Understanding Labour and Production in Alternative Agriculture: Requirements, variability and perceptions of labour on certified organic farms in Ontario, Canada

by

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ABSTRACT

UNDERSTANDING LABOUR AND PRODUCTION IN ALTERNATIVE AGRICULTURE:
REQUIREMENTS, VARIABILITY AND PERCEPTIONS OF LABOUR ON
CERTIFIED ORGANIC FARMS IN ONTARIO, CANADA

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Alternative agriculture may be unsustainable with respect to labour demands. To understand these requirements, this study synthesized methods previously used in determining land, labour and food production to evaluate labour required to meet daily dietary demands of the city of Guelph through local, certified organic production. Quantitative and qualitative analysis evaluated labour requirements alongside existing employment, as well as factors affecting productivity. We concluded based on this analysis that: 1) workforce requirements in forms of alternative agriculture could exacerbate an existing labour gap in Canadian agriculture; 2) there is considerable variation in certified organic horticultural production; 3) some examples of high productivity provided insight into efficient production but with caveats. This contributed to a greater understanding of resource requirements and to research on the criticisms of social justice of farm labourers in alternative agriculture. We suggest expansion of analysis spatially, temporally and to other methods of alternative agricultural production.
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CHAPTER ONE – INTRODUCTION

1. Research context

Agriculture is the leading form of human land use globally, and a massive driver of change with regards to society, economy, and the environment (Foley et al., 2011; Keller & Brummer, 2002). With the world's population estimated to grow to over nine billion people by 2050, there is the concern of meeting the demand for food production, alongside the issues of environmental degradation, rising food prices and competition for resources (Godfray et al., 2010). While scientific and technological innovations have made important contributions to food security, they have also led to massive environmental and social repercussions in favour of economic growth under an industrial agriculture paradigm (IAASTD, 2009; Reynolds, Smith & Farmer, 2014). Therefore, a shift towards more sustainable methods (Godfray et al., 2010), has been suggested as a means of implementing environmentally and socially-beneficial practices (Reynolds, Smith & Farmer, 2014), while maintaining productive and economic viability (Pimental et al., 2005). More sustainable methods of food production are often associated with alternative agriculture, such as localization and organic agriculture (Mount et al., 2012). Furthermore, these alternative forms of production are often referred to as counter to conventional agriculture (Born & Purcell, 2006).

An emerging area of concern and research is with respect to labour. Given there is an already existing shortage of labour in Canadian agriculture (CAHRC, 2016) questions are raised about how viable alternative agriculture could be (Woodhouse, 2010). Specific to employment, the labour gap as of 2014 is estimated at 59,200 people and expected to rise to 113,800 by 2025 (CAHRC, 2016). Furthermore, unlike conventional, labour-efficient, and intensively-mechanized forms of agriculture, a wide-scale shift to alternative agriculture could put further stress on this gap, creating an unsustainable demand for hands-on labour (Woodhouse, 2010).
Furthermore, this shift to alternative agriculture and greater demand for labour could present ethical concerns over social sustainability, as operators are already relying upon labour models such as internships or migrant labour programs to reduce cost of production (Ekers & Levkoe, 2016) and increase productivity (Braun, 2016). Studies (e.g., Ekers et al., 2015; Ekers & Levkoe, 2016) have questioned the sustainability of ecological farming in Ontario with respect to reliance upon non-waged labour, along with the exclusion of farm labour within topics of social equity and justice in organic standards (Shreck et al., 2006). This is particularly relevant with regards to horticultural production in Canadian agriculture, which already faces significant issues of labour shortages due to the seasonality and physicality of labourer positions, and higher than average amounts of migrant labourers to fill less desirable positions (CAHRC, 2016).

Given the claims regarding production with respect to labour (Braun, 2016; Shreck et al, 2016), it is important to assess how these factors vary in alternative agriculture to potentially optimize productivity through various means, and stress the importance of social justice and equity of farm labourers in alternative agriculture. Furthermore, while existing studies have demonstrated the need for greater amounts of labour in alternative agriculture (Brumfield et al., 2000; Nguyen & Haynes, 1995; Reganold et al., 2001), these studies are place-specific, and account for production in an economic sense, and do not engage in productivity in terms of a dietary-needs-based model or population requirements. Conversely, self-sufficiency studies that typically explore the localization of food systems with respect to land and amount of food production required for a given population claim the need for increased labour but have not quantified it (Desjardins, MacRae & Schumilas, 2010; Giombolini et al., 2011; MacRae et al., 2010). The potential for higher employment demands may mean higher input costs than what farm operators can manage, especially when compared to labour efficient conventional farms.
(Woodhouse, 2010). Therefore, while forms of alternative agriculture may present a source of employment, access to food, environmental and social benefits, as well as resource requirements in the form of labour, need to be considered and quantified to better understand different facets of sustainability.

1.1. Research aim and objectives

Based on existing and developing issues with respect to shortages and social sustainability, the aim of this study was to assess labour requirements and variability of production in alternative agriculture. This was operationalized in the form of the following question: "how much labour would be required to produce enough local, certified organic servings of fruit and vegetables to meet the daily dietary requirements for a mid-sized Canadian city?" In this case, 'local' was defined as within 100-miles of the city of Guelph, which is a typical Canadian community that has a population of approximately 131,790 people (Statistics Canada, 2016), is near to a major metropolitan region (Toronto) and is surrounded by good quality farm land. Two main objectives were determined in order to answer this question:

i. To determine how much labour local organic farms require to produce a single serving of local, certified organic produce, and use this to calculate how much labour would be required to meet the daily requirements for horticulture in the city of Guelph.

ii. To evaluate factors affecting productivity to explore how different operations may be more or less effective at meeting the needs of certified organic horticulture.

1.2. Thesis outline

This thesis is broken down into four subsequent chapters, in the following order: (2) a comprehensive literature review, (3) research methods, (4) a stand-alone manuscript, followed by (5) a summary of conclusions and contributions. The literature review provides a broad approach
to the state of agriculture with regards to describing modes of conventional production, its impacts, followed by outlining and defining aspects of alternative agriculture. The chapter concludes with a discussion of the primary focus of this study, labour in Canadian and alternative agriculture. Chapter three describes in detail, the parameters of this study, the methods of data collection and analysis, all with respect to achieving the aim and objectives addressed at the outset of the chapter. The chapter following this is a stand-alone manuscript containing its own introduction, summary of relevant literature, methods, results and conclusions, all tailored to submission requirements for the journal Agriculture and Human Values. The final chapter provides a more detailed summary of conclusions, contributions, limitations and areas for further investigation.

Three main conclusions evolved based on analysis as part of this research. Firstly, it was estimated that there is not enough available labour in certified organic horticulture, or agriculture generally, according to the area parameters, to meet the daily dietary requirements of fruits and vegetables for the city of Guelph. With that, a whole-system shift to certified organic horticulture to meet labour requirements and production demand is highly unrealistic on the basis of resource demands in terms of labour and farmer access to land and capital. These quantitative data were triangulated with interview data regarding issues of meeting labour demands and barriers to new farmers in certified organic agriculture. If the preliminary findings of this study reflect the reality of labour in certified organic or other forms of alternative agriculture, a wide-scale shift to forms of alternative agriculture could exacerbate an already unsustainable labour gap in Canadian agriculture.

The second finding was that there was a considerable level of variation in certified organic horticultural production based on quantitative variables such as cultivated area, crop
diversity, labour models, as well as qualitative factors such as worker experience, work ethic, and farmer philosophy. With that, the third conclusion was that there were some notable examples of high amounts of production that could provide insight into more efficient production but also present caveats. Firstly, high levels of productivity may be related to less labour-intensive crops, limiting biodiversity and of production. Furthermore, high levels of productivity through migrant labour combined with perceptions of declining domestic, Canadian farm labour, may increase the dependence upon that labour model, and put the sustainability of certified organic agriculture and horticulture, specifically, under further scrutiny, thus continuing to stress the need for inclusion of social justice for farm labourers in organic standards.

This study contributes a greater understanding of resource requirements in certified organic horticulture by expanding methods of existing literature on food systems localization to gauge labour requirements. Furthermore, these findings also contribute to a growing body of research on the criticisms of social justice and equity of farm labourers in certified organic agriculture by stressing that productivity in the area of horticulture is reliant on labour models such as non-waged internships or foreign workers. Given the preliminary findings and limitations based on sample size, and parameters imposed through this study, we suggest the need for expanding analysis spatially, temporally and to other methods of alternative agricultural production.
CHAPTER TWO – LITERATURE REVIEW

The following section outlines three main bodies of knowledge that will allow for a general understanding of the role of labour in local, alternative, agricultural production. Therefore, the following sections speak to: 1) the modern state of agriculture, 2) an argument for alternative food systems in response to conventional agriculture, and 3) labour in agriculture.

In order to understand the argument behind local and alternative agriculture, the predominant, conventional form of agricultural production must first be described. The final section, labour in agriculture, provides the most narrow scope with regards to this study, and provides relevant information which leads into the discussion of gaps as well as research design and methods.

1. The modern state of agriculture

In the modern context, agricultural production has been greatly influenced and defined by advancements made in the Industrial Revolution. In the North American context, from the World War II era, onward (Reynolds, Smith & Farmer, 2014), there has been a change systematically and philosophically towards industrialization, corporatization and productivity in agriculture (Keller & Brummer, 2002). This is characterized by large-scale, monoculture operations, global supply chains and synthetic inputs (Altieri & Nicholls, 2005). Through the technologies of the Industrial Revolution, natural ecosystems, human-nature interactions have been commodified and simplified (Keller & Brummer, 2002; Tilman, 1999). This philosophy is seen as problematic in that technological innovations may be giving a false sense of adaptability (Keller & Brummer, 2002). If any system is capable of such profound effects, it must be better understood, questioned and if necessary, changed. The following section will address how modern industrial agricultural practices became established norms, as well as the benefits and consequences thereof.
1.1. *Industrial as conventional agriculture*

There has been great productivity and technological advancement through the Industrial Revolution combined with the technological developments of the Green Revolution from the 1960's, onward (Godfray et al., 2010). The Green Revolution is characterized by the hybridization of high-yielding grains developed by Nobel Peace Prize-winner, Norman Borlaug, in an effort to combat food security and malnourishment worldwide (Tilman, 1999). This is seen as a major systematic shift in agriculture, and is characterized by high productivity, and large-scale mono-cropping systems dependent on mechanization and synthetic inputs (Leisinger, 1999; Tilman, 1999). The numerous lives that have been saved through the innovations of the Green Revolution cannot be understated, alongside other potential benefits (Leisinger, 1999). Some scholars claim (eg. Foley et al., 2011) that there has been less overall agricultural land use, globally, as a result of land intensification, as well as an increase in employment in the agricultural sector (Leisinger, 1999), though, in Canada this is disputed (eg. CAHRC, 2016; Statistics Canada, 2017h). Furthermore, higher yields through intensification have generally led to a decrease in food prices and alleviation of food insecurity (Leisinger, 1999).

With the world's population projected to grow to 9.5 billion by 2050 (UN 2015), it is estimated that food production will need to increase by at least 50% (The Royal Society, 2009) to meet demand. Some (Borlaug, 2000; Leisinger, 1999) argue innovation must continue in the direction of a new Green Revolution with more biotechnology and genetic modification at the forefront to improve pest and disease resistance, as well as nutrient uptake of crops. Leisinger (1999) notes that, in regards to these technological innovations, there could be detrimental effects but the benefits of alleviating poverty and future food insecurity would outweigh the consequences. Today, there is widespread distribution and growth of genetically-modified (GM) varieties of crops that are resistant to herbicides. While this has lead to improved yields, this has
also perpetuated herbicide use, in particular glyphosate, negatively affecting environmental health and leading to herbicide resistant weeds (Mortensen et al., 2012). Prior to the widespread production of glyphosate resistant crops, the herbicide's application was used more selectively alongside a greater diversity of weed control practices (Duke & Powles, 2009). Since then, it has been used almost exclusively and in greater frequency, creating favourable conditions for glyphosate resistant weeds (Duke & Powles, 2009). Furthermore, organic operations, whom are prohibited by standards to grow GM crops, are concerned with the rising threat of cross-pollination of these crops with theirs (Duke & Powles, 2009).

1.2. Criticisms of conventional agriculture

While scientific and technological innovations have contributed greatly to food security, there have been uneven benefits, and a focus purely towards production has led to significant social, environmental, and economic issues (Altieri & Nicholls, 2005; IAASTD, 2009). Rather than attempting to take away from the countless benefits of these technologies, the argument is based on the need to consider the complexity of environmental, social and economic impacts in the massive, necessary human endeavour of food production.

The technological and scientific innovations of conventional agricultural production have consequently given rise to "a highly simplified, disturbed and nutrient rich state" (Tilman, 1999, p.5995) as a result of large-scale, monoculture operations using fossil-fuel demanding mechanization and synthetic inputs (Reynolds, Smith & Farmer, 2014). This simplification has lead to unforeseen ecological and climate-related issues. With respect to the latter, conventional agriculture is a major contributor of greenhouse gas emissions whereby up to 30-50% (Foley et al., 2011; Ho, 2013; Tscharntke et al., 2012) of global emissions are tied to fossil fuel use through large-scale mechanization, synthetic inputs, land use change and global supply chains.
(Mundler & Rumpus, 2012; Wallgren & Höjer, 2009; Woodhouse, 2010). With such dependency on fossil fuels, there has also been great concern about the relation of food and fuel prices (OECD/FAO, 2015; Woodhouse, 2010). Food prices are also tied to the large amount of crops used as animal feed and biofuel, reducing the amount of land dedicated to edible crops (Foley et al., 2011; OECD/FAO, 2015; Tscharntke et al., 2012). Furthermore, the use of these fossil-fuel intensive technologies has lead to widespread issues, such as: soil contamination, loss of biodiversity, greenhouse gas emissions, soil compaction, excessive water use through irrigation, and nutrient loading through nitrogen and phosphorus-based fertilizers, thus further stressing the need for consideration of environmental impacts through our systems of food production (Green et al., 2005; Keller & Brummer, 2002; Pimental et al., 2005; Reynolds, Smith & Farmer, 2014; Tilman, 1999; Tscharntke et al., 2012; Woodhouse, 2010).

The argument that there should be a new Green Revolution to meet growing demand for food conflicts with claims that there is already more than enough food in the world to feed everyone adequately (Badgley et al., 2007; Smil, 2000). Furthermore, there is the case that reliance upon new technologies will intensify existing problems created through conventional agriculture (Altieri & Nicholls, 2005), and rates of productivity will level off by these means (Tilman, 1999; CAHRC, 2016). The highly successful productivity of the Green Revolution and conventional agriculture has allowed for sustaining large populations in terms of food supply (Borlaug, 2000). Although, as a result of favoring larger farms and more mechanization, this has forced many farmers off their land, into debt or out of work (Harwood, 2013; Rosset, 1999; Woodhouse, 2010). As farms have expanded and become more labour efficient through mechanization and other techniques, both Canada and Ontario have seen an overall decline in agricultural employment, operations and operators between 2011 to 2016 (Statistics Canada,
Alongside declining farm operators and labour, almost half of Canadian farm operators rely on off-farm income (Statistics Canada, 2017a) and there has also been a noticeable shift in employment from primary to secondary agricultural production (Statistics Canada, 2013). With that, conventional agriculture has led to profound effects with regards to socio-economic impacts in the form of dismantling rural communities and influencing the rate of urbanization (McGranahan & Tacoli, 2010).

The same form of conventional agriculture that has influenced urbanization, is also generally the system these heavily populated areas have come to depend upon. Worldwide, urban populations have exceeded rural populations (UN, 2014), leading to questions towards the consequences of employment, food security and food system reliance (Satterthwaite, McGranahan & Tacoli, 2010). Examples include a shift from primary to secondary agricultural production (i.e. processing) and a reliance on these type of products (Satterthwaite, McGranahan & Tacoli, 2010). There are environmental concerns to this dilemma as well, such as the competition for fertile land between agriculture and urban development (Satterthwaite, McGranahan & Tacoli, 2010, Zasada, 2011). Therefore, while conventional agriculture and innovations have had a significant impact on humanity's survival, the environmental and social sustainability of prevailing industrial agricultural methods are questionable, and fail to acknowledge the intertwining relationships of humanity and nature. Instead, there is gaining momentum towards a systematic shift, with a prioritization of local food systems and alternative methods of production over global supply chains and industrial agriculture.

2. An argument for alternative food systems in response to conventional agriculture

Spurred by research and consumer mistrust in conventional agricultural practices (Goodman, 2004) there has been a shift to, or re-emergence of, alternative agricultural systems
that would be considered counter-hegemonic to the globalized, industrial food system (DuPuis & Goodman, 2005) and more sustainable by accounting for, and abiding by, the limitations of growth and the Earth's resources (Reynolds, Smith & Farmer, 2014; Rockström et al., 2009). Where conventional farming has been criticized for lacking inclusivity and sustainability (Reynolds, Smith & Farmer, 2014), there is a push for a systematic shift to localized, alternative methods of production (DuPuis & Goodman, 2005; Reynolds, Smith & Farmer, 2014; Weis, 2010) in order to have a more sustainable food system, and consideration of environmental and social externalities of conventional agriculture (Ho, 2013; Tilman, 1999). The purpose of the following sections is to discuss the proposed benefits of, and barriers to, this shift in agricultural production by using two common examples of alternative agriculture: organic agriculture and food system localization.

2.1. Defining 'alternative' - organic agriculture

When applied to agriculture and food systems, the term "alternative" is both vague and ambiguous due to the many different methods and terms that have been applied to it. Some see alternative consumption as a shift away from the conventional towards a spectrum of methods of production (Altieri & Nicholls, 2005; Chapell & LaValle, 2001; Mount et al., 2013) and provision (Watts, Ilbery & Maye, 2005) that are equated with 'quality' (Goodman, 2004). Some of these methods, such as organic agriculture, have developed a form of certification and a labelling system for accountability and transparency. In Canada, certification of organic farming follows 2009 federal legislation according to the Organic Products Regulations of the Canada Organic Regime standards (Justice Laws, 2013). As of the 2016 Census of Agriculture, 2.2% of all farms in Canada were producing organic products, while Ontario was comparable at 1.7% of all agricultural operations (Statistics Canada, 2017b).
In terms of accountability, certification means only certain permitted substances are used for fertilizer, pest and weed control, reducing both environmental (Altieri & Nicholls, 2005) and public health impacts (Pimental et al., 2005). Alternative agriculture, such as organic, has been referenced as less fuel efficient than conventional through its reliance on mechanized tillage for weeding (Lynch, MacRae & Martin, 2011; Smith, Williams & Pearce, 2014). However, meta-analysis has shown that both vegetable and fruit organic production tends to be less energy intensive than conventional counterparts (Lynch, MacRae & Martin, 2011). This is largely due to the conventional agriculture's reliance on energy-intensive nitrogen fertilizer inputs. While energy efficiency is improving in nitrogen fixation for ammonia production, this production upon which conventional agriculture has come to depend on composed 1.1% of total global energy use as of 2008 (Dawson & Hilton, 2011). Therefore, a shift to this form of production may help address global environmental issues by reducing reliance on fossil fuels, synthetic inputs, and global freshwater use through improved soil health, biodiversity and water retention (Azadi et al., 2011; Mäder et al., 2002; Pimental et al., 2005).

As part of that turn to quality in alternative agriculture, there are major concerns that organic agriculture tends to be less focused on social sustainability compared to ecologically-driven values (Shreck et al., 2006), and that it may be equally as embedded in corporatized supply chains as conventional agriculture is (Altieri & Nicholls, 2005; Allen & Kovach, 2000; La Trobe & Acott, 2000). Therefore, it has been suggested that in the face of scaling-up and corporatization, organic agriculture can maintain its alternative ideologies of sustainability through social and political engagement with consumers through localization and decentralized supply chains (Goodman, 2000).
2.2. *Food system localization*

Much like a turn to organic methods in agriculture, many scholars and activists ascribe various benefits to localized food supply chains (Chapell & LaValle, 2011; Valchuis et al., 2015; Watts, Ilbery & Maye, 2005). Conventional agriculture and their associated globalized supply chains have been criticized for their association with corporatization (Watts, Ilbery & Maye, 2005), placelessness of culture and food (DuPuis & Goodman, 2005), and their potential vulnerability, affecting their efficiency and ability to provide adequate food supplies (Satterthwaite, McGranahan & Tacoli, 2010). Localization has thus emerged in contrast to these criticisms, as a means of embedding cultural and economic values through place (DuPuis & Goodman, 2005; Harris, 2009). Through localization, there are proposed benefits to local economies, communities and the environment (Chapell & LaValle, 2011; Ho, 2013; Rosset, 1999; Valchuis et al., 2015; Watts, Ilbery & Maye, 2005). Therefore, it may be extremely important to operate to some degree on a localized scale of food supply, not only for environmental values, but for food security, developing stronger communities and opportunities for employment.

