with achieving well-being for people and ecosystems as it has to do with reducing stress or impacts*."[479]

Sustainable agriculture: seeks to optimize skills and technology to achieve long-term stability of the agricultural enterprise, environmental protection, and consumer safety. Agricultural and food system practices do not compromise the ability of future generations to meet their food needs. Included in this approach are environmental protection, biodiversity, energy conservation, animal welfare, profitability, ethical treatment of food system workers, and community development. The goal of sustainable agriculture is to minimize adverse impacts to the immediate and off-farm environments while providing a sustained level of production and profit.[480] Also see the definition for "ecological agriculture".

Triangulation: Borrowed from surveying, it refers to the cross-referencing of one piece of evidence with another in order to better determine what the actual position is.[481]

Urban agriculture: Urban agriculture can be defined as an activity that produces, processes, and/or markets food, fuel, and other outputs, largely in response to the daily demand of urban citizens within an urban area. It can occur on many types of private or public land and water bodies both within (see "inner-city urban agriculture") and on the edges (see "peri-urban agriculture") of cities, taking on many forms depending on the local context. Some examples include urban (organic) gardening or farming, urban beekeeping, urban husbandry, permaculture, rooftop gardening, urban forestry and more[482].

[1] Peri-urban agriculture is agriculture on the edges of cities in the indistinct interface between rural and developed urban areas. It is a dynamic and expanding zone characterized by rapid land-use changes and changing livelihoods (van Veenhuizen 2006). See the Glossary, page 231.

[2] Mougeot (2005)

[3] Tisdell (1988)

[4] Estimated to be 7.5 billion by the year 2020 and ~9 billion by 2050 (Tilman *et al.* 2001).

[5] TFPC (1999b), Belevi and Baumgartner (2003), Alfsen-Norodom *et al.* (2004), Madaleno (2000), Ellis and Sumberg (1998), Falvey (2004), Aragrande and Argenti (2001), Tilman *et al.* (2001), Gleeson and Bodlovich (2002).

[6] For more information on food-miles see Pretty *et al.* (2005), TFPC (1994), Pirog and Benjamin (2003), Pirog and Benjamin (2005), Pirog (2003), Xuerub (2005), Jones (2002), Lam (2006), Bodlovich (2001), Gleeson and Bodlovich (2002).

[7] The ingredients of the average breakfast in Sweden travels the circumference of the Earth to reach the consumer's breakfast bowl. A basic diet using imports uses 4 times more energy and emits a like amount of GHG than equivalent domestic sources. Other examples: In the US, food typically travels 4000 km from farm to plate. The distance has increased by 25% in the last 25 years. In the UK, food has travelled 50% further than it did 2 decades ago (Halweil 2002).

[8] The use of energy releases greenhouse gases and chemicals which contribute to air pollution and smog (i.e. VOCs, particulate matter, etc.).

[9] EC (2003)

[10] We have already seen something similar in Mexico where ethanol biofuel speculation has led to rising corn prices. This led to increased tortilla prices in Mexico. This was mentioned during a presentation at a conference where one of the presenters was missing due to her involvement in assessing this issue. (Tovar *et al.* 2007)

[11] TFPC (1999b), Brown (2006), Mitchell (1998), Brown and Halweil (1998), Falvey (2004)

[12] The average city usually only has a food reserve of ~3 days if all food trade were stopped (TFPC 1999b, Roberts 2007b).

[13] TFPC (1999b), Brown (2006), Mitchell (1998), Aragrande and Argenti (2001), Pataki *et al.* (2006)

[14] Pretty *et al.* (2005)

[15] Re-localization involves producing, processing and distributing closer to home – bringing production and consumption closer together. We do not have to stop importing all goods but we need to achieve a dynamic "balance" between imports and local domestic production. Right now our current food system is skewed in favour of long-distance transport.

[16] Mougeot (2005), Mazereeuw (2005), Buller and Morris (2004), van Veenhuizen (2006)

[17] Other products of UPA can include fibres and feed for animals.

[18] Types include: urban (organic) gardening or farming, urban husbandry, permaculture, rooftop gardening, urban forestry, peri-urban agriculture and more (see Soots 2003).

[19] I.e. using and reusing natural resources and urban wastes.

[20] People are considered food secure when they have physical and economic access at all times to a safe, sufficient, culturally acceptable, nutritionally adequate diet (through local non-emergency sources) to have an active, healthy life. (Allen 1999, Hendrickson and Miewald 2005)

[21] Smit *et al.* (2000), Frojmovic (1996), Lindayati (1996), TFPC (1999)b, Roberts (2001), FAO (2001), Halweil (2002), Gleeson and Bodlovich (2002).

[22] Densely populated cities of the developing nations have been known to get 30% of their food from urban agriculture within city bounds. For the United States, that trend can be 30-40% (TFPC 1999b). It was estimated that 200 million urban residents produced 15-20% of the world's food in 2000 (van Veenhuizen 2006, Mougeot 2005).

[23] Bourque (1999), van Veenhuizen (2006), World Commission on Environment and Development (1987), Swanwick *et al.* (2004), Smith *et al.* (2005)

[24] DC (2005b), Allen (1999), Hendrickson and Miewald (2005)

[25] Morgan (2007b)

[26] The other dimension is equitable access and distribution of food (DC 2005b, DC 2007, Allen 1999).