Food system localization tends to be characterized by methods of direct marketing techniques including on-farm sales, farmers' markets or as community supported agriculture (Valchuis et al., 2015). By enabling this face-to-face interaction between producer and consumer, there are assumed social and communal benefits (DeLind, 2006), whereby consumers develop a form of food literacy as well as relationships with their local producers (La Trobe, 2001), while the farmer and community benefit economically (O'Hara & Pirog, 2013). Furthermore, by having strong local economies and societies, it is claimed there will also be a positive impact on national and global economies (Rosset, 1999).
Environmentally, local food production may have the greatest impact through reducing transportation costs and fossil fuel use (O'Hara & Pirog, 2013; Wallgren & Höjer, 2009). Local food systems activists argue for legitimacy of this point through studies of food miles and life cycle assessment to compare and contrast emissions of local versus globally-sourced products (Blanke & Burdick, 2005; Mundler & Rumpus, 2012). While certain studies have found that transport is still a greater producer of emissions than seasonal storage, others report that a larger-scale production is better in terms of energy efficiency (Blanke & Burdick, 2005; Schlich & Fleissner, 2005). These differences bring to light the relativity of scale in agricultural production, as well as the variation of how localization is assessed and understood.

As with alternative forms of production like organic agriculture, there is attention being paid to local consumerism in Canadian agri-food: in 2016, one in eight farms were involved in direct marketing (Statistics Canada, 2017a). Should this be an increasing trend, there may also be an increasing problem of local food system romanticization whereby the assumption that, because global supply chains and industrial agriculture are often implicated as one, the opposites of alternative and local systems are assumed to be inherently associated and counter-hegemonic (Born & Purcell, 2006). In reality, there is great variation in what is perceived as 'local', such as watershed-analogous foodsheds, literal distances, or a specific area boundary (Chambers et al., 2007; Desjardins, MacRae & Schumilas, 2010; Duram & Oberholtzer, 2010; Giombolini et al., 2011; Peters et al., 2008). Therefore, it is important to understand that scale and localization is a means, not an end (Born & Purcell, 2006), and what is 'local' must be defined in arguing the legitimacy of local food systems.
2.3. Barriers to alternative agriculture

With an increasing demand for food alongside a rapidly growing global population, a widespread shift to localized organic agriculture may be difficult because it would require systematic changes, resources and public support (Badgley et al., 2007). Should there be such a wide-scale land and food system reform, it is unknown how non-alternative producers would be incentivized to shift existing operations, and if that is even a possibility (Desjardins, MacRae & Schumilas, 2009; Satterthwaite, McGranahan & Tacoli, 2010). Furthermore, in favouring localized, alternative agriculture, there may be widespread economic, environmental, and social impacts by moving away from dependence on global supply chains and conventional agriculture (Giombolini et al., 2011; Leisinger, 1999). Criticisms of alternative agriculture often revolve around the argument that it is not economically sustainable, nor productive enough by comparison to conventional agriculture (Schaller, 1993).

A common argument against alternative agriculture is that it does not have the potential to meet the rising demand for food, worldwide (Schaller, 1993). In terms of productivity in alternative agriculture, there is conflicting evidence. While organic yields may be lower than conventional production (Pimental et al., 2005), the benefits of improved biodiversity, soil fertility and water retention (Azadi et al., 2011) could provide more long-term promise in terms of food security. Multiple analyses have assessed that yields in organic agriculture can vary from 5-40% lower than conventional, but it usually depends on the type of crop (Ponisio et al., 2015; Seufert, Ramankutty & Foley, 2012; Seufert & Ramankutty, 2017). Furthermore, despite lower yields in organic agriculture, there are claims that this yield gap may decrease through implementing techniques such as multi-cropping and crop rotations, as well as improving farmer knowledge and skills (Ponisio et al., 2015; Seufert, Ramankutty & Foley, 2012). Conversely, if there were to be a widespread shift to organic agriculture it would theoretically require large
amounts of expansion and land conversion, with the potential for greater environmental damage than what is already occurring (Green et al., 2005; Ponisio et al., 2005). As part of this, there is the debate between land sparing or land sharing, whereby sparing refers to a clear compartmentalizing and bordering between untouched nature and agricultural lands, while sharing involves an integration of nature into agricultural land, such as permaculture and agroecological techniques (Green et al., 2005). With regards to impact of agricultural land use, it is suggested that land intensification may be better environmentally, as opposed to expansion, and is better suited through land sparing (Green et al., 2005; Foley et al., 2011). Though, this debate is not so binary, rather operating on a spectrum where favouring one method over the other whether it be for environmental or productive benefits is highly context dependent (Benton et al., 2011; Tsharntke et al., 2012).

One of the major criticisms regarding localization of food systems is the idolization of "innately positive attributes" (Levkoe, 2011, p. 688) that have developed. Levkoe (2011) argues the act of knowing the location of food production fails to account for the political, social, environmental and economic implications of the definition. In championing one scale of food system over another, it is important to consider the actors and stakeholders involved in manipulating and defining it, so as to understand whom is benefitting (Born & Purcell, 2006). For example, labels such as “Made in...” as a definition of local could create a sense of nationalism or patriotism, while an area or distance marker includes and excludes different parties. In that sense, a strict designation of local may be more exclusive than inclusive, with imposed barriers in terms of affluence, culture or social status (Levkoe, 2011). Instead, adoption of "a more reflexive politics of localism" (DuPuis & Goodman, 2005, p.361) will expand beyond
the social interactions between producer and consumer, diversifying both the definition of local as well as the actors that are involved by being inclusive of class, gender and race.

Other major deterrents of local food production include the topics of price as well as food security with respect to spatial and temporal availability (Codyre, Fraser & Landman, 2015; Valchuis et al., 2015). Regarding food security, localized production may not be possible in areas with little to no growing seasons, or where soil is less fertile. Furthermore, sourcing locally may be limited with respect to points of sale, affecting consumer interest and demand (Bond & Feagan, 2012) and may incur greater fuel emissions depending on the amount of transport required at the consumer level (Coley, Howard & Winter, 2009; La Trobe & Acott, 2000). In this sense, a local food system cannot exist independently, and must rely on global supply chains and imports (Bellows & Hamm, 2001; Porkka et al., 2017). In terms of price, alternative agricultural products, especially those with label certifications (Wynen, 2002), are able to demand premiums that presents issues of access in a monetary sense (Levkoe, 2011). In assessing a variety of existing data, Bonti-Ankomah and Yiridoe (2006) suggest that consumer willingness to pay for certified organic products is dependent on many factors, including where the study took place and what type of product was being studied. Furthermore, there is increasing interest towards understanding access to alternative food products, and how their labelling and 'quality' are a limiting factor, where only a privileged few can monetarily access them (Goodman, 2004; Hodgins & Fraser, 2017).

The topic of agricultural labour arises alongside the notion of costs in alternative production. This is because alternative agricultural methods are typically more labour-intensive than their large-scale, conventional counterparts (Woodhouse, 2010). In order to be economically viable, smaller, sustainability-oriented farms may not be able to appropriately compensate
workers or must maintain potentially unfavourable price premiums (Shreck et al., 2006; Woodhouse, 2010). Ultimately, while it is predicted that organic premiums will drop as supply increases (IAASTD, 2009), thus potentially improving access, the issue of being able to sustain a productive labour force in alternative agriculture will persist.

3. Labour in agriculture

The following section is the final part of the literature review and provides a brief overview of labour in Canadian and alternative agriculture. Each sub-section will bring forth existing quantitative data on the aforementioned areas of focus along with existing research, commentary and questioning of socio-economic sustainability for Canadian and alternative agriculture.

3.1. Labour in Canadian agriculture

There are ongoing trends in Canadian agricultural labour that are of significant importance and partially a result of the proliferation of large-scale conventional agriculture. As of 2016, roughly 1.6% of all labour in Canada was part of the agricultural sector (Statistics Canada, 2017k). Between Census of Agriculture publications, farm employees (Statistics Canada, 2017h), operators and number of operations (Statistics Canada, 2017i) decreased in Canada and Ontario, while both total cropland and average size of farms increased (Statistics Canada, 2017ab). These values both indicate the proliferation of large-scale agriculture operations, and the effects they are having upon labour and farm ownership.

Labour in Canadian agriculture is currently subjected to a labour gap that is projected to widen to 113,800 people by 2025 (CAHRC, 2016). Alongside the issues of a growing labour gap in Canadian agriculture, there are factors such as the decline of non-waged family farm labour (Ekers & Levkoe, 2016), a rising median age (Statistics Canada, 2017a), and rise of other forms of labour. In lieu of the decline of non-waged family labour there has been a rise in paid labour
positions in Canadian agriculture. According to Ekers & Levkoe (2016), this shift to waged models of agricultural labour "stem in part from the consolidation and industrialization of agricultural operations, insofar as larger farms tend to require a higher number of paid employees compared to smaller operations" (p.181). Despite a shift in more year-round employment (Statistics Canada, 2017a), Canadian agriculture is still largely composed of seasonal and/or temporary employment, which, along with the physicality, makes agricultural labour hard to entice (CAHRC, 2016; Woodhouse, 2010) and positions remain unfilled.

As a result, a large portion of paid agricultural labour is migrant labour. In Canada, this is through the Seasonal Agricultural Worker Program (SAWP) or the agricultural stream of the Temporary Foreign Worker Program (TFWP) (Preibsich & Otero, 2014). Currently, over 10% of the total agricultural work force and over a quarter of the horticultural workforce is comprised of these foreign workers (CAHRC, 2016). Both the volume and alleged productivity (Braun, 2016) of migrant workers are vital characteristics they provide in solving issues in Canadian agricultural labour (CAHRC, 2016). With that, the ethical discussion of migrant labour has developed over time as well (Preibisch & Otero, 2014; Weiler, Levkoe & Young, 2016), whereby migrant workers are documented as having been subjected to dangerous, precarious and even abusive working conditions, as well as social isolation and little to no benefits. Therefore, alongside the quantitative issue of labour, there are also implications of qualitative issues of socio-economic and ethical concern with regards to farm labourers such as fair wages and on-farm living or working conditions (Levkoe & Ekers, 2017; Weiler, Levkoe & Young, 2016).

3.2. Labour in alternative agriculture

As with labour in Canadian agriculture, there has also been an increasing focus on labour in alternative agriculture. These inquiries have taken the form of comparing labour requirements
to resources required in conventional agriculture (Reganold et al., 2001; Wynen, 2003),
addressing different labour models (Braun, 2016; Ekers et al., 2015) as well as questioning
sustainability with respect to social justice and equitability (Levitte, 2010; Shreck et al., 2006;
Strochlic & Hamerschlag, 2005).

In discussing different systems and methods of agriculture, so too are there different
labour requirements. For example, alternative operations in general are less mechanized due to
aspects like higher crop diversity, little to no synthetic inputs, smaller total area, and thus require
more hands-on labour, meaning that where the prices of energy inputs are offset, such as reduced
inputs of ammonia fertilizer, the cost of labour increases (Woodhouse, 2010). The information
discussed has been mostly generalized to all sectors of agriculture, when in reality different
forms of production typically vary in amount of labour required (Wynen, 2003), with
horticultural labour often having the highest hands-on labour requirements (CAHRC, 2016).
Therefore, it remains to be seen if a switch to local, alternative production is feasible in terms of
labour requirements as it may be costly to the operator, especially for certain types of production.

From 2010 to 2016 in Ontario, the ratio of total operating costs after rebates across all
farms to farm receipts specific to fruit and vegetable production has decreased (Statistics Canada,
2017cd). While larger operations tend to be more profitable, and thus more likely to be able to
offer year-round, waged employment (Statistics Canada, 2017a), that may not be the case for
alternative agricultural operations that are typically smaller in size and may have lower total
income (Ekers & Levkoe, 2016), though price premiums on organic products can raise total
profits (Pimental et al., 2005). In a meta-analysis of organic crop production versus conventional,
it was found that organic premiums for crops were 32% higher than conventional equivalents,
compared to breakeven premiums estimated at 5%, suggesting high profitability of crop
production in organics (Crowder & Reganold, 2015). Within this same analysis, there was variability depending on type of production, and crop. Therefore, in combination with the need to reduce costs of production, low profit margins, and a decline in non-waged family labour, alternative operations have had to turn to other forms of labour.

Where waged labour has typically replaced non-waged family labour in conventional agriculture, other forms of labour have risen in place of it within alternative agriculture. For instance, Ekers and Levkoe (2016) calculate that 65% of workforces in Ontario on alternative operations rely on non-waged labour. One of those models is internships, which, similar to family labour are non-waged or underpaid, but are uniquely promoted as a learning experience and means to disseminate knowledge to ecologically-oriented, aspiring farmers (Ekers & Levkoe, 2016). In the same study, farming internships were mainly occurring in the alternative agricultural sector, by comparison, with an estimate of “several hundred ecological farms... offering non-waged internships” (Ekers & Levkoe, 2016, p.180) in Ontario, alone. Despite that there have been notable success stories of those involved also going on to establish their own operations, although, costs such as access to land remain a major hurdle (Ekers & Levkoe, 2016; Levkoe & Ekers, 2017). Within Canadian agriculture, new, young farmers tend to rent land, as the average price of land in Canada has increased by 38.8% since 2011 (Statistics Canada, 2017a). While there have been programs designed to help new farmers and provide land, there has been little support for them or they have since ceased operations (FarmStart, 2017).

As with other forms of agriculture, the alternative agriculture sector sources migrant or foreign labourers through SAWP and TFWP. With regards to dangerous working conditions, there is typically less exposure to harmful substances that would be used in conventional counterparts, but there are still substances used that can be harmful (Guthman, 2004), and the
physically-demanding hand labour remains and could be more prevalent as a result of lower mechanization and inputs. Furthermore, there is growing contention regarding the notion of the social aspects of sustainability in alternative agriculture (Weiler, Levkoe & Young, 2016) whereby a greater focus on environmental and ecological sustainability has overshadowed a lack of social justice in the alternative agricultural revolution, and documented issues with foreign worker programs and agricultural labourers have become focal points. Finally, as other studies have noted (Weiler, Levkoe & Young, 2016) the critiques mentioned here were done to demonstrate how these programs and arrangements have led to inequalities, not to berate farmers or slander the participants involved in this research.

3.3. **Socio-economic sustainability of alternative agriculture**

In terms of sustainability, forms of alternative agriculture, such as organics, are often referenced with respect to environmental standards, whereas social sustainability and justice is indirectly or outright ignored (Allen & Kovach, 2000). Similar criticisms include a lack of social justice and equity in local food systems are a result of "asymmetrical distributions of power, status or privilege" (Allen, 2010, p.304). Organic certification is allegedly not holistically sustainable or alternative (Brown & Getz, 2008) by having little to no inclusion of social justice and equitability with regards to the farm labourer (Guthman, 2004; Shreck et al., 2006; Strochlic & Hamerschlag, 2005). As of 2006, there was no consideration of the social aspects of sustainability and labour in organic standards (Shreck et al.), and the same is still true today of the Canadian organic standards. Today, the International Federation of Organic Agriculture Movements (IFOAM) makes note of the responsibility of organic principles in both social and environmental sustainability and health, however does not address the producer or labourer specifically (IFOAM, n.d.). Shreck et al. (2006), along with others (Strochlic & Hamerschlag,
2005; Marr, 2017), have suggested that fair wages, among other aspects of social justice, result in higher productivity. This is not just in reference to immediate productivity, but long-term retention of employees between off-seasons (Strochlic & Hamerschlag, 2005), thus reducing the cost of training and loss of productivity from less experienced workers, although it is unclear where this relationship of wages, productivity and profit begins (Ekers et al., 2015). Furthermore, it is not necessarily the direct fault of the farmer, and instead, Strochlic & Hamerschlag (2005) suggest that instead there are "economic constraints preventing growers from providing better labour conditions... [which] must be addressed by initiatives aimed at improving economic opportunities for farmers” (p.iii). Regardless, while leveraging costs of production by underpaying labourers may enable immediate competitiveness among a capitalist-based market (Ekers et al., 2015), the long-term sustainability of alternative agriculture could be simultaneously put at risk and the sustainability of these forms of agriculture is called into question.

**4. Gaps in existing research**

A major area of interest in an alternative food system is labour, with respect to requirements, reliance on different labour models as well as associated aspects of social justice and equity. The potential for higher employment may mean higher input costs than what smaller, alternative-oriented farms can manage, especially when compared to labour efficient conventional farms (Woodhouse, 2010). Furthermore, the sustainability of alternative agriculture has been put into question regarding non-waged labour practices and the ambiguity of organic standards, with respect to social justice and inclusivity of farm labourers (Ekers et al., 2015; Levkoe & Ekers, 2017; Shreck et al., 2006). Given the claims of a greater amount and different skills required in organic farming and that labour-intensive agriculture may be difficult to
support and entice, especially on a seasonal basis (Desjardins, MacRae & Schumilas, 2009; Pimental et al., 2005), a wide-spread shift to labour-demanding alternative agriculture could put further stress and exacerbate the existing gap in Canadian agriculture (CAHRC, 2016), thus calling into question the quantifiable aspects of sustainability in this type of agricultural production. Therefore, while local, organic agriculture may present a source for employment and access to food, it is also worth evaluating how much and what types of labour would be required by type of production.

In terms of existing research, claims of greater demands of hands-on labour in alternative agriculture (Woodhouse, 2010) have been confirmed by several studies (Brumfield et al., 2000; Nguyen & Haynes, 1995; Reganold et al., 2001). Despite these findings, there were limitations with respect to crop diversity (Reganold et al., 2001), in-situ production as opposed to research plots (Brumfield et al., 2000) as well as how labour was quantified (Nguyen & Haynes, 1995). Furthermore, other studies (Desjardins, MacRae & Schumilas, 2010; Giombolini et al., 2011; MacRae et al., 2010) have assessed land and quantity of food required to feed a given population through food systems localization, but have not addressed the amount of labour required. Therefore, these methods may complement one another in an attempt to expand spatial and temporal understanding of whole-farm production, meeting consumer dietary demands, as well as the types of labour, or total workforce required.
CHAPTER THREE – METHODOLOGY

The aim of this study was to assess labour and productivity in alternative agriculture. In order to do so, this was operationalized in the form of the following question: "how much labour would be required to produce enough local, certified organic servings of fruit and vegetables to meet the daily dietary requirements for a mid-sized Canadian city?" In this case, 'local' was defined as within 100-miles of the city of Guelph, which is a midsize Southern Ontario urban community that has a population of approximately 131,790 people (Statistics Canada, 2016), is near to a major metropolitan region (Toronto) and is surrounded by good quality farm land. Two main objectives were determined in order to answer this question:

i. To determine how much labour local organic farms require to produce a single serving of local, certified organic produce, and use this to calculate how much labour would be required to meet the daily requirements for horticulture in the city of Guelph.

ii. To evaluate factors affecting productivity to explore how different operations may be more or less effective at meeting the needs of certified organic horticulture.

In order to achieve this aim and the two associated objectives, three methods of data collection were used for this study:

(1) A diary-log was used as a means to collect quantitative data on yields, work hours and cultivated area over the course of the 2016 growing season. The implementation of a diary-log as a means to understand production over a given time period through self-reporting by participants draws on CoDyre et al. (2015) as an inspiration. Self-reporting was performed by certified organic horticultural farmers (n=10) and used in assessing labour requirements and productivity between participants.
(2) Three participating farmers were then selected for participant observation where the objective was to assess production through succession planting of leafy greens. Participants were selected on the basis that they partook in succession planting of greens and had different labour models from one another (e.g. internships and migrant labour).

(3) Semi-structured interviews from the diary-log participant pool (n=9) were employed which centred around questions of labour, new farmers and production in certified organic agriculture in a Canadian and Ontario context. Qualitative interview data were used to triangulate findings based on quantitative data from the above two methods. Semi-structured interviews have been widely used in research to gather qualitative data on perceptions of local and alternative food systems from farmers (Giombolini et al., 2011; Shreck et al., 2006). Interviews took place following the 2016 growing season (e.g. November 2016, onward), and were approximately 60 minutes in length.

The aim of this chapter is to provide an overview of methods in the following order: the study parameters, the characteristics of participants sampled, how data were collected, and how ethics were carried out for the project. The section concludes by discussing how data was analyzed to gain insight into labour requirements and variation in production in certified organic production of horticultural crops for human consumption.

1. **Research framework**

The following sub-section will describe the parameters upon which this study was based, including the terms used in representing local, alternative agriculture as well as providing designations by which participants were selected. First, "local" was represented by the popular 100-Mile Diet with the city of Guelph as the epicenter, while "alternative" was represented by certified organic, horticultural production. As a result, prospective participants were filtered
based on the following parameters: that they (1) held organic certification according to the Organic Products Regulations of the Canada Organic Regime standards, (2) produced horticultural products for human consumption, and (3) were within 100 miles of the city of Guelph. Guelph is a typical Canadian community that has a population of approximately 131,790 people (Statistics Canada, 2016), is near to a major metropolitan region (Toronto) and was selected on the basis of concentration of horticultural and certified organic agriculture with respect to the 100-mile parameter.

1.1. Defining local - study area

The area from which participants were drawn was within a 100-mile radius of the University of Guelph - 50 Stone Rd. E., Guelph, ON, N1G 2W1 (see figure 1). The rationale for this choice was the wide spread notoriety and popularity of the 100-Mile Diet (Smith & MacKinnon, 2007). The claims for local production and consumption are numerous, such as higher nutritional quality, strengthening of local economies and protection of the environment (Rose et al., 2008). The use of a 100-mile radius in this study was based on the lack of consensus on local, the popularity of the diet, as well as the simultaneous boundary definition of local (Rose et al., 2008), which allowed for a defined area of sampling from which participants could be selected from. While any location and associated population could have been used to orient the 100-mile diet, Guelph was used based on the significant interest in local and alternative sourcing of agricultural products, and the University of Guelph was selected as it is a well-known landmark and approximately centred within city boundaries. By comparison, there are currently at least 14 community supported agriculture shares servicing the city, which is proportionately more than the 12 and 9 servicing the nearby (and larger) cities of Kitchener and Hamilton, respectively (Ontario CSA Farm Directory, 2017). Furthermore, community groups and the
municipal government within Guelph have been actively pursuing the development of networks and forms of media promoting local and alternative agriculture initiatives, including local food maps (Taste Real, 2016).

It was also important to assess labour requirements within this designated area, given the concentration of agricultural activity with respect to Ontario, which, compared to other provinces, is projected to face a majority of labour shortages in agriculture (CAHRC, 2016). Furthermore, of the counties touched by this 100-mile radius, they contain approximately 70% of all 2016 census reporting farms in Ontario (Statistics Canada, 2017d). While this information suggests a large concentration of agricultural activity within this area, it may also present a limitation in that this study may not be representative of agricultural production in other parts of Ontario, or Canada, with regards to farm concentration or projected labour shortages.
1.2. Defining alternative - certified organic agriculture

As noted in the previous chapter, alternative is a broad and ambiguous term in relation to agriculture, as it includes elements such as biodynamic, agroecological, sustainable and organic farming (Chapell & LaValle, 2001; Mount et al., 2013). Therefore, while there are a range of methodologies involved in alternative food systems, for the sake of quantification, the option for certified organic production in Canada was selected as being representative of alternative agriculture food systems for this study. There were several reasons for this designation, for example, there is a great deal of existing data on organic farming in scholarly reports and through government censuses, certification signifies accountability and consistency in terms agricultural practice, and there are many publically-accessible directories available to find
While certified organic production has been argued as not alternative by possibly being situated in conventional supply chains (Altieri & Nicholls, 2005; Watts et al., 2005), it was rationalized, here, as alternative by partnering this more environmentally beneficial practice with an alternative network of distribution, with a localized focus on meeting dietary needs of consumers, as opposed to a purely economic productivist approach.

For this study, organic horticultural crops for human consumption were the focus of production. With regards to labour, horticulture was selected because of the challenges this form of production faces that includes low job security due to fluctuating seasonal labour requirements, dependence on foreign workers where Canadian recruitment is difficult, and negative perceptions of horticultural labour (CAHRC, 2016). Other rationales for this type of production includes: (1) produce tends to be the most common organic product purchased (COTA, 2016), (2) fruit and vegetables compose a large portion of recommended daily intake of food (Health Canada, 2007), and (3) in terms of prevalence, as of 2016 approximately 69% of all horticultural farms and 76% of those with organic certification in Ontario were in counties within or touched by this area designation (Statistics Canada, 2017de). The percentage of certified to claiming organic within this area is only about 1% different than across Canada, and the proportion remains approximately the same within Ontario (Statistics Canada, 2017e). Therefore, the designated area parameter used in this study is argued as being representative of certified organic production of horticultural products for human consumption at both the Ontarian and Canadian scale. Though, as mentioned in the previous sub-section, this designation may not be representative of other types of production associated with alternative in terms of methods involved or labour requirements, thus not providing a comprehensive understanding of labour
requirements. This will be discussed in greater detail in limitations and future considerations for research.

1.3. Population characteristics

Given these parameters, participants were selected if: 1) their operation held organic certification according to the Canadian Organic Regime standards (Justice Laws, 2013), 2) they produced horticultural products for human consumption, and 3) their operation was within 100 miles of the University of Guelph. In terms of the combined representation of area and method of production: as of 2016, there were 571 certified organic farms and approximately 198 reporting horticultural production in counties as part of the 100-mile parameter (Statistics Canada, 2017e). The means in which they were found were through both word-of-mouth as well as several databases, including: the Ecological Farmers of Ontario, Ontario Fresh and Eco-Cert.

1.3.1. Sample characteristics

In line with the above parameters, a total of 10 certified organic farm operators of an estimated pool of 198 farms agreed to participate in this study. In abiding with the ethics agreement for this study and participant anonymization, identifying factors such as age and gender as well as location of operation were either not recorded or were withheld, though a mix of all three factors are part of the data collection. In terms of the farms, operations ranged in size with 3 cultivated acres being the smallest while the largest had 120 acres of cultivated area. For comparison, the average acreage of fruits and vegetables, per operation as of 2016, in the designated study area was 13 and 32 acres, respectively (Statistics Canada, 2017fg). Similarly, crop diversity was recorded but not a limiting factor in participant selection. In terms of diversity of crops, some participants produced using monoculture methods, while others grew a wide variety of types of crops, such as greens, peppers, herbs, potatoes, and many fruits like berries and apples. Of this sample size of 10, some or all participated in each method of data collection.
For each of the following sub-sections detailing the methods of data collection, there will be descriptions of the parameters for participation.

2. Methods of data collection

2.1. Method 1: Developing a diary-log

A diary-log was employed in order to collect quantitative data from multiple participants, simultaneously, across a given time span. Some of the methodology for this format was inspired by CoDyre et al. (2015), who implemented a diary-log to gather data on how much time and money urban gardeners invested and compared this with harvests. The diary-log allowed for the collection of "tightly defined details about certain key activities" (Latham, 2010, p.192). Here, the types of data collected included the yields of fruits and vegetables and how much labour was required to produce them. Labour was tallied by participants as the amount of hours and workers involved on a task directly related to the production of these crops.

Selected participants were contacted initially by telephone for the purpose of describing the research project to them and to set up an in-person meeting at the farm itself, where the project was further described with regards to the participant's role, as well as provision of consent approval and the diary-log. Over the course of the growing season, the participants were contacted on a bi-weekly basis for the purpose of assessing progress of the diary-log. There was a general consensus among potential participants that they readily recorded this information already based on certification requirements. For this portion of the study, there were a total of 10 participants. The time span of recordings was the 2016 growing season in Ontario, which, given the area, varies between 125 and 170 days on average (OMAFRA, 2013). For an example of the diary-log used in this study, see appendix A.
2.2. **Method 2: Participant observation of labour and production through succession planting of leafy greens**

A second method of analysis was implemented as a means to gain a deeper understanding of production and labour in certified organic horticulture by studying the succession planting of leafy greens, which can include spinach, different lettuces, baby kale, and mustard greens. Three participants involved in diary-log participation were recruited for this method based on the parameters that they partook in succession planting of greens and also used different types of labour. The purpose of participant observation was to provide an alternative understanding of the variance of labour requirements and productivity on certified organic farms in Ontario under different types of labour.

Succession planting was chosen based on the short, repeatable time-spans in which different tasks of planting, cultivation and packing occurred for greens (i.e. a span of 2-3 weeks), thus allowing for repeat observations. Recordings were made across several visits to each participant's operation, but for the sake of consistency with regards to time of the season, visits were scheduled in close proximity to one another (generally, <10 days apart). Similar data to the diary-log (i.e. work hours, yields and cultivated area) were collected, but, observationally by the researcher. This has the additional benefit of correcting for possible biases in the diary-log data. In particular, there was concern that farmers could either over or under self-report labour and yields to appear more/less efficient. By having some data collected by the researcher it allowed for greater triangulation. Unlike the diary-log, labour was divided into to three main categories: planting, harvest, and packing. Area (acres) was recorded as well in order to calculate accurate rates across each of the tasks. These three tasks were chosen as they represented a majority of the labour (as time) involved in succession planting of greens, and were done according to a schedule. A task such as watering was not recorded as it was more passive, by comparison (i.e.
turn on water and leave it while other work was performed). Weeding was not recorded through participant observation as it was more sporadically performed and thus presents a significant limitation to this method.

2.3. Method 3: Semi-structured interviews

Semi-structured interviews with most of the participants of methods 1 & 2 were operationalized as a means of triangulating methods by gathering qualitative data on labour and production, and drawing on different perspectives as "an opportunity to explore the subjective values, beliefs and thoughts of the individual respondent" (Valentine, 2005, p.112). Interviewees were selected from those participating in the diary-log or participant observation, resulting in a total of 9 participants. When participants were first met to begin the diary-log method, they were also prompted with participation in a semi-structured interview, which would occur following the growing season. Interviews were not extended beyond the existing sample due to the fact that questions revolved around topics and data recorded according to the diary-log and participant observation. Interviews were recorded using a digital audio recorder and were typically around 60 minutes in length. For an example of the interview questions used in this study, see Appendix B.

2.4. Ethics, participant interaction and security

Prior to contact with participants the researcher and the project was first approved by the Research Ethics Board of the University of Guelph (REB # 16MR028). Participant engagement and use of data provided followed this protocol as a means of protecting identity, reducing risks to participants, as well as securing data. Furthermore, participants had the ongoing right to refuse participation and were offered consent forms prior to accepting participation in the diary-log, case-study or interview portions of the project. It is believed that the questions that the
participants were asked during the interview, and the data collected from the diary-logs carried minimal risk and that the participant would not feel uncomfortable in disclosing. Should the participant have wished to review any information they provided, they had the right to do so. For an example of the information letter and consent forms used in this study, see appendices D and E.

Upon transcription of audio files, they were deleted and transcripts were anonymized. Furthermore, all identifying information was removed in diary-log and participant observation data. All physical information was kept in a secure area, and electronic data was kept on a password-protected and encrypted personal device. All information was solely accessible by the researchers, and destroyed upon completion of research.

2.5. Disclosure of potential conflicts of interest

This research has been funded by the Social Science and Humanities Research Council Insight Grant in Solving the Global Food Crisis as well as the Canada Research Chair in Global Food Security under the supervisor, Dr. Evan Fraser.

While there were no financial relationships or compensation in terms of conflicts of interest as part of this study, the researcher (Bramberger) positioned himself as a volunteer in the participant observation method of analysis. While this may present bias in terms of data, it was reasoned that the participant's operation consistently welcomed volunteers to help in production. Therefore, the data collection accounted for aspects like teaching and learning in terms of assessing work hours.
3. Methods of data analysis

3.1. Specific Methods for Objective 1 - Quantitative analysis of labour requirements in local, certified organic horticulture

Following collection, data provided by participants from both the diary-log and participant observation had to be standardized in order to understand labour requirements and compare them to existing labour estimates within the same area parameter. Figure 2, below, is a visualization of the steps taken, after data collection, as part of this study with regards to quantitative analysis. This analysis allowed for the conversion of the yield and labour data into servings of food produced per person-hour of labour. Using this conversion factor and combining it with Canada Food Guide guidelines on recommended daily consumption, we were then able to calculate the amount of labour required to produce enough fruits and vegetables for the city of Guelph using organic farms within 100 miles and compare this with existing available work forces.

What follows is an in-depth description of each step of analysis: (1) the conversion of yields to servings, (2) serving requirements, and finally (3) labour requirements and available workforce estimates. For both objective 1 and 2, quantitative analysis was cross-referenced with qualitative data from semi-structured interviews. Following a discussion of all quantitative methods of data analysis, qualitative analysis will be described in detail. For an example of each calculation used for this objective, see appendix I.
**3.1.1. Yields to servings**

To convert yields to servings, an established guide and dietary recommendations had to be selected. For this study, servings were calculated according to Canada's Food Guide where a serving is 1 cup of leafy greens or 1/2 cup of other fruits and vegetables (Health Canada, 2007). Yields recorded in volume allowed for a direct conversion to cups then servings. If in weights, the equivalent of mass to volume was found using USDA's Nutrient Database (2016). Sometimes yields would be recorded in other units, like bunches. Solutions to this conversion included: participants providing their own calculation or estimate of what that would equal to, supermarket equivalents would be weighed, or online resources would be used. Some examples of these
resources included how many Brussels sprouts per stalk (Snyder, 2001), the average weight of kohlrabi (Babe Farms, 2016), or peas per bushel (USDA, 2015). Due to the diversity of production not necessarily matching with the range of available data, participants would also offer likeness equivalents. For example, it was suggested that lamb's quarters, a foraged green, would be similar to spinach. Should the provided crop yields be too diverse for the nutrient databases then the more general class would be used instead (i.e. lettuce instead of romaine, green leaf and butter).

3.1.2. Serving requirements
Once total work hours were calculated per participant, the objective was to develop an understanding of how much labour would be needed to meet the dietary requirements of the City of Guelph as part of localized, certified organic horticultural production. Canada's Food Guide suggests the daily requirement to be a range of 4-10 servings of fruit and vegetables depending on age and gender (2007). Combining serving requirements by age and gender with census data (Statistics Canada, 2016), the recommended daily intake of fruits and vegetables was estimated to be 1,106,973 servings daily for the city of Guelph, which, as of 2016, had a population of 131,790 (Statistics Canada). Given discrepancies between age groups in Canada's Food Guide and census data, age groups in the former were associated with closest age groups in the latter (ex. 2-3 in Canada's Food Guide was associated with 0-4 in Census data; then ages 4-8 associated with to 5-9). When there was a range of servings (i.e. 8-10 servings daily for males aged 19-50), the average was used in calculations.

3.1.3. Labour requirements and available workforce estimates
To develop an understanding of the required workforce based to produce enough servings for Guelph using local and certified organic farms, the following steps were taken:
1. Firstly, rates of servings/hour produced were calculated for each farm separately and aggregated to produce an average amount of production per labour hour.

2. This averaged value was then used to estimate the number of hours required to meet daily serving demands for an average individual.

3. Required workforces for meeting daily dietary demands of fruits and vegetables for the city of Guelph were calculated in conjunction with the mean length of work day in Ontario agriculture during the 2016 growing season. This value of 8.474 hours was used to produce a measure of person days of labour (Statistics Canada, 2017j).

4. Different amounts of labour required were calculated according to minimum, maximum, median and average rates of production from the diary-log and participant observation.

5. These values were then compared to estimates of the available labour within the study parameter's agricultural sector (Statistics Canada, 2017h).

6. The available labour based on study area was converted to estimate total labour dedicated to different sub-sectors of agriculture: horticultural production for human consumption, certified organic workforce, and horticultural production therein. These values were calculated on the assumption that labour amounts were proportional to reporting census farm operations by type of production (Statistics Canada, 2017de). For the 2016 Census of Agriculture, operations by types of production in organic agriculture were not recorded, however, they were in the previous census year. Therefore, proportional growth of certified organic operations in horticulture were estimated by percent change (+9.8%) of certified organic operations within the study area from 2011 to 2016 (Statistics Canada, 2017e).
3.2. Specific Methods for Objective 2 - Quantitative evaluation of factors affecting productivity on certified organic horticultural farm operations

Upon calculation and visualization of rates of production per participant, for both participant observation and diary-log, it quickly became clear that there was a significant amount of variance observed. Figure 3, below, is a visualization of the steps taken, after data collection, as part of this objective with regards to quantitative analysis. What follows is an in-depth description of each step of analysis in evaluating factors affecting productivity on certified organic horticultural farms. Following the discussion of all quantitative methods of data analysis, the qualitative analysis will be described in detail. For an example of formulas used in this objective, see appendix I.

Potential factors affecting production that were assessed were: cultivated area, types of labour, and diversity of production. All three of these calculations were based on claims of productivity being affected by size of farm (Rosset, 1999), efficacy of different types of labour (Braun, 2016; Shreck et al., 2006; Strochlic & Hamerschlag, 2005), as well as multi- and intercropping as a means to improved yields (Ponisio et al., 2014). Measurement of diversity was represented according to classes and subclasses of crops that were grown by each participant, over the course of diary-log data collection. These classes and sub-classes were determined according to the FAO (2005). Labour models were compared both as a higher-level comparison of waged versus non-waged, as well as more descriptively as intern, family, domestic waged and migrant labour. As this research was preliminary, no attempt was made to obtain representative farms, rather the goal was to provide a sense of whether different models of labour might influence productivity. For the higher-range comparison of waged versus non-waged production, a nonparametric statistical test (Wilcoxon Rank Sum test) was used due to the small sample sizes ($n_{waged}=5; n_{non-waged}=4$). Given that the average rate of production between diary-log and
participant observation data differed by an order of magnitude, z-score standardization was implemented to standardize productivity between labour forces when comparing and visualizing participant observation and diary-log data.

**Fig. 3 Flow chart of data analysis for objective 2** - evaluating factors affecting productivity on certified organic horticultural farm operations

### 3.3. Qualitative analysis of interview data

Due to the number of participants (n=9), transcripts were manually coded. Open and axial coding were performed to flesh out prominent themes within interviews, and provide qualitative, in-depth context to local and certified organic agriculture, as well as determine trends in these subjects (Cope, 2010). For results, each theme was described and documented as to how they were discussed by participants, along with provision of illustrative quotations. Therefore,
transcripts were analyzed for general opinions, positive or negative sentiment and self-reflection with regards to these topics and applied alongside the quantitative findings for both objectives.
CHAPTER FOUR – MANUSCRIPT

This chapter is a complete, stand-alone manuscript, including results and discussion. In accordance with department norms and standards, it has been prepared as a manuscript submission to the journal Agriculture and Human Values where it will be submitted after collaborative editing with the paper’s co-author, Dr. Evan Fraser.

UNDERSTANDING LABOUR AND PRODUCTION IN ALTERNATIVE AGRICULTURE: REQUIREMENTS, VARIABILITY AND PERCEPTIONS OF LABOUR ON CERTIFIED ORGANIC FARMS IN ONTARIO, CANADA

1. Introduction

Agriculture is the leading form of human land use globally, and a massive driver of change with regards to society, economy and the environment (Foley et al., 2011; Keller & Brummer, 2002). With the world's population estimated to grow to over nine billion by 2050, there is the concern of meeting the demand for food production alongside issues of environmental degradation, rising food prices and competition for land (Godfray et al., 2010). While scientific and technological innovations have made important contributions to food security (IAASTD, 2009; Reynolds, Smith & Farmer, 2014), a shift towards more sustainable methods (Godfray et al., 2010), such as localization and organic agriculture, have been suggested as a means of implementing environmentally and socially-beneficial practices while maintaining productive and economic viability (Pimental et al., 2005).