[27] Roberts (2007a)

[28] Morgan (2007b)

[29] Schumilas (2006), Clark (2007)

[30] Despommier (2007), Foley *et al.* (2005); COAG (2007)

[31] Despommier (2007), Foley *et al.* (2005); COAG (2007)

[32] Smith (2007)

[33] Ecosystem functions refer to the various habitat, biological or system properties or processes of ecosystems. Ecosystem goods (i.e. like food) and services (i.e. waste assimilation) represent the benefits that humans derive, directly or indirectly, from ecosystem functions. In order to keep things understandable, ecosystem goods and services are referred together as 'ecosystem services'. (Costanza *et al.* 1997)

[34] Despommier (2007)

[35] COAG (2007). Land is being converted to non-food production systems or uses (i.e. urban sprawl) and water resources are becoming more scarce.

[36] COAG (2007)

[37] COAG (2007), Schreiner (2007b)

[38] Foley *et al.* (2005), COAG (2007)

[39] IPCC (2007)

[40] Despommier (2007), COAG (2007)

[41] The backyard harvest of urban gardening in the US was approximately $17 billion (TFPC 1999b, Roberts 2001). Since this was only backyards it underestimates the full potential that an urban environment could provide for growing food. Nearly 33%+ of the dollar value of agricultural products was created within urban metropolitan areas in the US leading to a simultaneous increase in the number of processing or value added agricultural enterprises being established in the same area (Ewing 2006, Bellows *et al.* 2005). Another study in the United States indicated that 79 percent of total fruit production, 69 percent of vegetables, and 52 percent of dairy products are grown in metropolitan counties or fast-growing adjacent counties. According to Kaufman (2002), there were ~150 entrepreneurial UA projects in US inner-city areas that encompassed a wide spectrum of activities. A UN survey has also indicated that many cities provide 33% of the food for its cities on average worldwide on 1/3 of the land (Halweil 2002).

[42] Viljoen and Bohn (2005), Garnett (2000), Pouw and Wilbers (2005), Fisher *et al.* (2001), Carter *et al.* (2004), Lachance (2004), Brown *et al.* (2002), Vogl *et al.* (2003)

[43] Halweil (2002)

[44] Bourque (1999), Mougeot (1999)

[45] Population: 195 000 – which is only slightly larger than the entire Kingston Region population.

[46] 70 ha of the Fraser Valley provided 10% of all vegetables to the city of Burnaby in 1999 (TFPC 1999b).

[47] Frojmovic (1996), TFPC (1999b)

[48] van den Berg and van Veenhuizen (2005), TFPC (1999b), Rhoads *et al.* (2006), Halweil (2002).

[49] Pretty *et al.* (2005), DEFRA (2005), Carter *et al.* (2004), Rodrigues and Lopez-Real (1999).

[50] Brown (2006), Roberts (2001).

[51] Halweil (2002)

[52] Devaux *et al.* (2002)

[53] There is a lack of a "food safety net" if the global food system destabilizes even temporarily. (See TFPC 1999b, Brown 2006, Brown and Halweil 1998.)

[54] Poverty limits the ability to buy or access healthy food (Kaufman 2002).

[55] Every $1 spent on nutrition prevents $3 in medical costs (Roberts 2005, Roberts 2007b). Studies from several African cities have shown that families engaged in urban agriculture eat better, as measured by caloric and protein intake or children's growth rates (Halweil 2002).

[56] Roberts (2005, 2007b); van Veenhuizen (2006)

[57] DC (2005b)

[58] This is indicated by the steady rise in the use of food banks in Ontario. From 2001-2006 food bank used increased 18.6% - twice the rate of Ontario's population growth during the same period (Spence 2006, Tsering 2005).

[59] Morgan (2007b)

[60] Fleury and Ba (2005), Fang *et al.* (2005), Mason (2006), Ali *et al.* (2005), van Donkersgoed (2006).

[61] The Government of Canada (2006) indicates that road transportation may actually contribute 36% of GHGe emissions.

[62] See Figure 6.1 in OEE (2005). The figure details the distribution and changes in transportation energy use by sub-sector.

[63] That is an increase of 40% in energy usage and GHGe since 1990 (OEE 2005). According to NAEWG (2006), transportation was also the biggest consumer of petrol at 1.0 MMbbls/d (millions of barrels/day) in Canada (the US used fourteen times that amount).

[64] OEE (2005), EC (2003)

[65] I.e. increasing distance to reach large chain supermarkets, often at the urban fringes.

[66] Total fossil fuel use for automobiles increased 21% between 1990 and 1999. SUV or light duty truck use has also increased at the same time. The percentage of automobile passenger–kilometres traveled in light-duty trucks has tripled in the last 25 years, from 10%in 1976 to 27% in 2000. (EC 2003)

[67] EC (2003), Viljoen and Bohn (2005), DEFRA (2005), Roberts (2005), Pataki *et al.* (2006), Government of Canada (2006), Ang-Olson and Schroeer (2003).

[68] This was determined using data from Statistics Canada.

[Total Food Waste in Canada (kg/yr)] = A*B

A - From Table 002-0019 - Per capita disappearance of major food groups in Canada, annual (kilograms per year unless otherwise noted): I determined that 1367.25 kg/capita/yr were consumed. Approximately 32% (see page 116) would be wasted. This equated to 432.9625 kg/capita/yr. I will call this A.

B - The Canadian population B was 32270507 from:
Table 051-0001 - Estimates of population, by age group and sex, Canada, provinces and territories, annual (persons)(1,2,6)

Then [Total Food Waste in Canada (kg/yr)] = A*B = 13,971,919,387 or ~14,000,000 tonnes/yr.

[69] EC (2003)

[70] Producing fresh foods close to consumers means reducing energy used for transport, packaging, cooling, etc. It would also prevent the need for preservation additives (Rodrigues and Lopez-Real 1999).

[71] van Veenhuizen (2006), Carter *et al.* (2004), Vogl *et al.* (2003), Viljoen and Bohn (2005), Gleeson and Bodlovich (2002).