Furthermore, an emerging area of concern is with respect to labour. Put simply, many believe that local and organic agriculture needs more labour. Given there is an already existing shortage of labour in Canadian agriculture (2016), questions are raised about how viable alternative agriculture could be (Woodhouse, 2010). In other words, a proposed systemic shift to alternative agriculture could put further stress on this existing gap creating an unsustainable
demand for hands-on labour (Woodhouse, 2010). With these concerns, there are also ethical concerns over social sustainability with respect to certified organic agriculture, as operators are already relying upon labour models, such as internships or migrant labour programs, to reduce cost of production (Ekers & Levkoe, 2016) or increase productivity (Braun, 2016). This is particularly relevant with regards to horticultural production in Canadian agriculture, which already faces significant issues of labour shortages due to the seasonality and physicality of labourer positions, and relies on higher than average amounts of migrant labourers to fill less desirable positions (CAHRC, 2016). The existing and widening labour gap in Canadian agriculture is not explicit in addressing alternative agriculture, and given the higher requirements, this could call into question the quantifiable aspect of socio-economic sustainability in alternative agriculture.

Given the claims regarding production with respect to labour (Braun, 2016; Shreck et al, 2016), it is important to assess how these factors vary in alternative agriculture to potentially optimize productivity through various means, and stress the importance of social justice and equity of farm labourers in alternative agriculture. Furthermore, while existing studies have demonstrated the need for greater labour in alternatives like organic agriculture (Brumfield et al., 2000; Nguyen & Haynes, 1995; Reganold et al., 2001), these studies are place-specific, and account for production in terms of energy or economic demands, rather than engaging in consumer dietary demands. Conversely, self-sufficiency studies that typically explore the localization of food systems with respect to land and amount of food production required, claim the need for increased labour but have not directly quantified those demands (Desjardins, MacRae & Schumilas, 2010; Giombolini et al., 2011; MacRae et al., 2010). The potential for higher employment demands may mean higher input costs than what farm operators can manage,
especially when compared to labour efficient conventional farms (Woodhouse, 2010). Therefore, while this shift may present a source of employment and access to food, the types and amount of labour required by the sector must be considered.

In light of this gap, the aim of this study was to assess labour requirements and productivity in alternative agriculture. In order to do so, the overarching question this paper sets out to answer is: "how much labour would be required to produce enough local, certified organic servings of fruit and vegetables to meet the daily dietary requirements for a mid-sized Canadian city?" In this study, 'local' was defined as within 100-miles of the city of Guelph, which is a typical midsize Southern Ontario urban community that has a population of approximately 131,790 people (Statistics Canada, 2016), is near to a major metropolitan region (Toronto) and is surrounded by good quality farm land. Two main objectives were determined in order to answer this question:

i. To determine how much labour local organic farms require to produce a single serving of local, certified organic produce, and use this to calculate how much labour would be required to meet the daily requirements for horticulture in the city of Guelph.

ii. To evaluate factors affecting productivity to explore how different operations may be more or less effective at meeting the needs of certified organic horticulture.

2. Literature review

The following section outlines the main bodies of knowledge that will allow for a better understanding of the role of labour in local, alternative agricultural production. First, alternative agriculture will be discussed with regards to the proposed benefits of, and barriers to, this shift in agricultural production by using two common examples of alternative agriculture: organic agriculture and food system localization. Next, this paper will provide a brief overview of labour
in Canadian and alternative agriculture. Each sub-section will bring forth existing quantitative data on the aforementioned areas of focus along with existing research, commentary and questioning of socio-economic sustainability for Canadian and alternative agriculture.

2.1. Representations of ‘alternative’

Spurred by research and consumer mistrust in conventional agricultural practices (Goodman, 2004) alternative and local agriculture has re-emerged as a means to counter the, industrial food system (DuPuis & Goodman, 2005) through sustainable methods and abiding by the limitations of the Earth's resources (Reynolds, Smith & Farmer, 2014; Rockström et al., 2009). Some see the turn to alternative consumption as a shift away from the conventional towards a spectrum of methods of production (Altieri & Nicholls, 2005; Chapell & LaValle, 2001; Mount et al., 2013) and provision (Watts, Ilbery & Maye, 2005) that are equated with 'quality' (Goodman, 2004). Some of these methods, such as organic, have developed a form of certification and labelling system for accountability and transparency. In Canada, certification of organic farming follows 2009 federal legislation according to the Organic Products Regulations of the Canada Organic Regime standards (Justice Laws, 2013). As of the 2016 Census of Agriculture, 2.2% of all farms in Canada were producing organic products, while Ontario was comparable at 1.7% of all agricultural operations (Statistics Canada, 2017b). In terms of accountability, certification means only certain permitted substances are used for fertilizer, pest and weed control, reducing both environmental (Altieri & Nicholls, 2005) and public health impacts (Pimental et al., 2005).

As part of that turn to 'quality' in alternative agriculture, there are concerns that organic agriculture tends to be less focused on social justice compared to its ecologically-driven values (Shreck et al., 2006), and that it may be equally as embedded in corporatized supply chains as
conventional agriculture (Altieri & Nicholls, 2005; Allen & Kovach, 2000; La Trobe & Acott, 2000). Therefore, it has been suggested (Goodman, 2000) that in the face of scaling-up and corporatization, organic agriculture can maintain its connection to sustainability by engaging socially and politically with consumers through localization and decentralized supply chains.

In lieu of the placeless-ness of culture and food and corporatization associated with global supply chains and conventional agriculture (DuPuis & Goodman, 2005; Watts, Illbery & Maye, 2005), localization of food supply chains and production have emerged as a means of embedding cultural and economic values thereby benefitting local economies, communities and the environment (Chapell & LaValle, 2011; Harris, 2009; Ho, 2013; Rosset, 1999; Valchuis et al., 2015). Food system localization tends to be characterized by direct marketing techniques (Valchuis et al., 2015), enabling face-to-face interactions between producer and consumer, with assumed social and economic benefits to the producer, consumer and community (DeLind, 2006; La Trobe, 2001; O'Hara & Pirog, 2013). Furthermore, local food systems activists argue for environmental legitimacy through studies of food miles and life cycle assessment to compare and contrast emissions of local versus globally-sourced products (Blanke & Burdick, 2005; Mundler & Rumpus, 2012), though these benefits are dependent on type of production and other factors, like seasonal storage and volume transported.

As with other alternative forms of production, there is also a rise in popularity of local consumerism in agri-food: in 2016, one in eight Canadian farms were involved in direct marketing (Statistics Canada, 2017a). With the rise in popularity, so too is the problem of local food system romanticization (Born & Purcell, 2006) based on the assumption that, by being opposite to global supply chains and industrial agriculture, 'alternative' and 'local' are assumed to be inherently associated and counter-hegemonic. In reality, there is great variation in what is
perceived as 'local' (Chambers et al., 2007; Desjardins, MacRae & Schumilas, 2010; Duram & Oberholtzer, 2010; Giombolini et al., 2011; Peters et al., 2008). Therefore, it is important to understand that scale and localization is a means, not an end (Born & Purcell, 2006), and what is 'local' must be defined in arguing the legitimacy of local food systems.

2.1.1. Barriers to alternative agriculture

With an increasing demand for food alongside a rapidly growing global population, a widespread shift to localized, alternative agriculture may be difficult because it would require systematic changes as well as public support (Badgley et al., 2007). Furthermore, in favouring a localized, alternative agriculture, there may be significant economic, environmental and social impacts by moving away from dependence on global supply chains (Giombolini et al., 2011; Leisinger, 1999).

A common argument against alternative agriculture is that it does not have the potential to meet the rising demand for food, worldwide (Schaller, 1993). In terms of productivity in alternative agriculture, there is conflicting evidence. While organic yields may be lower than conventional production (Pimental et al., 2005), the benefits of improved biodiversity, soil fertility and water retention (Azadi et al., 2011) could provide more long-term promise in terms of food security. Multiple analyses have assessed that yields in organic agriculture can vary from 5-40% lower than conventional, but it usually depends on the type of crop (Ponisio et al., 2015; Seufert, Ramankutty & Foley, 2012; Seufert & Ramankutty, 2017). Furthermore, despite lower yields in organic agriculture, there are claims that this yield gap may decrease through implementing techniques such as multi-cropping and crop rotations, as well as improving farmer knowledge and skills (Ponisio et al., 2015; Seufert, Ramankutty & Foley, 2012). Conversely, if there were to be a widespread shift to organic agriculture it would theoretically require large amounts of expansion and land conversion, with the potential for greater environmental damage
than what is already occurring (Green et al., 2005; Ponisio et al., 2005). As part of this, there is the debate between land sparing or land sharing, whereby sparing refers to a clear compartmentalizing and bordering between untouched nature and agricultural lands, while sharing involves an integration of nature into agricultural land, such as permaculture and agroecological techniques (Green et al., 2005). With regards to impact of agricultural land use, it is suggested that land intensification may be better environmentally, as opposed to expansion, and is better suited through land sparing (Green et al., 2005; Foley et al., 2011). Though, this debate is not so binary, rather operating on a spectrum where favouring one method over the other whether it be for environmental or productive benefits is highly context dependent (Benton et al., 2011; Tsharntke et al., 2012).

One of the major criticisms regarding localization of food systems is the idolization of "innately positive attributes" (Levkoe, 2011, p. 688) that have developed. Levkoe (2011) notes that the act of knowing the location of food production fails to account for the political, social, environmental and economic implications of the definition. In championing one scale of food system over another, it is important to consider the actors and stakeholders involved in defining it (Born & Purcell, 2006), so as to understand whom it is benefitting. Other major deterrents to local food production includes food security with respect to accessibility through seasonality, distance and price (Codyre, Fraser & Landman, 2015; Valchuis et al., 2015). Sourcing through local food systems may be limited with respect to points of sale, affecting interest and demand (Bond & Feagan, 2012). Localization may also incur greater greenhouse gas emissions at the consumer level (Coley, Howard & Winter, 2009; La Trobe & Acott, 2000) and can be limited by area and seasonality. In this sense, a local food system cannot exist independently, and must rely on global supply chains and imports (Bellows & Hamm, 2001; Porkka et al., 2017). In terms of
economic barriers, alternative agricultural products, especially those with label certifications (Wynen, 2002), are able to demand premiums that presents another issue of access in a monetary sense (Levkoe, 2011).

The topic of agricultural labour arises alongside the notion of costs, especially with respect to alternative production, which are typically more labour-intensive than their large-scale, conventional counterparts (Woodhouse, 2010). In order to be economically viable, these farms may not be able to appropriately compensate workers or must maintain potentially unfavourable price premiums (Woodhouse, 2010). Ultimately, while it is predicted that premiums will decrease as supply increases (IAASTD, 2009), benefitting consumer accessibility, the issue of being able to sustain a productive labour force in alternative agriculture persists.

2.2. Labour in Canadian agriculture

There are ongoing trends in Canadian agricultural labour of significant importance that are partially a result of the proliferation of conventional agriculture. As of 2016, roughly 1.6% of all labour in Canada was part of the agricultural sector (Statistics Canada, 2017k). Between Census of Agriculture publications, farm employees, operators and number of operations decreased in Canada and Ontario, while total cropland and average size of farms increased (Statistics Canada, 2017abhi). These values both indicate the proliferation of large-scale agriculture operations, and the effects they are having upon labour and farm ownership.

Canadian agriculture is currently the subject of an existing and widening labour gap (CAHRC, 2016). As well, there are other existing trends, such as the decline of family labour (Ekers & Levkoe, 2016), a rising median age (Statistics Canada, 2017a), and rise of other forms of labour. In lieu of the decline of non-waged family labour, there has been a rise in paid positions in Canadian agriculture "in part from the consolidation and industrialization of
agricultural operations, insofar as larger farms tend to require a higher number of paid employees compared to smaller operations" (Ekers & Levkoe, 2016, p.181). Despite more year-round employment (Statistics Canada, 2017ah), Canadian agriculture is still largely composed of seasonal and/or temporary employment, which, along with the physicality, makes agricultural labour hard to promote (CAHRC, 2016; Woodhouse, 2010).

As a result, a large portion of paid agricultural labour is migrant labour. In Canada, this is through the Seasonal Agricultural Worker Program (SAWP) or the agricultural stream of the Temporary Foreign Worker Program (TFWP) (Preibsich & Otero, 2014). Currently, over 10% of the total agricultural work force and over a quarter of the horticultural workforce is comprised of these foreign workers (CAHRC, 2016). Both the volume and alleged productivity (Braun, 2016) of migrant workers are vital characteristics they provide in solving issues in Canadian agricultural labour with respect to reducing the widening labour gap (CAHRC, 2016). With that, the ethical discussion of migrant labourers has developed over time as well (Preibisch & Otero, 2014; Weiler, Levkoe & Young, 2016). Therefore, alongside the quantitative issue of labour, there are also implications of qualitative issues of socio-economic and ethical concern with regards to farm labourers such as fair wages and on-farm living or working conditions (Levkoe & Ekers, 2017; Weiler, Levkoe & Young, 2016).

2.3. *Labour in alternative agriculture*

There has also been an increasing focus on labour in alternative agriculture to address the different labour it employs (Braun, 2016; Ekers et al., 2015), and questioning sustainability with respect to social justice and equitability (Levitte, 2010; Shreck et al., 2006; Strochlic & Hamerschlag, 2005). In discussing different systems and methods of agriculture, so too are there different labour requirements. Alternative food systems, in general use fewer synthetic inputs
and require more labour (Pimental et al., 2005; Woodhouse, 2010). In comparing mechanization versus hands-on labour, there may not be that much difference in terms of costs (Pimental et al., 2005; Woodhouse, 2010). Furthermore, these arguments are generalized to all sectors of agriculture, when in reality different forms of production generally vary in amount of labour required (Wynen, 2003), with horticultural labour typically having the higher hands-on labour requirements (CAHRC, 2016). Therefore, it remains to be seen if a switch to local, alternative production is feasible in terms of labour requirements than the existing conventional format as it may be just as costly to the operator, along with the added difficulty of filling undesirable positions of employment with regards to physicality and monotony of tasks (CAHRC, 2016).

From 2010 to 2016 in Ontario, the ratio of total operating costs after rebates across all farms to farm receipts specific to fruit and vegetable production has decreased (Statistics Canada, 2017cd). While larger operations tend to be more profitable, and thus more likely to offer year-round, waged employment (Statistics Canada, 2017a), that may not be the case for alternative agricultural operations that are typically smaller in size and with lower total income (Ekers & Levkoe, 2016). Therefore, in combination with the need to reduce costs of production and a decline in non-waged family labour, there has been an increase in alternatives to paid labour in alternative agriculture.

Where waged labour has typically replaced the declining non-waged family labour model in conventional agriculture, other forms of labour have risen in place of it within alternative agriculture. By comparison with the previous subsection regarding the decline of non-waged family labour on farms, Ekers and Levkoe (2016) calculated that 65% of workforces on ecologically oriented (here: alternative) farms relied on non-waged labour, as of time of study. One of those models is internships, which, similar to family labour, are non-waged or underpaid,
but are uniquely promoted as a learning experience for ecologically-oriented, aspiring farmers (Ekers & Levkoe, 2016). In the same study (Ekers & Levkoe, 2016), farming internships were mainly occurring in the alternative agricultural sector, by comparison, with an estimate of “several hundred ecological farms... offering non-waged internships” (p.180) in Ontario, alone. Despite the low to no wage aspect of internships, there have been a few notable success stories of interns becoming farm operators in recent literature (Levkoe & Ekers, 2017), the costs such as access to land remain a major hurdle for most (Ekers & Levkoe, 2016). While there have been programs designed to help new farmers and provide land, there has been little support for them and many have since ceased operations (FarmStart, 2017).

As with other forms of agriculture, the alternative agriculture sector sources migrant or foreign labourers through SAWP and TFWP. With regards to similar ethical concerns expressed above, and the case of intern labour, there is growing consideration of the conflict with the social aspects of sustainability especially as it pertains to labour in alternative agriculture (Weiler, Levkoe & Young, 2016).

2.4. Socio-economic sustainability of alternative agriculture

In terms of sustainability, forms of alternative agriculture such as organics are referenced with respect to environmental standards, whereas social benefits are often claimed indirectly or outright ignored (Allen & Kovach, 2000). Similar criticisms include a lack of social justice and equity in local food systems as a result of "asymmetrical distributions of power, status or privilege" (Allen, 2010, p.304). Organic certification is allegedly not holistically sustainable or alternative (Brown & Getz, 2008) by having little to no inclusion of social justice and equitability with regards to the farm labourer (Guthman, 2004; Shreck et al., 2006; Strochlic & Hamerschlag, 2005). As of 2006, there was no consideration of these social issues in organic
standards (Shreck et al.), and the same is still true today of the Canadian organic standards. Today, the International Federation of Organic Agriculture Movements (IFAOAM) makes note of the responsibility of organic principles in both social and environmental sustainability and health, however does not address the producer or labourer specifically (IFAOAM, n.d.). Shreck et al. (2006), along with others (Strochlic & Hamerschlag, 2005; Marr, 2017), have suggested that fair wages, among other aspects of social justice result in a higher productivity as well as long-term retention of employees between off-seasons, thus reducing the cost of training and loss of productivity from less experienced workers, although it is unclear where this relationship of wages, productivity and profit begins (Ekers et al., 2015). Furthermore, it is not necessarily the direct fault of the farmer, and Strochlic & Hamerschlag (2005) suggest that instead there are "economic constraints preventing growers from providing better labour conditions... [which] must be addressed by initiatives aimed at improving economic opportunities for farmers” (p.iii). Regardless, while leveraging costs of production by underpaying labourers may enable immediate competitiveness among a capitalist-based market (Ekers et al., 2015), the long-term sustainability of alternative agriculture could be simultaneously put at risk and the sustainability of this 'more sustainable' form of agriculture is called into question.

3. Methodology

In order to understand the labour requirements of a local, alternative food system, the objectives of this paper are to: (1) determine how much labour would be required to meet the daily requirements for horticulture in the city of Guelph and (2) evaluate some of the factors affecting productivity in certified organic horticulture. To address these objectives, three data collection methods were used:
(1) A diary-log used as a means to collect quantitative data on yields, work hours and cultivated area over the course of the 2016 growing season. Implementing a diary-log as a means to understand production over a given time period through self-reporting by participants draws on CoDyre et al. (2015) as an inspiration. Self-reporting was performed by certified organic horticultural farmers (n=10) and used in assessing labour requirements and productivity between participants.

(2) Three participating farmers were then selected for participant observation where the objective was to assess production through succession planting of leafy greens. Participants were selected on the basis that they partook in succession planting of greens and had different labour models from one another (e.g. internships and migrant labour).

(3) Semi-structured interviews from the diary-log participant pool (n=9) centred around questions of labour, new farmers and production in certified organic agriculture in a Canadian and Ontario context. Qualitative interview data was used to triangulate quantitative findings from the above two methods. Semi-structured interviews have been widely used in research to gather qualitative data on perceptions of local and alternative food systems from farmers (Giombolini et al., 2011; Shreck et al., 2006). Interviews took place following the 2016 growing season (e.g. November 2016, onward), and were approximately 60 minutes in length.

3.1. Research framework

The following sub-section will describe the parameters upon which this study was based, including the terms used in representing local, alternative agriculture as well as providing designations by which participants were selected. First, "local" will be represented by the popular 100-Mile Diet with the city of Guelph as the epicenter, while "alternative" will be represented by
certified organic, horticultural production. As a result, prospective participants were filtered based on the following parameters: that they (1) held organic certification according to the Organic Products Regulations of the Canada Organic Regime standards, (2) produced horticultural products for human consumption, and (3) were within 100 miles of the city of Guelph. Guelph is a typical Canadian community that has a population of approximately 131,790 people (Statistics Canada, 2016), is near to a major metropolitan region (Toronto) and was selected on the basis of concentration of horticultural agriculture with respect to the 100-mile parameter.

3.1.1. Defining 'local' - study area
The area from which participants were drawn was within a 100-mile radius of the University of Guelph - 50 Stone Rd. E., Guelph, ON, N1G 2W1 (see figure 4). The rationale for this choice was widespread notoriety in the popularity of the 100-Mile Diet (Smith & MacKinnon, 2007). The claims for local production and consumption are numerous, such as higher nutritional quality, strengthening of local economies and protection of the environment (Rose et al., 2008). The use of a 100-mile radius in this study is based in lack of consensus on local, the popularity of the diet, as well as the simultaneous boundary definition of local (Rose et al., 2008), which allows for a defined area of sampling from which participants can be selected from. While any location and associated population could be used to orient the 100-mile diet, Guelph was used based on the significant interest in local and alternative sourcing of agricultural products, as well, the University of Guelph was selected as a point of reference as it is an established landmark and approximately centred within city boundaries. For instance, there are currently at least 14 community supported agriculture shares servicing the city, which is more than the 12 and 9 servicing the nearby (and larger) cities of Kitchener and Hamilton, respectively (Ontario CSA Farm Directory, 2017). Furthermore, community groups and the municipal
government within Guelph are also actively pursuing the development of networks and forms of media promoting local and alternative agriculture initiatives, including local food maps (Taste Real, 2016).

It could also be very important to assess labour requirements in this area parameter, given the concentration of agricultural activity with respect to Ontario, which is projected to face a majority of labour shortages in agriculture compared to most other provinces (CAHRC, 2016). Of the counties touched by the 100-mile radius from Guelph, they contain approximately 70% of all 2016 census reporting farms in Ontario (Statistics Canada, 2017d). While this information suggests a large concentration of agricultural activity within this area, it may also present a limitation in that this study may not be representative of agricultural production in other parts of Ontario, or Canada, with regards to farm concentration or projected labour shortages.
Fig. 4 Study Area - 100-Mile radius surrounding the University of Guelph which will be used as the definition of a local food system for this study

3.1.2. Defining Alternative - certified organic agriculture
While there is a range of forms of alternative agriculture, certified organic production in Canada was selected for this study. The reasoning behind this designation is that there is a great deal of existing data on organic farming in scholarly reports and through government censuses, certification signifies accountability and consistency in terms of agricultural practice, and there are many publically-accessible directories available to find organic certified farms in Ontario. While certified organic production has been argued as not alternative by possibly being situated in conventional supply chains (Altieri & Nicholls, 2005; Watts et al., 2005), it is rationalized, here, as alternative by partnering this more environmentally beneficial practice with an
alternative network of distribution, with a localized focus on meeting dietary needs of consumers, as opposed to a purely economic productivist approach.

For this study, organic horticultural crops for human consumption were the focus of production. With regards to labour, horticulture was selected because of the challenges this form of production faces that includes low job security due to fluctuating seasonal labour requirements, dependence on foreign workers where Canadian recruitment is difficult, and negative perceptions of horticultural labour (CAHRC, 2016). Other rationale for this type of production, with respect to parameters, includes: (1) produce tends to be the most common organic product purchased (COTA, 2016), (2) fruits and vegetables compose a large portion of recommended daily intake of food (Health Canada, 2007), and (3) in terms of prevalence, as of 2016, approximately 69% of all horticultural farms and 76% of those with organic certification in Ontario are in counties within or touched by this area designation (Statistics Canada, 2017de). The percentage of 'certified' to 'claiming' organic within this area is only about 1% different than across Canada, and the proportion remains approximately the same within Ontario (Statistics Canada, 2017e). Therefore, the designated area parameters used in this study is argued as being representative of certified organic production of horticultural products for human consumption at both the Ontarian and Canadian scale. Though, as similarly mentioned in the previous subsection, this designation may not be representative of other types of alternative and organic production, such as methods involved or labour requirements, therefore not providing a comprehensive understanding of labour requirements. This will be discussed in greater detail in limitations and future considerations for research.
3.1.3. Population characteristics
Given these parameters, participants were selected if: 1) their operation held organic certification according to the Canadian Organic Regime standards, 2) they produced horticultural products for human consumption, and 3) their operation was within 100 miles of the city of Guelph. In terms of the combined representation of area and method of production: as of 2016, there were 571 certified organic farms and approximately 198 reporting horticultural production in counties as part of the 100-mile parameter (Statistics Canada, 2017e). The means in which they were found were through both word-of-mouth as well as several databases, including: the Ecological Farmers of Ontario, Ontario Fresh and Eco-Cert.

3.1.4. Sample characteristics
In line with the above parameters, a total of 10 certified organic horticultural operators of an estimated total of 198 operations agreed to participate in this study. In abiding with the ethics agreement for this study and participant anonymization, identifying factors such as age and gender as well as location of operation were either not recorded or were withheld. In terms of the farms, operations ranged in size with the smallest having 3 cultivated acres while the largest had 120 acres. By comparison, average acreage of fruits and vegetables per operation within counties as part of this 100-mile designation were 13 and 32 acres, respectively (Statistics Canada, 2017fg). Similarly, crop diversity was recorded but not a limiting factor in participant selection. In terms of diversity of crops, some participants produced using monoculture methods, while others grew a wide variety of types of crops, such as greens, peppers, herbs, potatoes, and many fruits like berries and apples. Of this sample size of 10, some or all participated in each method of data collection. For each of the following sub-sections detailing the methods of data collection, there will be further detail of the parameters for participation.
3.2. Methods of data collection

3.2.1. Method 1: Developing a diary-log

All 10 farmers collected data throughout the 2016 growing season on how much labour went into production as well as data on how much food they produced. The types of data collected using a diary-log included the yields of fruits and vegetables and how much labour was required to produce them. Yields were recorded in a variety of units (e.g. weights, bunches, volumetrically), and were subsequently converted to servings (the method used to convert yields into servings will be discussed in the data analysis section). Labour was recorded as the amount of hours and workers spent on a task directly related to the production of these crops. For an example of the diary-log, see appendix A.

Selected participants were contacted initially by telephone for the purpose of describing the research project to them and to set up an in-person meeting at the farm itself, where the project was further described with regards to the participant's role, as well as provision of consent approval and the diary-log. Over the course of the growing season, the participants were contacted on a bi-weekly basis for the purpose of assessing progress of the diary-log.

3.2.2. Method 2: Participant observation of labour and production through succession planting of leafy greens

A secondary method of analysis was implemented as a means to gain a deeper understanding of production and labour in certified organic horticulture by studying the succession planting of leafy greens, which can include spinach, different lettuces, baby kale, and mustard greens. Three participants involved in diary-log participation were recruited for this method of analysis based on the parameters that they partook in succession planting of greens and also had used different types of labour (e.g. unpaid internships, domestic waged labour, and migrant labour). The purpose of participant observation was to provide an alternative
understanding of the variance of labour requirements and productivity on certified organic farms in Ontario under different types of labour.

Succession planting was chosen based on the short, repeatable time-spans in which different tasks of planting, cultivation and packing occurred for greens (i.e. a span of 2-3 weeks), thus allowing for repeat observations. Recordings were made across several visits to each participant's operation, but for the sake of consistency with regards to time of the season, visits were scheduled in close proximity to one another (generally, <10 days apart). Similar data to the diary-log were collected, but, observationally by the researcher. This has the additional benefit of correcting for possible biases in the diary-log data. In particular, there was concern that farmers could either over or under self-report labour and yields in an effort to appear more/less efficient. By having some data collected by the researcher, it allowed for greater triangulation.

Furthermore, and unlike the diary-log, labour was divided into three main categories: planting, harvest, and packing. Area (acres) was recorded as well in order to calculate accurate rates across each of the tasks. These three tasks were chosen as they represented a majority of the labour involved in succession planting of greens, and were done according to a schedule. A task such as watering was not recorded as it was more passive, by comparison (i.e. turn on water and leave it, while other work was performed). Weeding was not recorded through participant observation as it was more sporadically performed and thus presents a significant limitation to this method.

3.2.3. **Method 3: Semi-structured interviews**

Semi-structured interviews with most of the participants of methods 1 and 2 were operationalized as a means of triangulating methods by gathering qualitative data on labour and production, and drawing on different perspectives as "an opportunity to explore the subjective values, beliefs and thoughts of the individual respondent" (Valentine, 2005, p.112). Interviewees
(n=9) were selected from those participating in the diary-log or participant observation. When I first met with participants to begin the diary-log method, they were also asked to participate in a semi-structured interview following the growing season. Interviews were not extended beyond the existing sample due to the fact that questions revolved around topics and data recorded according to the diary-log and participant observation. Interviews were recorded using a digital audio recorder and were typically around 60 minutes in length. For an example of the interview questions used in this study, see appendix B.

3.3. Specific Methods for Objective 1 - Quantitative analysis of labour requirements in local, certified organic horticulture

Following collection, data provided by participants from both the diary-log and participant observation had to be standardized in order to understand labour requirements and compare them to existing labour estimates within the same area parameter. Figure 5, below, is a visualization of the steps taken, after data collection, as part of this study with regards to quantitative analysis. This analysis allowed for the conversion of the yield and labour data into servings of food produced per person-hour of labour. Using this conversion factor, we were then able to calculate the amount of labour required to produce enough fruits and vegetables for the city of Guelph using organic farms within 100 miles and compare this with existing available work forces. For more information on formulas used in calculations, see appendix I.

What follows is an in-depth description of each step of analysis: (1) the conversion of yields to servings, (2) serving requirements, and finally, (3) labour requirements and available workforce estimates. For both objective 1 and 2, quantitative analysis was cross-referenced with qualitative data from semi-structured interviews. Following a discussion of all quantitative methods of data analysis, qualitative analysis will be described in detail.
3.3.1. **Yields to servings**

To convert yields to servings, an established guide and dietary recommendations had to be selected. For this study, servings were calculated according to Canada's Food Guide where a serving is 1 cup of leafy greens or 1/2 cup of other fruits and vegetables (Health Canada, 2007). Yields recorded in volume allowed for a direct conversion to cups then servings. If in weights, the equivalent of mass to volume was found using USDA's Nutrient Database (2016). Sometimes yields would be recorded in other units, like bunches. Solutions to this conversion included: participants providing their own calculation or estimates of what that would equal to, weighing supermarket equivalents, or using online resources as reference. Some examples of resources and
measurements used include how many Brussels sprouts per stalk (Snyder, 2001), the average weight of kohlrabi (Babe Farms, 2016), or peas per bushel (USDA, 2015). Due to the diversity of production not necessarily matching with the range of available data, participants would also offer likeness equivalents. For example, it was suggested that lamb's quarters, a foraged green, would be similar to spinach. Should the provided crop yields be too diverse for the nutrient databases then the more general class would be used instead (i.e. lettuce instead of romaine, green leaf and butter).

3.3.2. Serving requirements
Once total work hours were calculated per participant, the objective was to develop an understanding of how much labour would be needed to meet the dietary requirements of the City of Guelph as part of a localized, certified organic food system. Canada's Food Guide suggests the daily requirement to be a range of 4-10 servings of fruit and vegetables depending on age and gender (2007). Combining serving requirements by age and gender with census data (Statistics Canada, 2016), the recommended daily intake of fruits and vegetables was estimated to be 1,106,973 servings daily for the city of Guelph, which, at the time the research was conducted had a census population of 131,790 (Statistics Canada, 2016). Given discrepancies between age groups in Canada's Food Guide and census data, age groups in the former were associated with closest age groups in the latter (ex. 2-3 in Canada's Food Guide was associated with 0-4 in Census data; then ages 4-8 associated with to 5-9). When there was a range of servings (i.e. 8-10 servings daily for males aged 19-50), the average was used in calculations.

3.3.3. Labour requirements and available workforce estimates
To develop an understanding of the required workforce based to produce enough servings for Guelph using local and certified organic farms, the following steps were taken:
1. Firstly, rates of servings/hour produced were calculated for each farm separately and aggregated to produce an average amount of production per labour hour.

2. This averaged value was then used to estimate the number of hours required to meet daily serving demands for an average individual.

3. Required workforces for meeting daily dietary demands of fruits and vegetables for the city of Guelph were calculated in conjunction with the mean length of work day in Ontario agriculture during the 2016 growing season. This value of 8.474 hours was used to produce a measure of person days of labour (Statistics Canada, 2017j).

4. Different amounts of labour required were calculated according to minimum, maximum, median and average rates of production from the diary-log and participant observation.

5. These values were then compared to estimates of the available labour within the study parameter's agricultural sector (Statistics Canada, 2017h).

6. The available labour based on study area was converted to estimate total labour dedicated to different sub-sectors of agriculture: horticultural production for human consumption, certified organic workforce, and horticultural production therein. These values were calculated on the assumption that labour amounts were proportional to reporting census farm operations by type of production (Statistics Canada, 2017de). For the 2016 Census of Agriculture, operations by types of production in organic agriculture were not recorded, however, they were in the previous census year. Therefore, proportional growth of certified organic operations in horticulture were estimated by percent change (+9.8%) of certified organic operations within the study area from 2011 to 2016 (Statistics Canada, 2017e).
3.4. *Specific Methods for Objective 2 - Quantitative evaluation of factors affecting productivity on certified organic horticultural farm operations*

Upon calculation and visualization of rates of production per participant, for both the participant observation and diary-log, it quickly became clear that there was a significant amount of variance observed. Figure 6, below, is a visualization of the steps taken, after data collection, as part of this objective with regards to quantitative analysis. What follows is an in-depth description of each step of analysis in evaluating factors affecting productivity on certified organic horticultural farms. Following the discussion of all quantitative methods of data analysis, the qualitative analysis will be described in detail.

Potential factors affecting production that were assessed were cultivated area, types of labour, and diversity of production. All three of these calculations were based on claims of productivity being affected by size of farm (Rosset, 1999), efficacy of different types of labour (Braun, 2016; Shreck et al., 2006; Strochlic & Hamerschlag, 2005), as well as multi- and intercropping as a means to improved yields (Ponisio et al., 2014). Measurement of diversity was represented according to classes and subclasses of crops that were grown by each participant, over the course of diary-log data collection. These classes and sub-classes were determined according to the FAO (2005). Labour models were compared both as a higher-level comparison of waged versus non-waged, as well as more descriptively as intern, family, domestic waged and migrant labour. As this research was preliminary, no attempt was made to obtain representative farms, rather the goal was to provide a sense of whether different models of labour might influence productivity. For the higher-range comparison of waged versus non-waged production, a nonparametric statistical test (Wilcoxon Rank Sum test) was used due to the small sample sizes \( n_{\text{waged}}=5; n_{\text{non-waged}}=4 \). Given that the average rate of production between diary-log and participant observation data differed by an order of magnitude, \( z \)-score standardization was
implemented to standardize productivity between labour forces when comparing participant observation and diary-log data.

Fig. 6 Flow chart of data analysis for objective 2 - evaluating factors affecting productivity on certified organic horticultural farm operations

3.5. Qualitative analysis of interview data

Due to the number of participants (n=9), transcripts were manually coded. Open and axial coding were performed to flesh out prominent themes within interviews, and provide qualitative, in-depth context to local and certified organic agriculture, as well as determine trends in these subjects (Cope, 2010). For results, each theme was described and documented as to how they were discussed by participants, along with provision of illustrative quotations. Therefore,
transcripts were analyzed for general opinions, positive or negative sentiment and self-reflection with regards to these topics and applied alongside the quantitative findings for both objectives.

4. Results

The results follow the structure with regards to the previously addressed objectives in assessing the labour requirements in local, alternative agricultural production: 1) analysis of labour requirements in local, certified organic horticulture to meet the dietary requirements for fruits and vegetables for the city of Guelph then 2) evaluating factors affecting production in certified organic production of fruits and vegetables. For quantitative data from both diary-log and participant observation data collection as well as formulas used in calculations, see appendices E through I.

4.1. Objective 1 - Analysis of labour requirements in local, certified organic horticulture

4.1.1. Quantitative results

To provide an indication of the potential labour requirements that would be needed for local, certified organic horticulture, we present the maximum, minimum and average range of values from both the diary-log and participant observation alongside estimated available work forces, by sector, within the study area (see figure 7, below). For more detail of workforces calculated from study date, estimated available labour, and formulas see appendices G through I.

According to available census data on farm labour and derived estimated labour by sub-sector, there was a total of 59422 workers within identified counties at the time of the study, leading to estimates of 4373 workers in horticultural, 975 workers in certified organic and 338 workers in certified organic horticulture. Based on aggregated diary-log data, on average, respondents produced 91 servings of horticultural products per hour. Extrapolating-up, this means that if all of Guelph were to obtain horticultural products from such operations, there would have to be 1429 full time workers employed by the sector, within 100 miles of the city.
The participant observation uncovered similar results where the existing labour in certified organic horticulture could not meet the labour required through the average rate of production (1258 servings/hour; 510 workers). However, the findings demonstrated a higher degree of meeting labour demands should the existing workforce be producing leafy greens through succession planting at the highest rate of production (2584 servings/hour; 51 workers). By comparison, there is 66% the amount of available certified organic horticultural labour than required by the average rate of production from participant observation data.

Furthermore, when comparing available to estimations of required workers, it was found that there is not enough existing certified organic horticultural labour within the designated area parameter, as of 2016, to meet the daily dietary demands of fruits and vegetables for the city of Guelph on a daily basis, even if producing at the highest rate of production calculated (324 servings/hour; 403 workers). Looking at other estimates of available labour, there is theoretically not enough horticultural (4373 workers) or certified organic (975 workers) labour to match the number of workers required according to the lowest rate of production (17 servings/hour; 7567 workers) from the diary-log production data.

Overall, therefore, these data suggest a huge variability in the productivity and efficiencies of this sector. This variability is highlighted when we examine specific farms within each group. Of the 10 farmers that filled in the diary, the participant that observed the highest rate of production was 19 times greater than the least productive farm. Although the cause of this variation might be because farmers may have filled in the diary logs differently. The participant observation method, where all the data were collected by the researcher, produced a similar order of magnitude in terms of variance. Therefore, these preliminary results suggest that while it seems likely that a local, certified organic food system may require more labour than there is
Currently employed by the sector, there are individual farms that produce food with enough labour efficiencies that if their approach were used, it should be possible to produce enough local and organic food without radically re-shaping the labour market.
Fig. 7 Comparison of estimated available to required workforces - Estimates of available total, horticultural, certified organic and certified organic horticultural labour were compared to workforces required to meet the daily dietary demands of fruits and vegetables for the city of Guelph through certified organic production. Required workforces were calculated based on the min, max, median and mean rates of production (servings/hour) according to diary-log and case-study data. The max, min and quartiles here are therefore the reverse of servings/hour, for example, where the minimum servings/hour is the maximum labour requirement. Estimated available workforces were calculated based on the average work day in Ontarian agriculture during the 2016 growing season (Statistics Canada, 2017j)
4.1.2. Reflections on labour requirements

Overall, qualitative interviews identified two major themes, each of which was made up of three sub-themes. First, interviewees discussed the theme of meeting labour demands by focusing on: 1) accountability, 2) perceptions of agricultural labour, and 3) the decline in agricultural employment. Second, interviewees discussed challenges faced by new farmers by focusing on: 1) access to land, 2) access to capital, and 3) institutional support. Findings are summarized in table 1, below.

Questions regarding meeting labour demands on respective operations were met with mixed responses. Some participants were cited as having no issues of hiring adequate amounts of labour, while others discussed not being able to hire local, Canadian labour, negative perceptions of agricultural labour, lack of accountability, and worker unwillingness to continue due to physical demands of work. Regarding the topic of perception of agricultural labour, one participant is quoted as saying: "I think it's worth exploring that as well, what is it we're saying about this work that's discouraging people from getting involved?"

Increasing the number of new farmers was also discussed with respect to the decline of family labour, and the difficulty of access to alternative agriculture. Though some mentioned the perception of more, young farmers in alternative agriculture, others frequently mentioned two major barriers involved with getting into farming: (1) access to land and (2) access to capital. These were often referenced in connection with internships in alternative agriculture, the high cost of mechanization and the decline of succession of land through family farming. For example, one participant is quoted as saying: "Any time a farm family doesn't produce any kids that want to farm, you have a reduction in the number of farmers available. If they don't all come from there you have to do something about the cost of entry". Alternatives to ownership of land that were discussed included crop sharing, land trusts and rented land; the latter of which a
Another reoccurring topic for this theme included institutional support, governmental or otherwise. By comparison to conventional farming, participants noted less support for certified organic agriculture as well as the added burden of organic certification in terms of cost and time. For example, one participant noted "they [conventional] have a safety net...organic agriculture doesn't have a lot of support systems". Some participants were considering or already were offering some type of crop or land sharing. More institutionalized support that was discussed included improving access to agriculture in education, implementing large-scale land trusts, farm incubation projects and improving zoning policies to protect and provide for easier access to farmland.
Table 1 *Summary of themes, sub-themes and illustrative quotations from semi-structured interviews* regarding the challenge of meeting labour demands and new farmers in alternative agriculture. Sub-themes included accountability, perceptions of labour and decline in employment for the former, and land, capital and institutional support for the latter.