[72] Many planners, health authorities and other decision makers see urban agriculture – be it gardens or animal keeping as being unsanitary and having no place in modern cities of the West (Keil 2007, TFPC

1999b). Examples of this include old grandmothers selling vegetables on the sidewalks of China Town in Toronto or laws against raising poultry in one's yard.

[73] Frojmovic 1996, TFPC 1999b

[74] Viljoen and Bohn (2005), van Veenhuizen (2006), Devaux *et al.* (2002)

[75] Fairholm (1998)

[76] TFPC (1999b)

[77] Reynolds *et al.* (2006)

[78] van Veenhuizen (2006), Devaux *et al.* (2002)

[79] Devaux *et al.* (2002)

[80] Agriculture is the second largest contributor of greenhouse gases after direct fossil fuel useage. (IPCC 2007)

[81] KFL&A Public Health (2006)

[82] Shedd (2006), Bedore *et al.* (2007)

[83] Bedore *et al.* (2007)

[84] Van Bers and Robinson (1993 in TFPC 1999b)

[85] Lomborg (2006)

[86] Devaux *et al.* (2002)

[87] Risjord *et al.* (2002)

[88] Viljoen and Bohn (2005), van Veenhuizen (2006)

[89] Valentine (2005), Risjord *et al.* (2002)

[90] Valentine (2005), Kesby *et al.* (2005)

[91] Risjord *et al.* (2002)

[92] Nugent (2000)

[93] Risjord *et al.* (2002), Moran-Ellis *et al.* (2006)

[94] Sankar (2005)

[95] Parfitt (2005)

[96] Robinson (1993)

[97] Dobyns (2004), Lindayati (1996), Frojmovic (1996), Sommers and Smit (1994), Bodlovich (2001)

[98] Parfitt (2005)

[99] Parfitt (2005)

[100] These were on Tue, Thu, Sat of each week - the favoured operation days of the KFM vendors.

[101] This was the high traffic period according to vendors who were consulted.

[102] I.e. due to work and travel circumstances

[103] I.e. this was to increase the representative strength of the sampling.

[104] Parfitt (2005)

[105] Parfitt (2005)

[106] Valentine (2005)

[107] These were no longer than 30 minutes and at a location convenient to the interviewee (see page 95).

[108] Valentine (2005)

[109] Lindayati (1996), Frojmovic (1996), Pothukuchi (2004), Bodlovich (2001), Halweil (2002)

[110] Valentine (2005)

[111] Valentine (2005)

[112] Allen and Allen (2007), Ewing (2006), Reynolds *et al.* (2006), WHO (2000)

[113] Valentine (2005)

[114] Kesby *et al.* (2005), Reynolds *et al.* (2006), Cook (2005)

[115] Kesby *et al.* (2005), Reynolds *et al.* (2006), Cook (2005)

[116] Kesby *et al.* (2005), Reynolds *et al.* (2006), Cook (2005)

[117] Kesby *et al.* (2005), Reynolds *et al.* (2006)

[118] Clark (2007)

[119] This term is used to represent any agriculture that actually uses methods that nurture the land and is sustainable well into the future. It is used to avoid the disputed label of organic. The co-optation of the branding by agribusinesses has diluted the meanings and practices, creating confusion. (Guthman 2004) See the Glossary for additional details (page 231).

[120] StatsCan (2007c)

[121] TFPC (1999b), WRAP (2007)

[122] Statistics Canada (2002, 2007b, 2007d)

[123] Moran-Ellis *et al.* (2006), Valentine (2005), Sporton (1999), Risjord *et al.* (2002)

[124] Risjord *et al.* (2002), Moran-Ellis *et al.* (2006)

[125] Valentine (2005), Kesby *et al.* (2005), Cook (2005)

[126] Freshwater (2006)

[127] Freshwater (2006), Risjord *et al.* (2002)

[128] Moran-Ellis *et al.* (2006), Risjord *et al.* (2002)

[129] Risjord *et al.* (2002): 273

[130] Risjord *et al.* (2002): 273

[131] i.e. cooking, medicinal herbs, etc. not ornamental

[132] Clark (2007)

[133] Moran-Ellis *et al.* (2006)

[134] Moran-Ellis *et al.* (2006), Valentine (2005), Sporton (1999), Risjord *et al.* (2002)

[135] Stormwater management helps to reduce pollution that destroys surface water quality (Cantrell *et al.* 2006).

[136] Costanza *et al.* (1997): 253

[137] Costanza *et al.* (1997)

[138] Pimentel *et al.* (1997), City of Kingston (2002)

[139] Clark (2007)

[140] COAG (2007) and WRAP (2007) respectively. It is very difficult to tease apart the transport contribution in the food system. Transport is linked to all segments of the production, processing and even storage. One must transport the plastic that goes into packaging the food. One must transport inputs for producing the food. The literature reviewed to date has not revealed any comprehensive lifecycle management studies that examine the full impact of the food system in fine detail.

[141] Lam (2006)

[142] Mazereeuw (2005), Nowak (2004), Sutic (2003), Pelkonen and Niemela (2005), Balfors *et al.* (2005), Drinnan (2005).

[143] This is supported by the literature: see Dobyns (2004), Lindayati (1996), Frojmovic (1996), Sommers and Smit (1994), Bodlovich (2001).

[144] Again there is literature supporting these benefits – see Bellows *et al.* (2005).

[145] Gateway Greening (2007)

[146] Bedore *et al.* (2007)

[147] Thomsen (2006), Steinman (2006), LA4 (1999), Allen and Allen (2007), Hamm (2006), Cantrell *et al.* (2006)

[148] Lebel (2003)

[149] Lattanzi (2007)

[150] See Bellows *et al.* (2005).