<table>
<thead>
<tr>
<th>Theme(s)</th>
<th>Sub-themes</th>
<th>Key points</th>
<th>Illustrative quotations</th>
</tr>
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</table>
| Meeting labour demands | Accountability | • Often discussed with regards to specific types of labourers (e.g. volunteers, urban-sourced labourers)  
• Conflicts with work-life balance | "I would welcome them if they showed up...but whether we can count on them to show up, that's always an issue" |
| | Perception of agricultural labour | • Physical demands, scheduling and fluctuating seasonal demands | "A lot of people that come to our farm are city kids that have a starry-eyed version of ideal country scenes with an organic farm, and have no idea how much work it is." |
| | Decline in employment | • Some perceived higher amounts of new, young farmers  
• Mixed responses on having adequate labourers | "The biggest thing this year was having a position or two open for most of the season" |
| New farmers | Land | • Often discussed with respect to cost, land-parcelling and zoning by-laws, as well as renting versus ownership  
• Some participants mentioned how they were involved in, or considering land sharing, rentals or land trusts | "Being an intern depletes any savings you may have had. Where are you going to come up with the money to buy land?" |
| | Capital | • The other major barrier to new farmers in alternative agriculture, often discussed in relation to internships. | "Any time a farm family doesn't produce any kids that want to farm, you have a reduction in the number of farmers available. If they don't all come from there you have to do something about the cost of entry" |
| | Institutional support | • Discussed by comparing alternative agriculture to support for conventional agriculture  
• As with 'land' sub-theme, some discussed non-governmental support like land trusts | "They [conventional] have a safety net...organic agriculture doesn't have a lot of support systems" |
4.2. **Objective 2 - Evaluating factors affecting production in certified organic horticulture**

Along with the difference between available and required labour, there was a wide variability of rates of production between participants observed, both within diary-log (std. dev. = 102 servings/hour; range = 307 servings/hour) and participant observation data (std. dev. = 1252 servings/hour; range = 2488 servings/hour).

Therefore, comparisons were made based on comparing other variables, such as cultivated area, labour type and diversity of production, to rates of production in order to analyze and better understand variability between participants. Data from the semi-structured interviews are included here as well, with discussion surrounding the themes of production and labour models. While production for this section is addressed in terms of variability, it was discussed in the semi-structured interview in the context of improving production in relation to meeting the dietary requirements of fruit and vegetables for the city of Guelph.

4.2.1. **Comparison of production to other factors - Quantitative results**

The first factor in assessing variability of total production is farm size, represented by cultivated area. Cultivated area ranged from 3-120 acres across participants and is visualized in figure 8, below. With respect to cultivated area, there appears to be a weak and positive relationship between cultivated area and productivity suggesting, perhaps, somewhat greater efficiency on larger holdings. However, given the small sample size this result should not be seen as definitive and it is not statistically significant especially as we see that larger cultivated areas had lower labour efficiency than those between 7-11 acres of cultivated area.
Fig. 8 Comparison of average rates of production (y=servings/hour; y-axis) across three groups of cultivated area (x=≤6, 7-11, and 12≤ acres) based on data from diary-log participants (n = 3 per group; range of cultivated area = 117 acres). Standard deviation by group: ≤6 = 4.56; 7-11 = 142.00; 12≤ = 89.04
The second assessment of factors affecting variability of production compared diversity of crops to productivity, with the understanding that the yield gap between organic and conventional production could be reduced by multi-cropping and inter-cropping (Ponisio et al., 2014). A scale of crop diversity was determined by FAO (2005) classification of crops whereby classes and subclasses (when indicated) are each equal to 1 unit of diversity. Data were arranged according to crop diversity per participant (n = 10) and visualized in figure 9, below. At first observation, there is the appearance of a relationship between specialization and increased rates of production. Although, similar to cultivated area and rates of servings/hour, there is considerable variation from one participant to another which suggests there was no clear relationship observed in this sample. For example, the third lowest rate of productivity corresponds to monoculture production (diversity of 1), followed by the highest rate of production through the participant growing two types of crops (diversity of 2). Though there appears to be less productivity with more diversity, for \( x \leq 6 \) and \( x = 7-20 \) we see that the respective standard deviations (134 and 106 servings/hour, respectively) are higher than the mean (132 and 83 servings/hour, respectively), thus suggesting a high amount of variability within those groups. These data suggest that farms with low and high crop diversity can obtain high levels of labour efficiency.
Fig. 9 Comparison of average rates of production (y=servings/hour) across three groups of crop diversity (x=≤6, 7-20, and 21≤) - based on number of crops grown by each diary-log participant (n=4 for x=≤6 crops grown and n=3 for both x=7-20 crops grown and 21≤; crops grown)
4.2.2. **Reflections on variability of production**

Overall, qualitative interviews identified four sub-themes under the theme of improving production. Interviewees discussed this theme by focusing on: 1) scaling-up size, 2) farmer philosophy, and 3) crop diversity. Findings are summarized in table 2, below.

When prompted with the suggestion of scaling-up by area to increase production, all participants voiced reluctance for a number of different reasons: age, physical limitations, and the costs required to do so. Suggested alternatives included intensification, diversification, or even scaling-down. For example, one participant stated: "I see, globally, this trend, this industry must grow, farming must grow, and this constant temptation to make things as big as possible. I think where we're at on the farm right now is to just see, can we maintain at this scale?"

Furthermore, participants made note of environmental limitations such as unproductive land (i.e. conserved or natural wetland).

Another reasoning for this reluctance was in connection with the philosophy of the farm operator. For example, one participant felt less urgency to expand their operation as they also had a form of off-farm income, and is quoted as saying "I'm not as diligent about it, I don't have to make a living farming". Not all participants made direct reference to whether or not they supplemented their farm revenue with off-farm income, but there was some discussion that some participants were able to successfully make a transition to full-time farming. Others operating through intern labour made reference to how the drive for improving production on their operation conflicted with the means to educate.

The topic of crop diversity was also addressed under the theme of productivity, summarized in table 2. Although reasoning for what crops were grown was not frequently discussed, diversity was mentioned with relation to: customer satisfaction, the combination of marketing and geo-climatic location of operation dictating what was grown, or diversifying
beyond horticultural crop production in order to create a more ecologically-diverse and self-sufficient operation. Therefore, despite only some comments, there was a spectrum of impetus for diversification based on social, economic and environmental factors.
Table 2 Summary of themes, sub-themes and illustrative quotations from semi-structured interviews (2) regarding the theme of improving production, inclusive of sub-themes of scaling-up operations, farmer philosophy, and crop diversity

<table>
<thead>
<tr>
<th>Theme(s)</th>
<th>Sub-themes</th>
<th>Key points</th>
<th>Illustrative quotations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improving production</td>
<td>Scaling-up size</td>
<td>• When prompted with increasing production in this manner participants were generally adverse to the idea.</td>
<td>&quot;I see, globally, this trend, this industry must grow, farming must grow, and this constant temptation to make things as big as possible. I think where we're at on the farm right now is to just see, can we maintain at this scale?&quot;</td>
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<td></td>
<td>Farmer philosophy</td>
<td>• Along with reasons above, improving production came in conflict with choices made by the farmers (e.g. employing a less efficient work force, favouring teaching over productivity, or having off farm income)</td>
<td>&quot;I think that maybe that efficiency is less, but we're doing it because it is sort of the way that we feel good about bringing people into farming and having a system which is accessible.&quot;</td>
</tr>
<tr>
<td></td>
<td>Crop diversity</td>
<td>• Crop diversity and productivity was discussed with respect to meeting consumer demand over efficiency and how the geo-climate dictated what grows best.</td>
<td>“...there are all these crops we grow just because people expect us to grow everything... There's crops that are worth doing and there's really crops that are not worth doing”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increasing diversification of production beyond crops was also mentioned as a means to improve sustainability and reduce inputs</td>
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</table>
4.2.3. **Labour models - Quantitative results**

Productivity and labour was first compared between two categories: those that employed a non-waged or waged labour model. Based on quantitative data (see: figure 10, below), non-waged farms as part of this research demonstrated only a slightly lower rate of productivity (96 servings/hour) compared to waged (102 servings/hour), although, the standard deviation of production in the non-waged group (152 servings/hour) was over double that of the waged group (67 servings/hour), which suggests a high variability of range in rates of production. Using a Wilcoxon Rank Sum Test, there was not sufficient evidence to conclude that productivity varied between these wage structures.

To investigate why these deviations were occurring, labour models were further divided into four groups: family (non-waged; n=2), intern/volunteer (non-waged; n=2), domestic (waged; n=3) and migrant (waged; n=2) and compared alongside individual participants and respective labour models (intern/volunteer, domestic, migrant) from participant observation. Given the significant discrepancies between diary-log and participant observation rates of productivity, variability of production between labour models was examined using z-score standardization. For more detail of the z-scores per labour group, see appendix H.

As seen in Figure 11, below, the high productivity in non-waged labour was skewed by one participant who operated through a family labour model. Aside from this, both the diary-log and participant observation data observe below average production from non-waged labour models, whereas waged labour models are above average. Though, based on these data, it is difficult to make generalizations of productivity and labour models given that properly done non-waged models can be productive, or not. Similarly, waged models can also vary in productivity.
Fig. 10 Comparison of average rate of production (servings/hour; y-axis) between labour models based on wage structure (waged vs. non-waged; x-axis) - based on data from diary-log participants, where intern, volunteer and family labour is considered non-waged (n=4), whereas migrant and paid domestic labour is categorized as waged (n=5). Standard deviation: Non-waged = 152; Waged = 67
Fig. 11 Comparison of z-score standardization of rates of production (servings/hour; y-axis) between labour models employed by participants as part of diary-log (DL) and participant observation (PO) data (x-axis) - Where, DL mean=99.54 servings/hour; standard deviation=104.54 - family [1] (non-waged; n=1), intern/volunteer (non-waged; n=2), domestic (waged; n=3), migrant (waged; n=2), and family [2] (non-waged; n=1). PO mean=1258.22 servings/hour; standard deviation=1251.99 - intern/volunteer (non-waged; n=1), domestic (waged; n=1) and migrant (waged; n=1).
4.2.4. Reflections on labour models

Overall, qualitative interviews identified six sub-themes under the theme of labour models. Interviewees discussed this theme by focusing on: (1) non-waged labour versus waged labour, (2) internships, (3) migrant labour, (4) domestic waged labour, (5) volunteers, as well as (6) work ethic, skill and knowledge of labourers. Findings are summarized in table 3, below.

On the subject of waged versus non-waged labour one participant noted: "we find that the importance of being able to account on people showing outweighs the benefits of free labour". Despite negative perceptions towards internships by some participants, those that operated through such a model defended it as a means of creating a learning environment for new, potential farmers.

Migrant labour was often discussed in terms of its high level of productivity compared to other models. For example, on transitioning from an intern model to migrant labourers, one participant highlighted the concurrent rise in profit and financial stability on their operation. Social justice and ethical concern of this model was less frequently discussed though one participant acknowledged that "it's unfortunate that we're still leveraging a system where we're using our more powerful economy to get labour less expensively than hiring local people".

The topic of domestic, waged labour in Canada was often brought up in relation to sub-topics of declining employment in agriculture, as well as work ethic. For example, participants that rely on migrant labour did so on the basis of not being successful in hiring locally, or that posting local job ads is a requirement for applying to the SAWP. Comparison of work ethic and skill was typically discussed as an urban versus rural binary, whereby participants observed differences in initiative and experience amongst these two groups, often related to urban-sourced false expectations of farm labour.
Table 3 Summary of themes, sub-themes and illustrative quotations from semi-structured interviews (3) - focusing on the themes labour models in certified organic agriculture in Ontario

<table>
<thead>
<tr>
<th>Theme(s)</th>
<th>Sub-themes</th>
<th>Key points</th>
<th>Illustrative quotations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Labour models</td>
<td>Non-waged labour vs. waged labour</td>
<td>• Participants often referenced this binary as waged being more productive, more reliable as well as the desire to appropriately compensate labour</td>
<td>&quot;We find that the importance of being able to account on people showing outweighs the benefits of free labour&quot;</td>
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<tr>
<td></td>
<td>Internships</td>
<td>• Those that partook in internship programs did so on the basis of providing a learning experience</td>
<td>&quot;Labour is one of the things that's probably keeping us small, however it's the sharing of education that we want to be sure everyone is getting&quot;</td>
</tr>
<tr>
<td></td>
<td>Migrant labour</td>
<td>• Migrant labour was frequently discussed with respect to high amounts of productivity and dependence upon them for their financial success</td>
<td>&quot;If we don't get foreign labour on this farm, particularly, it is very difficult for us to survive. So we do rely on the foreign worker program to survive...&quot;</td>
</tr>
<tr>
<td></td>
<td>Domestic waged labour</td>
<td>• This sub-theme was often referenced in relation to not being able to attract local, Canadian labour</td>
<td>&quot;We're fulfilling a need, but it's not fulfilling the Canadian job market&quot;</td>
</tr>
<tr>
<td></td>
<td>Volunteers</td>
<td>• This labour model was often referenced with respect to lack of accountability and the desire to compensate farm work</td>
<td>&quot;...they'll show up one day and won't show up the next. Or they'll stop, they'll quit. If they don't show up it's no skin off their nose type of thing&quot;</td>
</tr>
<tr>
<td></td>
<td>Work ethic/skill/knowledge of labourers</td>
<td>• Often discussed with respect to urban/rural sourcing of labourers</td>
<td>&quot;That comes back to me, I need to make sure that I teach them properly how to do things, but it's always nice when somebody initiates or will make the effort...instead of just standing around&quot;</td>
</tr>
</tbody>
</table>

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5. **Discussion**

The following section will elaborate on the results of both objectives with respect to the gaps identified, as well as make connections to the existing knowledge and research on labour with respect to Canada and local, alternative agriculture. The first sub-section will focus on the first objective of assessing the labour requirements according to the parameters of this study and assess the relation to the existing and widening labour gap in Canadian agriculture. Following that will be a focus on the results of variability in production within this study, as well as a discussion on a deeper understanding of some exemplar forms of production observed.

5.1. **Labour gaps in Canadian agriculture and the demands of local, alternative agriculture**

Based on the rates of production as a means to quantify demand versus supply of agricultural labour, it is suggested that, on average, there is not enough existing certified organic horticultural labour available within an 100-mile radius to meet the daily dietary demands of fruit and vegetables for the city of Guelph. While other labour categories, such as total certified organic labour within 100-miles of Guelph, may meet even the lowest labour demands calculated through diary-log data (403 workers) and average labour demands through participant observation data (510 workers), the workforce and skills required is general to the entire agricultural sector and is not representative of labour requirements in horticulture. For example, horticulture is typically more hand-labour intensive than it's conventional counterpart, and dairy or livestock do not differ much in labour required between organic and conventional (Wynen, 2002). Therein lies the caveat: required labour may vary by type of production, but census data does not break available labour down by those categories. Therefore, proportional calculations of more specific labour amounts by type of production (i.e. horticulture and certified organic
horticulture) may not be exact and conclusions based on this data is also not representative of all labour and productivity in Canadian agriculture.

Furthermore, while a shift in horticultural production to certified organic horticultural production may be possible, another barrier exists as a shift in one form of land use or agricultural production to another, along with organic certification is highly improbable. A large-scale shift to certified organic production would theoretically require systematic changes in terms of political, public and private sector support, as well as potentially a large labour force and convincing producers to shift existing operations (Badgley et al., 2007; Desjardins, MacRae & Schumilas, 2009; Godfray et al., 2010; Satterthwaite, McGranahan & Tacoli, 2010; Tscharntke et al., 2012). Finally, these workforces are not solely producing for Guelph, thus diluting the available labour and production of horticultural products based on where they are distributed. Therefore, this study suggests a demand for labour based on the study’s parameters that could exacerbate an already widening labour gap in Canadian agriculture. Suggestions made in self-sufficiency studies of food system localization can be applied to a shift to local, alternative agriculture in Canada: in order to meet the labour demands in a large-scale shift to localized, certified organic horticulture, there would be a great demand for monetary and technological support as well as enticing new farmers and labourers (Desjardins, MacRae & Schumilas, 2010).

In terms of increasing farmer populations, concerns were raised by most participants regarding capital costs and access to land for new farmers. These concerns fall in line with several documented realities: Canadian farms continue to increase in size while the total number of operators and operations have decreased (Statistics Canada, 2017abhi), and access to land becomes increasingly difficult for new farmers (Ekers et al., 2015). In lieu of this decline, internships are framed as a means to train and educate future farmers (Ekers et al., 2015).
Despite knowledge and skill-building, the non-waged aspect of internships means these labourers are typically unable to accrue enough capital to own their own land as they are not receiving a substantial wage, if any. From 2011 to 2016, the average value of land and buildings per acre in Canada increased 38.8% to $2,696/acre (Statistics Canada, 2017a). Furthermore, while land is being protected to some extent by the Ontario GreenBelt and municipal zoning, most zoning requirements have area minimums. Although Wellington county by-law suggests some flexibility, it, and nearby township and city policies place the minimum primary agricultural area as roughly 86 acres (City of Hamilton Planning Committee, 2015; Township of North Dumfries, 2012; Wellington County Council, 2016). Therefore, not only is the price of agricultural land increasing, but the requirements in terms of minimum area acts as another barrier to small-scale farm operators.

With low to no wages and increasing land prices, new farmers have turned to alternatives to ownership. As of 2016, over 50% of Canadian farm operators under the age of 35 were renting land (Statistics Canada, 2017a). While dependent on the land that is rented, renting may prove problematic combined with the transition time of 3 years in organic certification (OMAFRA, 2011). Participants as part of this study were either doing so, or thinking of leasing land or involved in some form of land trust. To reduce barriers to new farmers, some suggestions included government support, such as zoning policies that protect land for farming.

In general, comments from participants regarding availability of labour reflected the struggles currently faced by Canadian agriculture (CAHRC, 2016): employment is declining, and hard to entice. In retaining or recruiting labour, key challenges include physicality, variable hours with respect to seasonality, insufficient compensation, as well as negative perceptions (CAHRC, 2016), all of which were mentioned by participants with respect to Canadian
labourers, in some capacity or another. For example, those that turned to migrant labour models did so not only because they could not find Canadians to fill those positions, but they felt the appropriate compensation they would need to provide to entice said workers would be too high to be financially sustainable.

Wages for agricultural workers, in general, have also become a point of focus in terms of enticing labour and in exploitation (Levkoe & Ekers, 2017). Labour laws in Canada are dictated at a provincial level, and can vary dramatically (Lambek, 2017; Mandryk, 2017). The Employment Standards Act, 2000, S.O. 2000 c.41 (ESA) provides insight into what kind of protections do or do not exist for farm labourers. Some notable absent protections for farm employees in Ontario include minimum wages, overtime, maximum work hours, or even rest periods during and between shifts (Lambek, 2017). While articles in Levkoe and Ekers (2017) highlight these shortcomings with respect to intern labour exploitation, this also presents an overall negative perception of labour and employment in Ontario agriculture.

The topic of younger workers was typically brought up in relation to variable hours, in that those seeking to have a social life or work-life balance, often conflicted with limited time frames for things like harvesting with the threat of frost approaching. Of potential labourers, younger workers have been identified as a group that is particularly hard to entice (CAHRC, 2016), especially for general or less-skilled positions. Instead, positions requiring higher education tend to be more attractive, otherwise employment preferences tend to lie in more urban areas, where there is more stability in terms of variability of hours and greater negative perceptions of agricultural labour (CAHRC, 2016). This further stresses the impacts of urbanization, and creates a need for changing the perception of agricultural labour. Participants
made note of how urban-sourced workers were surprised by the reality of farm labour, or, how systemically it is framed negatively and needing to be more efficient.

5.2. *Evaluating variability of production in local, alternative horticultural production*

Although we do not equate these preliminary results as being representative of Canadian alternative agriculture, like with the previous sub-section, interview data both supported and contradicted claims in literature, with respect to the analysis of each of the three factors of land, crop diversity and labour. For example, the participant operating under the non-waged family labour model had the highest calculated rate of servings/hour. This would conflict with claims of migrant labourers being very, if not the most productive type of agricultural labourer (Braun, 2016) and the possibility of wages increasing productivity (Ekers et al., 2015; Shreck et al., 2006; Strochlic & Hamerschlag, 2005; Woodhouse, 2010). Furthermore, there was no evidence supporting the inverse relationship between farm size and productivity (Rosset, 1999) or that multi-cropping would improve yields (Ponisio et al., 2014) based on the preceding analysis. Rather, the study also contributed to an understanding of a demonstratively high degree of variability in production in certified organic horticulture.

Although not generalizable to all alternative agriculture, this conclusion in itself lends support to the variety of claims regarding variability of labour required depending on the crop (Kim, 2003), type of production (Wynen, 2003) or that productivity varies in part by the skill level of labourers (Strochlic & Hamerschlag, 2006). Though skill level of labourer is less tangibly quantifiable, participants did make substantial mention of different work ethics and mentality towards agricultural labour such as aspects of work-life balances, rural versus urban-sourced labour, and the high-level of productivity from migrant labourers. This supports the claims regarding the growing labour gap in Canadian agriculture: insufficient skills and
experience of workers is cited as the top challenge in recruitment for Canadian agriculture (CAHRC, 2016). Despite this variability, the data also presented scenarios of high levels of productivity.

5.3. Exemplar forms of production

Among participants, and the analysis based on different variables, there were some that stood out in terms of high levels of productivity. For both participant observation and diary-log data, it was mostly participants who operated through waged workers, particularly migrant labour, that demonstrated the highest levels of productivity. Furthermore, there was also the one participant that operated through family labour that was highly productive compared to any other participant. Specifically, the productivity observed through these participants suggested means of operating at a level that could potentially be met by the existing agricultural labour available, with respect to the parameters of this research. What follows is a discussion of the differences and implications of these means of high productivity, first of the highly-efficient family farm, followed by waged domestic and migrant labour.

5.4. Non-waged family labour demonstrating the highest rate of production

To understand the productivity of the participant from the diary-log data whom operated with the highest rate of productivity (324 servings/hour), this section will first break down the factors under which they operated, followed by a comparison and discussion of the level of potential for emulating this model of production.

This participant produced on a relatively mid-to-high-range level of cultivated area (11 acres), and by way of non-waged family labour thereby reducing cost of production. In assessing variability of productivity, there was no clear relationship found between crop diversity and production. When compared to the participant growing only one type of crop with a significantly
lower rate of production, this participant had a diversity of two crops, and the highest level of productivity. A difference between this participant and the former could be the crop they grew or the means by which it was grown as amount of labour can vary by type of crop (Kim, 2003).

As with crop diversity, no clear relationship between cultivated land size and productivity, and the other participants that operated through non-waged labour models had lower productivity, there are almost certainly other factors that help to explain this. However, there is also potential that this size of farm is optimal for models like family labour-based operations. Given the average fruit and vegetable farm size in this study area was calculated to be 13 and 32 acres, respectively, it is somewhat near the norm of what farmers are operating on already. Furthermore, in scaling-up production as part of a turn to larger, conventional operations, the rise of paid labour has filled the added requirements unable to be met by non-waged family labour (Ekers et al., 2015; Statistics Canada, 2017).

The implications of this high level of production are two-fold. Firstly, non-waged family labour has declined in both conventional and in alternative agriculture in Canada (Ekers & Levkoe, 2016), leading to the rise in paid labour in the former, and non-waged intern models in the latter. The second implication returns to the diversity of production. While monocultures have become a staple in large-scale conventional agriculture, and could be a reason for the high level of productivity for this participant, the lack of diversity and types of crops grown by this participant may present a major short-coming with respect to implementing a consumer-based, dietary-need model of production with diverse needs and wants. Therefore, while there are aspects of meeting consumer dietary demands at a surface-level of understanding, looking deeper into the nuances of efficiency for the highest level of production uncovers the complications with achieving these needs.
5.4.1. **Waged labour models**

Despite what some participants noted as being a major portion of their cost of production, there were counter-points made in favour of dependency and productivity of paid labour. These attitudes, along with calculated findings, fall in line with the literature which suggests that farmers who use waged labour are more productive (Ekers et al., 2015; Marr, 2017; Shreck et al., 2006). Furthermore, there was also acknowledgement of the difference in productivity between Canadian and migrant workers. This was largely addressed in the context of cultural differences, as well as expectations put on the migrant worker systematically and by their employers. Cultural differences often took form in the discussion of work-life balance for Canadian labourers, particularly those that are sourced from more urban areas.

With regards to opting for migrant labourers, those that chose this model cited increased profitability, economic sustainability and productivity. One participant mentioned the influence on mentality of the migrant worker by systematic and employer expectations: "they [migrant labourers] have expectations upon them, and they know that they can be replaced". Furthermore, there is the existing critiques in literature of the treatment and ethical concerns of migrant labourers, brought in through Canada’s agricultural stream of TFWP or SAWP (Ekers et al., 2015; Preibish & Otero, 2015; Weiler, Levkoe & Young, 2016). This concern was less apparent from the qualitative data collected, though one participant noted an internal conflict and ethical concern with supporting a migrant labour program. Though, it must be acknowledged that none of this exploitation of migrants, or any group of labourers was evident throughout this study.

Therefore, production through waged labour is subject to more systemic and social issues, similarly to the decline of family labour in Canadian agriculture. Unlike the top-performing producer who participated in this study, most participants operating through migrant
and intern-based labour had their own ethical issues and questions of sustainability within an alternative food system such as certified organic horticulture.

6. Conclusion

The following section will first discuss the main conclusions in relation to the research aim and objectives followed by contributions and future considerations based on both the conclusions as well as the methods, and any limitations they may have presented.

In an attempt to determine how much labour would be required to meet the daily requirements for horticulture in the city of Guelph and evaluate factors affecting productivity in certified organic horticulture, there were three main conclusions:

1. A shift to local, certified organic horticultural production as alternative could further exacerbate an already unsustainable labour gap in Canadian agriculture due to the potentially increased amounts of labour required depending on efficiency of productivity.

2. There is a considerable level of variation in production in certified organic horticultural production - whereby factors such as diversity of crops, farm area and labour models which tend to be addressed as main contributors or barriers to productivity did not fully explain variation that was observed among the study participants. Instead, productivity tended to vary down to the individual participant and farm-level variables overwhelming all other discussion.

3. There are some notable examples of high amounts of productivity that could provide insight into more efficient production, thereby potentially leveraging the possibility of a shift to local, alternative agricultural food systems.

Therefore, these findings suggest that a local, certified organic food system may likely require more labour than there is currently employed by the sector. Although the results of this
study may not be applicable to all forms of alternative agriculture and labour models in a Canadian context, there are quantitative and qualitative findings that support the literature. Most importantly, in relation to requirements with respect to labour, resources and productivity, theoretically there would need to be an intensive reorganization of the labour market, land use policy and by-laws, and greater support to new farmers in order to be dependent upon alternative agriculture.

Within certified organic production there has been a lot of variation in productivity. Of the variables investigated, the analysis suggests the possibility that productivity varies between labour models, diversity of crop production, and area being harvested. While studies have cited variation between sectors, such as more hands-on labour required in horticultural production compared to dairy (CAHRC, 2016; Wynen, 2003), existing research on labour required through organic horticultural crop production have not thoroughly evaluated these variations. What has been investigated through this study suggests the need for greater assessment and consideration of the various factors affecting productivity, whether quantitative or qualitative. Aside from one participant whom operated through non-waged family labour and had the highest rate of production, most participants who employed migrant labour demonstrated very high productivity compared to others, giving credence to both participant perceptions and claims in print (Braun, 2016).

Furthermore, analysis of non-waged labour models contributes to recent research with regards to internships in alternative agriculture (Ekers et al., 2016). Access to land and capital were noted as a significant barrier to future success. While there are success stories of interns establishing their own operation in alternative agriculture, there are ever-present systemic issues in terms of labour laws that allow for the propagation of internships in Ontario (Levkoe & Ekers,
Therefore, the need to support those that actually want to learn and become farm operators in alternative agriculture is further stressed alongside the potential loss of family labourers and farm success.

Should this evidence and analysis be representative of the average requirements of labour in production of certified organic horticultural products, this calls into question the sustainability of forms of alternative agriculture from a socio-economic perspective in the face of existing labour gaps in Canadian agriculture. Though discussed in reference to IFOAM and the USDA National Organic Program (Shreck et al., 2006), the standards set out by the Canadian Organic Regime similarly do not "explicitly reference in their definitions [of organic agriculture] to the relevance of organic practices for hired farm workers" (p.442). Given the projected widening labour gap in Canadian agriculture (CAHRC, 2016), and the dependence placed upon these labour models in Canadian and certified organic agriculture, this research contributes to the need to further investigate and ethically question production in our food systems, as well as lends support to the inclusion of farm labour in certification standards.
CHAPTER FIVE – CONCLUSION

1. Summary of arguments and findings

In an attempt to determine how much labour would be required to meet the daily requirements for horticulture in the city of Guelph and evaluate factors affecting productivity in certified organic horticulture, there were three main conclusions:

1. A shift to local, certified organic horticultural production as an alternative could further exacerbate an already unsustainable labour gap in Canadian agriculture due to the potentially increased amounts of labour required depending on efficiency of productivity.

2. There is a considerable level of variation in production in certified organic horticultural production - whereby factors such as diversity of crops, farm area and labour models which tend to be addressed as main contributors or barriers to productivity did not fully explain variation that was observed among the study participants. Instead, productivity tended to vary down to the individual participant and farm-level variables overwhelming all other discussion.

3. There are some notable examples of high amounts of productivity that could provide insight into more efficient production, thereby potentially leveraging the possibility of a shift to local, alternative agricultural food systems.

Therefore, these results suggest that a local, certified organic food system may likely require more labour than is currently being employed by (and perhaps available within) the sector. Though caution must be applied in the results of this study being representative of all forms of alternative agriculture and labour models in a Canadian context, there are quantitative and qualitative findings that support the literature. Most importantly, in relation to requirements with respect to labour, resources and productivity, theoretically there would need to be an
intensive reorganization of the labour market, land use policy and by-laws, and greater support to new farmers in order to be dependent upon alternative agriculture.

The following sub-sections will elaborate on each of these conclusions, with respect to the objectives of this study, as well as discuss relation to the existing knowledge and research in labour with respect to Canada and local, alternative agriculture. The first sub-section will focus on the first objective of assessing the labour requirements according to the parameters of this study and assess the relation to the existing and widening labour gap in Canadian agriculture. Following that will be a focus on the results of variability in production within this study, as well as provide a deeper understanding of some exemplar forms of production observed.

1.1. Labour gaps in Canadian agriculture and the demands of local, alternative agriculture

Based on the rates of production as a means to quantify demand versus supply of agricultural labour, it is suggested that there is not certified organic horticultural labour available within an 100-mile radius to meet the daily dietary demands of fruit and vegetables for the city of Guelph. While other labour categories, such as total available agricultural labour within 100-miles of Guelph, may meet even the highest labour demands calculated through this study (17 servings/hour; 7567 individuals), the workforce and skills required is general to the entire agricultural sector and may not be representative of labour requirements in horticulture. For example, horticulture is typically more hand-labour intensive than it's conventional counterpart, and dairy or livestock do not differ much in labour required between organic and conventional (Wynen, 2002). Therein lies the caveat: required labour may vary by type of production, but census data does not break available labour down by those categories. Therefore, proportional calculations of more specific labour amounts by type of production (i.e. horticulture and certified
organic horticulture) may not be exact and conclusions based on this data is also not representative of all labour and productivity in Canadian agriculture.

Furthermore, while a shift in horticultural production to certified organic horticultural production may be possible, another barrier exists as a shift in one form of land use or agricultural production to another, along with organic certification is highly improbable. Finally, these workforces are not solely producing for Guelph, thus diluting the available labour and production of horticultural products based on where they are distributed. Therefore, this study suggests a demand for labour based on the study’s parameters that could exacerbate an already widening labour gap in Canadian agriculture. Suggestions made in self-sufficiency studies of food system localization can be applied to a shift to local, alternative agriculture in Canada: in order to meet the labour demands in a large-scale shift to localized, certified organic production of fruits and vegetables, there would be a great demand for monetary and technological support as well as enticing new farmers and labourers (Desjardins, MacRae & Schumilas, 2010).

In terms of increasing farmer populations, concerns were raised by most participants regarding capital costs and access to land for new farmers. These concerns fall in line with several documented realities: Canadian farms continue to increase in size while the total number of operators and operations have decreased (Statistics Canada, 2017abhi), and access to land becomes increasingly difficult for new farmers (Ekers et al., 2015). In lieu of this decline, internships are framed as a means to train and educate future farmers (Ekers et al., 2015). Despite knowledge and skill-building, the non-waged aspect of internships means these labourers are typically unable to accrue enough capital to own their own land as they are not receiving a substantial wage, if any. From 2011 to 2016, the average value of land and buildings per acre in Canada increased 38.8% to $2,696/acre (Statistics Canada, 2017a). Furthermore, while land is
being protected to some extent by the Ontario GreenBelt and municipal zoning, most zoning requirements have area minimums. Although Wellington county by-law suggests some flexibility, it, and nearby township and city policies place the minimum primary agricultural area as roughly 86 acres (City of Hamilton Planning Committee, 2015; Township of North Dumfries, 2012; Wellington County Council, 2016). Therefore, not only is the price of agricultural land increasing, but the requirements in terms of minimum area acts as another barrier to small-scale farm operators.

With low to no wages and increasing land prices, new farmers have turned to alternatives to ownership. As of 2016, over 50% of Canadian farm operators under the age of 35 were renting land (Statistics Canada, 2017a). While dependent on the land that is rented, renting may prove problematic combined with the transition time in organic certification, which can be up to 4 years (OMAFRA, 2011). Participants as part of this study were either doing so, or thinking of leasing land or involved in some form of land trust. To reduce barriers to new farmers, some suggestions included government support, such as zoning policies that protect land for farming.

In general, comments from participants regarding availability of labour reflected the struggles currently faced by Canadian agriculture (CAHRC, 2016): employment is declining, and hard to entice. In retaining or recruiting labour, key challenges include physicality, variable hours with respect to seasonality, insufficient compensation, as well as negative perceptions (CAHRC, 2016), all of which were mentioned by participants with respect to Canadian labourers, in some capacity or another. For example, those that turned to migrant labour models did so not only because they could not find Canadians to fill those positions, but they felt the amount of appropriate compensation they would need to provide to entice said workers would be too high to be financially sustainable.
Wages for agricultural workers in general is also a major topic in terms of enticing labour and in exploitation (Levkoe & Ekers, 2017). Labour laws in Canada are dictated at a provincial level, and may vary dramatically (Lambek, 2017; Mandryk, 2017). The Employment Standards Act, 2000, S.O. 2000 c.41 (ESA) provides insight into what kind of protections do or do not exist for farm labourers. Some notable absent protections for farm employees in Ontario include minimum wages, overtime, maximum work hours, or even rest periods during and between shifts (Lambek, 2017). While articles in Levkoe and Ekers (2017) highlight these shortcomings with respect to intern labour exploitation, this also presents an overall negative perception of labour and employment in Ontario agriculture.

The topic of younger workers was typically brought up in relation to variable hours, in that those seeking to have a social life or work-life balance, often conflicted with limited time frames for things like harvesting with the threat of frost approaching. Of potential labourers, younger workers have been identified as a group that is particularly hard to entice (CAHRC, 2016), especially for general or less-skilled positions. Instead, positions requiring higher education tend to be more attractive, otherwise employment preferences tend to lie in more urban areas, where there is more stability in terms of variability of hours and greater negative perceptions of agricultural labour (CAHRC, 2016). This further stresses the impacts of urbanization, as well as a need for changing the perception of agricultural labour. Perceptions were a prominent topic as well, where participants made note of how urban-sourced workers were surprised by the reality of farm labour, or, how systemically it is framed negatively and needing to be more efficient.
1.2. **Variability of production in local, alternative horticultural production**

Although we do not equate these preliminary results as being representative of all Canadian alternative agriculture, like with the previous sub-section, there were data, particularly with respect to the interviews, that both supported and contradicted claims in literature. For example, the participant operating under the non-waged family labour model had the highest calculated rate of servings/hour. This would conflict with claims of migrant labourers being very, if not the most productive type of agricultural labourer (Braun, 2016) and the possibility of wages increasing productivity (Ekers et al., 2015; Marr, 2017; Shreck et al., 2006; Strochlic & Hamerschlag, 2005; Woodhouse, 2010). Furthermore, there was no evidence supporting the inverse relationship between farm size and productivity (Rosset, 1999) or that multi-cropping would improve yields (Ponisio et al., 2014) based on the preceding analysis. Rather, data collected here suggest that small and diverse farms can be highly productive, and so this opens new avenues of research that could aim to study such examples as a way of trying to help make small and diverse farms more efficient in terms of labour.

Ultimately, the analysis demonstrated a high degree of variability in production in certified organic horticulture. Although not generalizable, this conclusion in itself lends it's support to the variety of claims regarding variability of labour required depending on the crop (Kim, 2003), type of production (Wynen, 2003) or that productivity varying in part by the skill level of labourers (Strochlic & Hamerschlag, 2006). Though skill level of labourer is less tangibly quantifiable, participants did make substantial mention of different work ethics and mentality towards agricultural labour such as aspects of work-life balances, rural versus urban-sourced labour, and the high-level of productivity from migrant labourers. This supports the claims regarding the growing labour gap in Canadian agriculture: insufficient skills and experience of workers is cited as the top challenge in recruitment for Canadian agriculture.
CAHRC, 2016). Despite this variability, the data also presented scenarios of high levels of productivity.

1.3. **Exemplar forms of production**

Among participants, and the analysis based on different variables, there were some that stood out in terms of high levels of productivity. For both participant observation and diary-log data, it was mostly participants that operated through waged workers, particularly migrant workers that demonstrated the highest levels of productivity. Furthermore, there was also the one participant that operated through non-waged family labour that was highly productive compared to any other participant. Specifically, the productivity observed through these participants suggested means of operating at a level that could potentially be met by the existing agricultural labour available, with respect to the parameters of this research. What follows is a discussion of the differences and implications of these means of high productivity, first of the highly-efficient family farm, followed by waged domestic and migrant labour.

1.3.1. **Non-waged family labour demonstrating the highest rate of production**

To understand the productivity of the participant from the diary-log data whom operated with the highest rate of productivity (324 servings/hour), this section will first break down the factors under which they operated, followed by a comparison and discussion of the level of potential for emulating this model of production.

This participant produced on a relatively mid-to-high-range level of cultivated area (11 acres), and by way of non-waged family labour thereby reducing cost of production. In assessing variability of productivity, there was no clear relationship found between crop diversity and production. When compared to the participant growing only one type of crop with a significantly lower rate of production, this participant had a diversity of two crops, and the highest level of
productivity. A difference between this participant and the former could be the crop they grew or the means by which it was grown as amount of labour can vary by type of crop (Kim, 2003).

As with crop diversity, no clear relationship between cultivated land size and productivity, and the other participants that operated through non-waged labour models had lower productivity, there are almost certainly other factors that help to explain this. However, there is also potential that this size of farm is optimal for models like family labour-based operations. Given the average fruit and vegetable farm size in this study area was calculated to be 13 and 32 acres, respectively, it is somewhat near the norm of what farmers are operating on already. Furthermore, in scaling-up production as part of a turn to larger, conventional operations, the rise of paid labour has filled the added requirements unable to be met by non-waged family labour (Ekers et al., 2015; Statistics Canada, 2017fg).

The implications of this high level of production are two-fold. Firstly, with regard to the labour model, non-waged family labour has declined in both conventional and in alternative agriculture in Canada (Ekers & Levkoe, 2016), leading to the rise in paid labour in the former, and non-waged intern models in the latter. The second implication returns to the diversity of production. While monocultures have become a staple in large-scale conventional agriculture, and could be a reason for the high level of productivity for this participant, the lack of diversity and types of crops grown by this participant could also be a major short-coming with respect to implementing a consumer-based, dietary-need model of production. Therefore, while there are aspects of meeting consumer dietary demands at a surface-level of understanding, looking deeper into the nuances of efficiency for the highest level of production uncovers the complications with achieving these needs.
1.3.2. **Waged labour models**

Despite what some participants noted as being a lot, if not the largest portion of their costs of production, there were counter-points made in regards to dependency upon, and productivity of paid labour. These attitudes, along with calculated findings, fall in line with the literature which suggests that farmers who use waged labour are more productive (Ekers et al., 2015; Marr, 2017; Shreck et al., 2006). Furthermore, there was also acknowledgement of the difference in productivity between Canadian and migrant workers. This was largely addressed in the context of cultural differences, as well as expectations put on the migrant worker systematically and by their employers. Cultural differences often took form in the discussion of work-life balance for Canadian labourers, particularly those that are sourced from more urban areas.