[151] Jobin (2006)

[152] Lipscombe and Hux (2007), Mesley (2007), Cooper (2007)

[153] Bellows *et al.* (2005) conducted a comprehensive literature review on how urban agriculture could help to improve health through both better diet and exercise.

[154] There would be transport provided between different areas to try out various local food specialties.

[155] Mason (2006), van Donkersgoed (2006)

[156] Pimentel *et al.* (1997)

[157] The annual non-consumptive revenue of bird watching in the United States in 1996 was $18 billion (Pimentel *et al.* 1997). Visiting a farm certainly can often involve "consuming" good food.

[158] For the local multiplier effect to work money has to be spent within the local economy. Supporting businesses (even if they are locally based) that do not spend a greater percentage of their money within the local area does not help as much as supporting any businesses that spend more locally. Urban agriculture which produces for local markets and gets its inputs locally is something which would keep money within the local economy. (See page 168)

[159] According to Zenghelis (2007), this could be three (If greenhouse gas emissions are valued at $15/tonne of CO2e equivalent) to eight times higher (If it is valued at $80/tonne).

[160] StatsCan (2002)

[161] Viljoen and Bohn (2005)

[162] The Edible Schoolyard (2006), Allen and Allen (2007)

[163] Compare this to ~40% of the populations of cities like Vancouver, BC and Toronto, ON or 10% of London, UK (in CGs with 30000 gardeners). (Gerritt 2006)

[164] According to StatsCan (2002), that was 27% of the Kingston CMA population.

[165] See page 24 of City of Kingston (2005) for existing land-uses for brownfields.

[166] There is a living wall located within the Integrated Learning Centre in Beamish-Munro Hall at Queen's University – however its primary purpose is air filtration not food production.

[167] Lam (2006)

[168] Allen and Allen (2007)

[169] Themelis (2007), Allen and Allen (2007)

[170] This had no effect on the calculations for current levels of citizen backyard gardening. It was not factored into the potential maximum production as I was looking only at readily useable or available area. High-density residential areas do not have "backyards" hence the reason it was factored into the calculations for **Table 7**.

[171] Schmidt (2007), Ableman (2007)

[172] NFU (2003), NFU (2005), NFU (2007), Roberts (2005), Roberts (2007b)

[173] Clark (2007), Dowling (2007)

[174] Lattanzi (2007): Mark Lattanzi is the Campaign Director of the Be a Local Hero, Buy Locally Grown program in western Massachusetts—the longest running and most comprehensive "buy local" program for

farm products in the United States. Annually this program engages more than 120 farms, 12 restaurants, 45 grocery stores and 8 farmers' markets to raise awareness and sales of locally grown farm products. Recently, two hospitals in this same region have committed to serving healthy, locally sourced and sustainably grown food in their facilities.

[175] Hubay (2007a)

[176] Clark (2007)

[177] Clark B (2007) (Agricultural Study); Clark Consulting Services (2006) (Agricultural Study); City of Kingston (2005) (Community Improvement Plan); Clark Consulting; Services (2005) (City Owned Industrial Land (Coil) Strategy); J.L. Richards & Associates Limited (2004) (Urban Growth Strategy)

[178] Hubay (2007b)

[179] See Bellows *et al.* (2005) for supporting evidence.

[180] Harmon and Maretzki (2006), Kerton (2006)

[181] Harmon and Maretzki (2006), Kerton (2006)

[182] See Bellows *et al.* (2005) for supporting evidence.

[183] Lattanzi (2007): CISA stands for Community Involved in Sustaining Agriculture.

[184] This was an actual suggestion made by Dr. Wayne Roberts for promoting local food at the Food Movements for Momentum event in May (Roberts 2007b).

[185] A motorized rotary cultivator.

[186] Roberts (2007b)

[187] Desjardins (2007c)

[188] Friedmann (2006)

[189] Schreiner (2007a)

[190] Babcock (2006)

[191] Blay-Palmer *et al.* (2006)

[192] Sustainable Table (2007)

[193] TFPC (1999b), Roberts (2001)

[194] Ewing (2006), Bellows *et al*. (2005)

[195] Kaufman (2002)

[196] Roberts (2007a, b)

[197] Cloud J. 2007. Eating Better Than Organic. Time Magazine. 05 Mar 2007
<http://www.time.com/time/magazine/article/0,9171,1595245,00.html>

[198] Which mirrors a similar problem of insufficient "organic" production to meet demand.

[199] Packaged Facts. 2007. Local and Fresh Foods in the U.S. 19 Aug 2007
<http://www.packagedfacts.com/Local-Fresh-Foods-1421831/>

PRNewswire. 2007. Locally Grown Foods Niche Cooks Up at $5 Billion as America Chows Down on Fresh! 20 Jun. DairyField Magazine. 19 Aug 2007
<http://www.dairyfield.com/viewprnews.php?nid=17736>

[200] Allen and Allen (2007)

[201] Gerritt (2006)

[202] Jaouich (2007)

[203] Hale (2007)

[204] Hale (2007)

[205] Hale (2007)

[206] Lam (2006)

[207] One local community advocate expressed disappointment over the fact there was no berry production in Kingston. According to city officials, bushes of any sort are generally prohibited on public property since they are a personal security concern for joggers or passersby. Bushes allow people to hide behind them.

[208] City of Kingston (2002)

[209] Giles (2007)

[210] StatsCan (2007a, e)

[211] Themelis (2007)

[212] City of Kingston (2002)

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[213] Typical container gardening often requires chemical inputs unless the soil is changed frequently. Growing Power, an urban farm and NGO in Milwaukee is an example that demonstrates that fostering soil fertility is integral to chemical free growing practices. Using high-quality vermicompost created from organic waste and red worms, Growing Power is able to nurture and build up the soil life within a pot. Each pot has over 100 or more worms. They grow salad mixes in these pots and never have to replace the soil until the pot falls apart 7 years later. (Allen and Allen 2007)

[214] Allen and Allen (2007)

[215] Lachance (2004)

[216] Balmer *et al.* (2005)

[217] Lachance (2004), TFPC (1999b), Land Use Consultants (2004), Rhoads *et al.* (2004), Badami *et al.* (2002), Ewing (2006), Mwalukasa (1999), Chaplowe (1998), Roberts (2005), Heinegg *et al.* (2002), IDRC (2006h), MCHG (2005), Allen and Allen (2007).

[218] CURE (2005), Smit (2006b)

[219] Nowak (2004), LA4 (1999)

[220] Developers can substitute 50-70% green roof area for open space area in Germany. (Cutlip 2006)

[221] In Portland, buildings that have 500 square feet of impervious surface are required to reduce storm water pollution and flow rates. (Cutlip 2006)

[222] Albedo is the proportion of the incident light or radiation that is reflected by a surface.

[223] Leading to reduced energy use through cooling buildings and the city.

[224] Land Use Consultants (2004), Roberts (2001)

[225] Grass alone would absorb NOx, SOx, PM10 (particulate matter of 10 microns or greater) and 48% of ozone (O3) (Currie 2007).

[226] Green areas can absorb 15% more stormwater than lawns with savings to sewage transport systems. (Roberts 2001)

[227] See Nowak (2004), Sutic (2003), Belevi and Baumgartner (2003), Ruel *et al.* (1998), Morris (2003), EC (2003), ELT (2006), LA4 (1999), Roberts (2001), Pataki *et al.* (2006), van Veenhuizen (2006), Bryld (2003), Currie (2007)

[228] The estimated socio-economic costs of air pollution are significant (Judek *et al.* 2004 and Chestnut *et al.* 1999 in Government of Canada 2006) – annually at least 5900 deaths in a city are linked to air pollution. It is estimated that the costs of the resulting poor health are in the billions per year. According to Currie (2007), well over 1000 people die from air pollution every year in Toronto alone.

[229] In the 2003 European heat wave, there were ~19000 confirmed deaths with unreported heatstroke fatalities unaccounted for (Koppe *et al.* 2004).

[230] Sokol *et al.* (2006), Koppe *et al.* (2004), Morello-Frosch and Jesdale (2006), Foley *et al.* (2005).

[231] Foley *et al.* (2005)

[232] In Banting *et al.* (2005), green roofs in Toronto had significant financial benefits in terms of reduced stormwater flow, improved air quality, reduced direct energy use and reduced urban heat island effect. The initial cost savings were $313 million with annual savings of around $37 million. This does not include the hard to measure benefits such as aesthetics, increases in property values, amenity values, food production value, biodiversity value and more!

[233] Currie (2007), Banting *et al.* (2005)

[234] See Nowak (2004), Sutic (2003), LA4 (1999), Mazereeuw (2005).

[235] Cutlip (2006): Slopes greater than 40% will require additional anchors for plants which may slide under their own weight.

[236] This is a new issue to the insurance industry in Canada. Nations like Japan and Germany could serve as models for rooftop garden insurance provision. (Mazereeuw 2005)

[237] Using plant containers with affixed wheels could facilitate rooftop container gardening in the right cases. For example, a building with elevator access to the roof could make this a useful option.

[238] Currie (2007), Schreiner (2007c), ELT (2007a)

[239] Hobbs (2002)

[240] Smit and Nasr (1995), Bellows *et al.* (2005), Yilma (2002), Mougeot (1999), TFPC (1999b)

[241] MCHG (2005)

[242] ELT (2007b)

[243] Tang and Cheng (2005)

[244] TFPC (1999b)

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[245] Levenston (2006), also see ELT (2006)

[246] Currie (2007)

[247] Can also double as a semi-covered outdoors room for selling, sitting or socializing – an efficient use of space. (MCHG 2005)

[248] "Hanging nets" constructed of natural fibres or recycled plastic for example might be one easy innovative method of expanding production within an urban area. In addition, this sort of design could be taken down if needed.

[249] This combination of fences and container gardening is also briefly mentioned in Yilma (2002).

[250] WHO (2000), Brown *et al.* (2002)

[251] Garnett (2000)

[252] In the Kingston context this would mean individuals (perhaps in high-density residential buildings) with little or no growing space.

[253] Kiguli (2003), van Veenhuizen (2006)

[254] Kiguli (2003)

[255] Garnett (2000)

[256] van den Berg *et al.* (2005), Kiguli (2003)

[257] TFPC (2000)

[258] TFPC (1999b)

[259] Lang (2005)

[260] Smit (1996), Kiguli (2003), Mwalukasa (1999)

[261] Kiguli (2003)

[262] Steinman (2006)

[263] Vogl and Axmann (2002), Vogl *et al.* (2003)

[264] Permaculture is both a philosophy or lifestyle ethic as well as a design system. It utilizes a systems thinking approach to create sustainable human habitats by analyzing and duplicating nature's patterns (ecology).

Wikipedia. 2007. Permaculture. 20 Jun. Wikipedia. 20 Jun 2007 <http://en.wikipedia.org/wiki/Permaculture>

[265] Ableman (2007)

[266] Allen and Allen (2007)

[267] Morton (2006), Gerritt (2006), Rhoads *et al.* (2006), Brayley *et al.* (2006)

[268] Lachance (2004)

[269] M'Gonigle (2007)

[270] City of Victoria (2005)

[271] Chaplowe (1998), Altieri (1999), de la Salle (2004), Lazo and Barada (2002)

[272] Research in the UK (WRAP 2007) indicates that the average time to prepare a meal has dropped from 30 minutes to 19 minutes.

[273] Ives (1999), Artz (2004), Whiting (2002), The Edible Schoolyard (2006)

[274] Desjardins (2007a), Mason (2006), Lattanzi (2007)

[275] "Deconstructing Dinner is a weekly radio program produced at Kootenay Co-op Radio in Nelson, British Columbia, Canada. The program discusses the impacts our food choices have on our communities, the planet and ourselves. Deconstructing Dinner is broadcast on seven radio stations and is available for download on the program's web site or via a podcast feed." (GPM 2007; also see DD (2007)).

[276] BBC Radio 4 (2007)

[277] Davis *et al.* (2007), Ray (2007)

[278] Costanza *et al.* (1997), Nino-Murcia (2006), Duraiappah (2006), Sankar (2005), Steiner *et al.* (2004).

[279] Health Canada (1998)

[280] Lam (2006)

[281] Gateway Greening (2007)

[282] Which is part of the Community Development Services (CDS) branch of the local government.

[283] Cummings *et al.* (2000)

284 Referring only to Kingston City, Kingston Township and Pittsburgh Township, which make up the amalgamated City of Kingston or CMA (Census Metropolitan Area).

285 KEDCO (2004a), StatsCan (2002), StatsCan (2007c).

286 Cummings *et al.* (2000)

287 KEDCO (2004a)

288 KEDCO (2004c)

289 This is the average amount most North Americans spend on food (Roberts 2007a,b).

290 KEDCO (2004a)

291 See page 31.

292 Kirwan *et al.* (2003), Chartrand (2005)

293 In 2001, 16% and 13% of employment was in peri-urban/intermediate/fringe regions and urban central areas respectively. (Chartrand 2005)

294 Bodlovich (2001)

295 Cummings *et al.* (2000)

296 Roberts (2005, 2007b), NFU (2003, 2005, 2007)

297 NFU (2003, 2005, 2007)

298 This was indicated in Clark (2007).

299 Cummings *et al.* (2000)

300 Cummings *et al.* (2000), NFU (2003)

301 UPA can also generate "specialty" ornamental and horticultural products within urban spaces (Mougeot 1994, Mougeot 1999, Sommers and Smit 1994).

302 Cummings *et al.* (2000)

303 Which is part of the Community Development Services (CDS) branch of the local government.

304 City of Kingston (2000)

305 The average world value was stated in $USD per 0.45 kg which I converted to Canadian dollars per kg using 2005 currency exchange rates. (Marulanda Tabares 2003)

[306] WHO (2000)

[307] Cohlmeyer (2006)

[308] Ableman (2007)

[309] Hamm (2006)

[310] Allen and Allen (2007)

[311] Smit (2006a), Reilly *et al.* (2001), Deschenes and Greenstone (2006), House of Lords (2005), IPCC (2007), COAG (2007).

[312] Cleveland (1997), Bellows *et al.* (2005), Gerritt (2006)

[313] OPVG (2004): OPVG is Ontario Processors and Vegetable Growers

[314] Also see Gleeson and Bodlovich (2002), MCHG (2005), Smit (2006a), Despommier (2007).

[315] Clark (2007)

[316] This was apparent according to the sources that were examined and the calculations that were made. (See Cleveland 1997, Bellows *et al.* 2005, Gerritt 2006.)

[317] Statistics Canada (2007c)

[318] The following Statistics Canada data was used:

StatsCan (Statistics Canada). Table 001-0042 - Supply and disposition of corn in Canada and selected provinces as of March 31, August 31 and December 31, 3 times per year (metric tonnes x 1,000)(1,2,3,4). This was for the period from Jan-Mar 2006

StatsCan (Statistics Canada). Table 001-0041 - Supply and disposition of grains in Canada as of March 31, July 31, August 31 (soybeans only) and December 31, 3 times per year (metric tonnes x 1,000)(1,2,3). This was for the period from Jan-Mar 2006

[319] Roberts (2007a,b); WRAP (2007)

[320] StatsCan (2007b,d)

[321] This was determined from StatsCan (2002).

[322] The median was selected as it was very close to what was indicated as a typical size for a citizen garden in Bellows *et al.* (2005).

[323] Statistics Canada (2002)

[324] This was determined from StatsCan (2002).

[325] A 3000 square foot size was chosen. This size was typical according to correspondence with a former greenhouse farmer and information on similar operations in Michigan and Milwaukee. This estimate was several times smaller than what I had observed. This however had little impact on the overall analysis of urban production. (See Hamm 2006, Cantrell *et al.* 2006, Allen and Allen 2007)

[326] One producer had previously grown soybean and corn in the past until market circumstances made it too difficult. Both soybean and corn crops are generally input intensive crops. The producer rents out land and hires out labour to farmers who approach them. Most of their operations were dairy in the past though it is no longer the case now.

[327] Clark Consulting Services (2006), Clark (2007)

[328] StatsCan (2007c)

[329] City of Kingston (2005)

[330] See Nowak (2004), Sutic (2003).

[331] City of Kingston (2000)

[332] Peck (2004)

[333] Peck (2004)

[334] Lam (2006), Xuerub (2005)

[335] Pimentel *et al.* (1997), City of Kingston (2002)

[336] Pimentel *et al*. (1997)

[337] City of Kingston (2002)

[338] Lam (2006)

[339] NOx has 310 times the warming potential of carbon dioxide. Agriculture is also the source of more than 33% or 1/3 of all human NOx emissions (IPCC 2007).

[340] Biocap (2005)

[341] OEE (2005)

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[342] This was based on CAA (2005).

[343] EC (2004)

[344] A similar explanation is found in Lam (2006) on page 206 and Xuerub (2005).

[345] LA4 (1999), Thomsen (2006), Van Bers (1991) in Barbolet *et al*. (2002)

[346] LA4 (1999), Thomsen (2006), Van Bers (1991) in Barbolet *et al*. (2002)

[347] Van Bers (1991) in Barbolet *et al.* (2002)

[348] Health Canada (1998)

[349] Health Canada (1998), Birmingham *et al.* (1999), Ohinmaa *et al.* (2004), CIHI (2007), Gundgaard *et al.* (2003), Health Canada (2004), Blanchard *et al.* (1996), Blanchard *et al.* (2000)

[350] Health Canada (1998)

[351] Health Canada (1998)

[352] Health Canada (1998)

[353] Health Canada (1998)

[354] Health Canada (1998)

[355] Health Canada (1998)

[356] StatsCan (2002)

[357] Brown *et al.* (2002), Carter *et al.* (2004), van den Berg and Veenhuizen (2005), Reynolds *et al.* (2006), Garnett (2000)

[358] Allik KA and RCF Mulder. 2002. Fragrances of Time and Space: Block D. 12 Aug. A Whole in One. 05 Jul 2007 <http://www3.sympatico.ca/robmulder/fragranc.htm>

[359] The corner of Albert and Brock.

[360] The Sleepless Goat Workers' Co-operative specializes in certified fair trade coffees and fine home-made desserts. It is a collectively owned restaurant and association of workers committed to shared values derived from a participatory, non-hierarchical workplace and a consensual decision making process. (See http://www.thesleeplessgoat.ca/mission.html)

[361] Bhatt *et al.* (2005), de la Salle (2004), Balmer *et al.* (2005), Jayaratne (2005), Raja (2000).

[362] The garden is located on Charles Street between Bagot and Rideau Street. It is adjacent to a warehouse owned by Loblaws, close to the Loblaw-owned No Frills store on Bagot Street.

[363] A private school located on John Street.

[364] It is $700/year for a $2 million liability insurance policy that theoretically the private owner (Loblaws) could have folded into their own policy. They were unwilling or unable to do so.

[365] The demonstration ARG workshop and construction was slated for Oct 14, 2006. A tabletop design was selected.

[366] World Book (2005)

[367] van den Berg and van Veenhuizen (2005), TFPC (1999b), Rhoads *et al.* (2006), Halweil (2002).

[368] The floating garden marshes of Xochimilco (Fleury and Ba 2005).

[369] See Fang *et al.* (2005), Mason (2006), Ali *et al.* (2005).

[370] Bedore *et al.* (2007)

[371] 5.34% of the city's urban population as of the 2001 census (City of Kingston 2006, StatsCan 2002)

[372] City of Kingston (2006)

[373] This is with regards to both food and shelter.

[374] The success of this measure has yet to be determined. (Drescher and Iaquinta 2002)

[375] Lattuca *et al.* (2005)

[376] Molino Blanco has a garden park as well as a demonstration garden in a flooded area where UPA is already practiced. (Lattuca *et al.* 2005)

[377] This is 300 out of 21907 ha or roughly 1%. (Pouw and Wilbers 2005)

[378] The municipal government has purposely limited or banned development of these areas whenever possible. See Ali *et al.* (2005).

[379] Fleury and Ba (2005)

[380] Underwood (2006)

[381] There are 13 municipal/district level forest parks in Beijing with a total area of 41000 ha. (Fang *et al.* 2005)

[382] de la Salle (2004)

[383] Garnett (2000)

[384] Balmer *et al.* (2005), Bodlovich (2001)

[385] Bodlovich (2001)

[386] van Donkersgoed (2006)

[387] van Donkersgoed (2006)

[388] Growing Power Inc. is a highly successful urban agriculture business founded by former basketball star Will Allen out of Milwaukee. The Chicago garden was created through the efforts of his daughter Erika Allen as part of the mayor's plan to "green the city". (Allen and Allen 2007)

[389] The combination of aquaculture (fish farming) and hydroponics results in reduced energy & heating costs. The synergy is due to the fact that the thermal water mass of the aquaculture cools the greenhouse in the summer while it provides humidity and heating in the winter. Much of the fish is sold in Toronto. (TFPC 1999b)

[390] Greensgrow Farm has ~0.2043 ha of operations – including a greenhouse, raised beds, hydroponics, nurseries, flower beds, beehives, farm market area and vermiculture. See Carter *et al.* (2004).

[391] Allen & Allen (2007): compost mounds on a flat surface (elevated or not) could also work.

[392] The initiatives include the Frontenac Farmers' Market, the NFU's Feast of Fields, Local Food Logo and "Eating Close to Home" directory.

[393] Purkey (2007)

[394] EC (2003)

[395] Clark Consulting Services (2006); also see the Glossary (page 231) for the definitions of inner-city and peri-urban agriculture.

[396] Bedore *et al.* (2007)

[397] IDRC (2006a)

[398] Noel (2006)

[399] MCHG (2005)

[400] Carter *et al.* (2004)

[401] The area for Cataraqui Region Conservation Authority is actually a minimum and it would be unlikely that a large portion of it would be used for cultivation.

[402] Pretty *et al.* (2005), Pirog *et al.* (2001), Pirog and Benjamin (2003)

[403] Xuerub (2005)

[404] Xuerub (2005)

[405] This is roughly the distance from Kingston to Vancouver by road.

[406] See EC (2003), OEE (2005B)

[407] Pretty *et al.* (2005), Pirog *et al.* (2001), Pirog and Benjamin (2003)

[408] Xuerub (2005)

[409] Xuerub (2005)

[410] Xuerub (2005)

[411] Addington Highlands, Central Frontenac, Frontenac Islands, Gananoque, Kingston, Leeds and the Thousand Islands, Loyalist, North Frontenac, South Frontenac and Stone Mills. Data was derived through PCensus for MapPoint (Stauffer Library, Queen's University) from Canadian Census 2001.

[412] Xuerub (2005)

[413] See Blay-Palmer *et al.* (2006).

[414] This point is raised in the Study Limitations section of Xuerub (2005)in more detail and is briefly mentioned later on.

[415] This was also suggested in Xuerub (2005).

[416] Xuerub (2005)

[417] Pirog *et al.* (2001)

[418] It also means that the results of this analysis may be somewhat of an underestimation since we are not calculating the emissions of all food imports into the Kingston region (only 58).

[419] See Annika Carlsson-Kanyama (1997), Pirog *et al.* (2001), Lifecycles (2004) and Bentley (2005) in Xuerub (2005).

[420] See McKibbon (2005) in Xuerub (2005).

[421] Environment Canada (2002)

[422] See Xuerub (2005)

[423] Statistics Canada's Food Expenditure survey (2003)

[424] Supply and Disposition data (2005)

[425] For more details, see Xuerub (2005) and section 3.6 Food Consumption data in his report.

[426] Xuerub (2005)

[427] For details see also section 3.7 Imports as a Percentage of Domestic Consumption in Xuerub (2005).

[428] Xuerub (2005)

[429] Statistics Canada (2005)

[430] OEE (2005a)

[431] This was based on CAA (2005).

[432] EC (2004)

[433] Xuerub (2005)

[434] Xuerub (2005)

[435] Xuerub (2005)

[436] This value was obtained by multiplying the average WAER value by the emissions for a truck in Table 7 and then dividing by 1 million to obtain units kg/(kg•km).

[437] Roberts (2007b)

[438] Mesley (2007)

[439] Mooney (2007)

[440] CIHI (2006a,b)

[441] CIHI (2006a,b)

[442] Compare and contrast this to the United States, where the direct and indirect costs of obesity for example - in terms of medical and productivity measures are estimated at $117 billion USD annually (Levi *et al.* 2006). That is only for a single disease and it exceeds all the health costs of the provinces and territories combined. Of course one most consider the fact that their population is much larger.

[443] Morgan (2007b)

[444] Morgan (2007b)

[445] Lipscombe and Hux (2007)

[446] Hamm (2006), Haslam *et al.* (2006)

[447] Jobin (2006)

[448] Roberts (2007b) stated at a recent talk in Kingston that 60% of all cancers are linked to food.

[449] Only smoking is slightly worse in terms of mortality. All other causes of death do not compare to the magnitude of either smoking or deaths linked to poor diet. (Hamm 2006, Cantrell *et al.* 2006, Haslam *et al.* 2006)

[450] Finegood (2006)

[451] Cantrell *et al.* (2006)

[452] Morgan (2007b)

[453] Wikipedia (2007)

[454] Lipscombe and Hux (2007)

[455] Morgan (2007b)

[456] BioenergyWiki. 2007. What is bioenergy - BioenergyWiki. 03 Aug. Wikipedia. 05 Aug 2007 <http://www.bioenergywiki.net/index.php/Bioenergy>

[457] Sustainable Table. 2007. Sustainable Table: Dictionary. 03 Jun 2007 <http://www.sustainabletable.org/intro/dictionary/>

[458] Some farmers may specifically refer to soil fertility.

[459] Guthman (2004)

[460] Ableman (2007)

[461] Schreiner (2007a)

[462] This is one of the favourite mottos of the Slow Food movement.

[463] Costanza *et al.* (1997)

[464] Sankar (2005)

[465] Mari Gallagher Research & Consulting Group. 2006. Examining the Impact of Food Deserts on Public Health in Chicago. A Report Commissioned by LaSalle Bank. Chicago, Illinois.

[466] Lam (2006), Xuerub (2005), Pirog and Benjamin (2003), Pirog and Benjamin (2005), Pirog (2003).

[467] DC (Dietitians of Canada). 2007. Community Food Security: Position of Dietitians of Canada. Public Policy Statements.

[468] DC (2005), Allen (1999), Hendrickson and Miewald (2005).

[469] Declaration of Nyéléni (text). 2007. Nyéléni 2007 - Forum for Food Sovereignty. 27 Feb. 08 Aug 2007 <http://www.nyeleni2007.org/spip.php?article290>

[470] Halweil (2002)

[471] Blay-Palmer *et al.* (2006): During the BSE crisis, Canadian farmers were slaughtering their own cattle while the nation, as a whole was still required under NAFTA to import beef from elsewhere to meet the import quota.

[472] Cornell University. 2004. A primer on community food systems: Linking food, nutrition and agriculture. 13 Dec 2006 <http://foodsys.cce.cornell.edu/primer.html>

[473] Srinivas H. 2006. Life Cycle Assessment. 22 Aug. Life Cycle Analysis Systems for Cities. 03 Aug 2007 <http://www.gdrc.org/uem/lca/lca-define.html>

[474] Ward and Lewis (2002)

[475] Wikipedia. 2007. Nutraceutical. 16 Jul. Wikipedia. 05 Aug 2007 <http://en.wikipedia.org/wiki/Nutraceutical>

[476] van Veenhuizen (2006), Drescher *et al.* (2001)

[477] Bouraoui (2005)

[478] See Clark Consulting Services (2006).

[479] Tisdell (1988). Also see: Wikipedia. 2007. Sustainability. 04 Jun 2007 <http://en.wikipedia.org/wiki/Sustainability#Definitions.2C_metrics_and_indices>

[480] USDA. 2006. Sustainable agriculture: Definitions and terms. United States Department of Agriculture. <http://www.nal.usda.gov/afsic/AFSIC_pubs/srb9902.htm>

[481] Kesby *et al.* (2005)

[482] Soots (2003)