With regards to opting for migrant labourers, those that chose this model cited the increase in profitability, economic sustainability and productivity. Although, not mentioned by most participants, one did mention the influence on mentality of the migrant worker by systematic and employer expectations: “they [migrant labourers] have expectations upon them, and they know that they can be replaced”. Furthermore, there is the existing critiques in literature of the treatment and ethical concerns of migrant labourers, brought in through SAWP or the agricultural stream of TFWP (Ekers et al., 2015; Preibish & Otero, 2015; Weiler, Levkoe & Young, 2016). This concern was less apparent from the qualitative data collected, though one participant noted an internal conflict and ethical concern with supporting a migrant labour program. Though, there must be acknowledgement that none of this exploitation or ethical concern of this group, or any group of labourers was evident throughout this study. In fact, participants, particularly those operating through migrant labour models, noted the strong, near-familial bond they have developed with them over the time they have employed them.
Therefore, waged labour-based production is subject to more systemic and social issues. Unlike the case of the top-performing producer of this study, those operating through migrant and intern-based labour have their own ethical issues and questions of social sustainability in alternative agriculture.

Based on these conclusions, the following subsection will discuss the scholarly and practical contributions this study has provided followed by future considerations based on both the conclusions as well as the methods, and any limitations they may have presented.

2. Contributions

The major contributions of this research include a better understanding of the theoretical requirements of labour in local, certified organic production, the variability therein, and the potential for efficient production, but with caveats. Within certified organic production there has been a lot of variation in productivity. Of the variables investigated, the analysis suggests the possibility that productivity varies between labour models, diversity of crop production and area being harvested. While reports have cited variation between sectors, such more hands-on labour required in horticultural production compared to dairy (CAHRC, 2016; Wynen, 2003); existing research on labour required through organic horticultural crop production have not thoroughly evaluated these variations. What has been investigated through this study suggests the need for greater assessment and consideration of the various factors affecting productivity, whether quantitative or qualitative. Aside from one participant whom operated with family labour, and had the highest rate of production, participants whom employed migrant labour demonstrated very high productivity compared to others, giving credence to both participant perceptions and claims in print (Braun, 2016).
Furthermore, analysis of non-waged labour models contributes to recent research with regards to internships in alternative agriculture (Ekers et al., 2016). Access to land and capital were noted as a significant barrier to future success. While there are success stories of interns establishing their own operation in alternative agriculture, there are ever-present systemic issues in terms of labour laws that allow for the propagation of internships in Ontario (Levkoe & Ekers, 2017). Therefore, the need to support those that actually want to learn and become farm operators in alternative agriculture is further stressed alongside the potential loss of family labourers and farm succession.

If this analysis is in any way representative of the average requirements of labour in production of certified organic horticultural products, this calls into question the sustainability of forms of alternative agriculture from a socio-economic perspective in the face of existing labour gaps in Canadian agriculture. Though discussed in reference to IFOAM and the USDA National Organic Program (Shreck et al., 2006), the standards set out by the Canadian Organic Regime similarly do not "explicitly reference in their definitions [of organic agriculture] to the relevance of organic practices for hired farm workers" (p.442). Given the projected widening labour gap in Canadian agriculture (CAHRC, 2016), and the dependence placed upon these labour models in Canadian and certified organic agriculture, this research contributes to the need to further investigate and ethically question production in our food systems, as well as lends support to the inclusion of farm labour in certification standards. What follows is a discussion of potential areas for future research based on these conclusions as well as any limitations based on the methods of study.
3. Considerations for future research

The subject of valuing and perceptions of agricultural labour was mentioned by some participants, and was also highlighted as a key issue with respect to recruitment and the widening Canadian agricultural labour gap (CAHRC, 2016). Therefore, a new area of inquiry would involve understanding how to help maintain the economic viability of farms in alternative agriculture by ensuring their ability to recruit and incentivize labour in a socially equitable manner. As mentioned by one of my participants: "somebody giving you food somehow is not as valuable as somebody telling you whether or not you can sue somebody [...] It's like people not valuing the teacher or the child care worker, working with your child when they're most vulnerable, getting minimum wage". Therefore, along with improving access to those that want to farm, another point of focus in both a scholarly and practical sense would be to assess and understand the impacts of how agricultural labour is framed and valued.

In terms of methods, the parameters used as part of this study allowed for a narrowing of scope in an attempt to address the aim, but also presented limitations spatially, temporally and by designation of alternative. Although, with these limitations, so too does this present opportunity for expansion and consideration for future research.

With regards to the time frame of data collection, participants discussed how the weather affected production. Comparing 2016's meteorological data (The Weather Network, 2017a) with historical data from the past 30 years (The Weather Network, 2017b) in Guelph, Ontario, from May 1st to October 31st, there was over 150mm less precipitation in 2016, but also over 100 more growing heat days. Therefore, given the hot and dry growing season, farms may not have been productive had data been recorded at a different time. Other temporal limitations include days in which data was retrieved for the case-study: although there were return visits across the growing season, the data of select days does not necessarily represent consistency in yields and
labour; this would depend on labour, on weather, on time of year and yields. For example, were recordings done on a hotter day, labour may have been less efficient.

As was addressed when determining the parameters for this study, certified organic is not the sole representation of alternative agriculture, thus skewing findings towards those that are willing to go through the process and can afford certification. Similarly, horticultural production would not be representative of all agricultural labour requirements or factors of variance. According to a recent report (CAHRC, 2016), horticultural labour is typically higher and more demanding than other areas of production, thus skewing analysis and potential labour requirements. Therefore, further research should be inclusive of other definitions of local and alternative, as well as different forms of production to better understand the nuances of production and labour requirements in local, alternative agriculture. Ultimately, expanding upon these areas, in one capacity or another was limited by the time constraints of Master degree requirements.
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doi: http://dx.doi.org/10.1787/agr_outlook-2015-en


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APPENDICES

Appendix A

Diary-Log for Local, Certified Organic Farmers in Ontario

The first section will deal largely with background information, purely for the purpose of filing and organization. Please note that no names will be disclosed as part of the publication: upon collection of data and interview transcripts all identifying information will be anonymized and any identifying information will be deleted or destroyed.

1. Please, state the name of your farm operation, your name, and your business-related contact information.
   Name:
   Farm Operation:
   Address:
   Email:
   Phone #:

Horticultural production

The following is an example of the portion of the diary-log pertaining to horticultural production:

<table>
<thead>
<tr>
<th>Crop</th>
<th>Harvest Date</th>
<th>Area Harvested</th>
<th>Weight by Crop</th>
<th>Yield (by Standard Unit)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


Labour:
The other portion of the diary-log involves evaluating quantitative and qualitative aspects of labour on certified organic farms in Ontario. This will include: positions, amount of people per position, average hours per position, average wage or salary per position, specific roles pertaining to horticultural production, and if there are any changes to the workforce. The following is an example of the labour portion of the diary-log:

<table>
<thead>
<tr>
<th>Date</th>
<th>Hours Spent in Field</th>
<th>Workers in Field</th>
<th>Date</th>
<th>Hours Spent in Field</th>
<th>Workers in Field</th>
</tr>
</thead>
<tbody>
<tr>
<td>Notes</td>
<td>Notes</td>
<td>Notes</td>
<td>Notes</td>
<td>Notes</td>
<td>Notes</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>7</td>
<td>9</td>
</tr>
<tr>
<td>3</td>
<td>11</td>
<td>12</td>
<td>4</td>
<td>14</td>
<td>15</td>
</tr>
<tr>
<td>5</td>
<td>17</td>
<td>18</td>
<td>7</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>8</td>
<td>24</td>
<td>25</td>
<td>11</td>
<td>29</td>
<td>28</td>
</tr>
<tr>
<td>9</td>
<td>18</td>
<td>18</td>
<td>13</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Notes</td>
<td>Notes</td>
<td>Notes</td>
<td>Notes</td>
<td>Notes</td>
<td>Notes</td>
</tr>
<tr>
<td>10</td>
<td>26</td>
<td>26</td>
<td>15</td>
<td>29</td>
<td>29</td>
</tr>
<tr>
<td>12</td>
<td>21</td>
<td>21</td>
<td>18</td>
<td>30</td>
<td>30</td>
</tr>
</tbody>
</table>

The following is an example of the labour portion of the diary-log:
Appendix B

Sample Interview Questions for Local, Certified Organic Farmers in Ontario

Formalities:

Today is [DATE], and I am with participant F[X].

Today I will be interviewing you regarding labour and production in certified organic farming for the purpose of providing data for my thesis as part of my Master of Geography at the University of Guelph. Together, we have previously gone over the consent form and participation in this interview suggests you have agreed to the terms. I will be asking you questions about organic farming in Ontario, labour on your farm and also some opinions regarding some initial findings from my research. You do not have to answer any question you do not feel comfortable doing, or that you feel does not apply to you. Following the interview the transcript will be anonymized (meaning the removal of identifiers to protect your identity). You, the participant, at that point will have the opportunity to review the transcript. At any point you may elect to not participate in this research project.

Also note that there may be some things discussed here that may have been brought up before in previous conversations. I want to make it clear that those conversations were not intended for any research purposes, whereas this will be. Finally, This interview is to be recorded.

General Questions - Your operation

1. Could you describe why and how you began farming.
2. Can you describe your farm operation? in terms of Size? in terms of Crops?
3. More recently... Did you experience any barriers or hurdles over the 2016 growing season? This could include weather, employment...etc. Please be as in-depth as you feel comfortable with.

Labour

4. Describe your approach to labour with regards to organic farming. What is the overall structure of employment?
   a. Sources of employment?
5. In general, how many are employed through your farm? Full-time vs. seasonal? What about beyond just farm labour?
6. Would you say there are any barriers to employment? For example, being able to have workers for a set time...skills/abilities

Questions on Organic Ag.

7. What are your perceptions of the capacity for success of local, organic in Ontario? What are some potential ways to improve the state of organic farming in Ontario? In Canada?
8. Would you say there any shortcomings to organic certification? Positives?
Regarding initial findings

Preamble - A case study on three different styles of labour regarding the production of leafy greens found that across three main tasks: planting, harvesting and washing/packing, intern and volunteer labour produced the lowest amount of servings/minute, paid domestic labour produced the second highest, and migrant labour through the Seasonal Agricultural Worker Program produced the most.

9. If it meant improving your production, would you change your labour model? What would some barriers to this be on your behalf, why or why not would this be feasible?
10. Would you like to share any opinions regarding any of these labour models? In particular intern and volunteer labour or migrant labour in Canada offered through the SAWP.

Using these different rates of servings/minute as a gauge for production, we calculated using census data that there would have to be a significant shift in labour to produce enough servings of fruits and vegetables to meet the dietary requirements of Guelph on a daily basis. Keep in mind these are estimates based on 2011 census data that will hopefully be updated prior to publication, but, for example I calculated that production through intern/volunteer labour would need more people than in domestic waged labour, which would need more than migrant labour. As, well, on average there would need to be quite a shift and need for more labour to meet these dietary demands. Now, keep in mind these numbers are preliminary and do not represent every farm in Ontario/Canada, this is more so a theoretical talking point.

11. Similar to a question previously, if it meant improving your production, would you scale up in terms of increasing your harvestable area and your workforce? Would you have a different answer if it meant improving your ability to help feed a larger population through organic agriculture? Or if it meant improving your income?
12. Are there any opinions you would like to share about these initial calculations. For example, any suggestions as how to meet these labour demands given that less than 2% of all labour in Canada is part of the agricultural sector?
13. Are there any barriers you see in enticing labour in an alternative agricultural system such as certified organic agriculture? Any barriers to new farmers?

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Appendix C

Invitation to Participate in Research: Diary-Log, Farmer Interview and Case Study
Labour Requirements and Efficiency of Local, Organic Agriculture in Ontario

Thank you for considering this invitation to participate in a research project investigating the efficiency of local, certified organic farms in Ontario by examining the relationship between the amount and types of labour involved with production of horticultural crops for human consumption. You have been selected as a potential participant based on the methods used and certification your farm has achieved. The main investigator is Lucas Bramberger, a Master of Arts (MA) candidate in the Department of Geography at the University of Guelph. The academic advisor for the study is Dr. Evan Fraser. Results will contribute to the completion of the student researcher’s MA thesis. This research is sponsored by the Social Sciences and Human Research Council (SSHRC).

You have been selected based on the following criteria:

- You are the operator/owner/manager and/or head farmer of a certified organic farm, which grows horticultural crops for human consumption
- You are fluent in English
- Your farm is within 100 miles of the University of Guelph

Purpose of the Study
To examine the relationship between the amount and type of labour involved in local, certified organic farming in Ontario with the production of horticultural crops intended for human consumption.

Benefits of the Study
The range of labour requirements for local, certified organic farms in Canada is not well understood. This study aims to better understand alternative food systems that offer the potential for environmental and social justice alongside economic growth.

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

- Complete a series of diary-log entries (max. 10 minutes per week) over the course of the 2016 growing season, detailing quantitative (amount of positions, hours per position per week, wages/salaries) and qualitative (roles, tasks and employee positions) aspects of labour. You will also be asked to include quantitative and qualitative information (total output per crop, amount of land dedicated to that crop, planting and harvesting dates, any other tasks involved) of horticultural crop production for human consumption.
  - Should you already be performing record-keeping of labour, yields and/or area of your farming operation, you may opt to provide this information for the student investigator (Bramberger) to interpret, instead of filling out the diary-log.
  - You will also be contacted (please indicate on the consent form if you prefer by email or telephone) during the course of the 2016 growing season on a bi-weekly basis by the student investigator (Bramberger) to assess the progress of the diary-log.
log as well as if there are any questions or concerns with the process of filling out information. This is expected to take no longer than 10 minutes per contact, whether by phone or email.

- Be asked the by the student investigator (Bramberger) if they may partake in observing the labour and specific tasks involved in succession planting of leafy greens via participant observation and field notes. It is expected that the student investigator will ask questions of the farmer and labourers about quantitative and qualitative aspects of this labour over the course of a designated harvest and planting time frame.
  - The intention is to partake in any labour involved, although should the participant not want to invest time in training the student investigator (Bramberger) then this will purely be a form of naturalistic observation.

- You are also invited to engage in a follow-up interview (max. 1 hour) at a later date when the diary-logs are picked up by the student investigator (Lucas Bramberger) to discuss their labour practices, organic farming methods and perceptions of local and organic farming in Ontario and Canada more deeply. Such follow up, like the diary-log, is entirely voluntary.

**Security and Confidentiality**

It is now normal practice at the University of Guelph to inform all study participants of their rights and our obligations. Please note the following items:

- There perceived minimal risks or discomforts associated with this research. This includes the potential discomforts of disclosing socio-economic information of your farming operation as well as sharing opinions about farming practices and methods of employment.
  - Questions are not intended to be prejudiced or presumptuous, you may decline to answer any questions or disclose specific information both in the diary-log and interviews.

- You will receive a $20 gift card for Tim Hortons as a thanks for your participation in the diary-log. The student investigator (Bramberger) requests that you sign the receipt for auditing purposes.

- Every effort will be made to ensure confidentiality of any identifying information that is obtained in connection with this study. All answers connected with the diary-logs and follow-up interviews will be used solely for the research purpose and your name will not be associated with your responses or released at any time. For this study, your identity will remain confidential.
  - Should you opt to not fill out the diary-log and provide existing data instead, you may black out and/or remove any unnecessary information that may act as identifier to you, your employees or your farming operation.
  - During the participant observation portion of this research, it is assumed that the only identifiers being described would be that your operation is a) organic
Your participation in the study is entirely voluntary and you may withdraw at any time without consequences of any kind. You may request to have your answers removed from the study. You may refuse to answer any question and still remain in the study. The researcher reserves the right to disregard your data should circumstances arise which require this.

The final results will be made available to participants electronically. Written form will also be available to interested individuals.

Interviews will be carried out where you choose to be most comfortable for identity and privacy protection. Should you consent, interviews will be audio-recorded on a device belonging to primary graduate student researcher and kept secure. This audio recorder is password-protected and has the capacity to be encrypted. Both options will be used throughout the research project.

The researchers (Bramberger & Fraser) will be the sole individuals with access to data collected. All electronic information will be kept on a password-protected and encrypted computer. Physical copies of consent forms will be kept in a secure, locked cabinet.

All diary-logs, supplementary data and audio files from interviews that may directly identify you, the participant, will be destroyed or deleted upon aggregation or transcription of information.

Audio files will be transcribed into a physical document. In doing so, quotes will be used verbatim in the final analysis, except all directly identifying factors will be made anonymous.

All data from diary-logs, supplementary data and transcripts will be coded according to participant and a physical master list of participants will be kept in a separate, secure location. The purpose of this list is for future contact with you, the participant. This list will be destroyed once communication with participants has ceased.

It is believed that there may be indirect identifying factors involved - for example: should your farm be sole grower of a particular product of all participants of this study. In the case of indirectly identifying content involved on your behalf, you will be notified about this and may request to have it removed from the study.

Should you request to review any information from the diary-log or interview, any direct identifiers or person or workplace will be removed. Security cannot be guaranteed if any information is sent electronically.

All remaining data will be destroyed and deleted upon publishing this research.

Rights of Study Participants

This project has been reviewed by the Research Ethics Board for compliance with federal guidelines for research involving human participants.

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• If you have any questions regarding your rights and welfare as a research participant in this study (REB # 16MR028), please contact: Director, Research Ethics; University of Guelph; reb@uoguelph.ca; 519-824-4120 ext. 56606.
• You do not waive any legal rights by agreeing to take part in this study.

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

Lucas Bramberger
MA Candidate
Department of Geography
University of Guelph, Guelph ON
lbramber@uoguelph.ca

Dr. Evan Fraser
Department of Geography
University of Guelph, Guelph ON
519 824 4120 ext 53011
Appendix D

Consent to Participate in Research: Diary-Log

Labour Requirements and Efficiency of Local, Organic Agriculture in Ontario

Continuing Contact with Researcher

If you consent, the main investigator (Bramberger) may contact you over the course of the growing season every two weeks to discuss the progress of diary-logs and to answer any concerns or questions.

I agree to be contacted about the diary-log, during the course of the 2016 growing season, in which I participate. (Please indicate preferred means of communication)

Yes ☐ No ☐

Email ☐ Phone ☐

Email:____________________

Phone:____________________

SIGNATURE OF RESEARCH PARTICIPANT

I have read the accompanying information letter provided for the study “Labour Requirements and Efficiency of Local, Organic Agriculture in Ontario”. My questions have been answered to my satisfaction and I agree to participate in the diary-log portion of the study. I have been given a copy of this form and the information letter.

________________________               ________________________          ___________
Name of Participant (Print)       Signature                    Date

________________________               ________________________          ___________
Name of Witness (Print)            Signature                     Date

If you have any questions or concerns about the research, please feel free to contact:
Lucas Bramberger       Dr. Evan Fraser
MA Candidate            Department of Geography
Department of Geography  University of Guelph, Guelph ON
University of Guelph, Guelph ON  519 824 4120 ext 53011
lbramber@uoguelph.ca
Consent to Participate in Research: Diary-Log - Supplementary Data

Labour Requirements and Efficiency of Local, Organic Agriculture in Ontario

The completion of this consent form signifies that you, the participant, are already accounting for yields, labour and/or area of your farming operation and opt to provide this information rather than filling out the diary-log provided by the student researcher (Bramberger).

SIGNATURE OF RESEARCH PARTICIPANT

I have read the accompanying information letter provided for the study “Labour Requirements and Efficiency of Local, Organic Agriculture in Ontario”. My questions have been answered to my satisfaction and I agree to participate in the diary-log portion of the study by providing records as opposed to filling out the diary-log provided by the researchers. I have been given a copy of this form and the information letter.

________________________               ___________________          _________
Name of Participant (Print)  Signature  Date

________________________               ___________________          _________
Name of Witness (Print)  Signature  Date

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

Lucas Bramberger  Dr. Evan Fraser
MA Candidate  Department of Geography
Department of Geography  University of Guelph, Guelph ON
University of Guelph, Guelph ON  519 824 4120 ext 53011
lbramber@uoguelph.ca
Consent to Participate in Research: Farmer Interviews

Labour Requirements and Efficiency of Local, Organic Agriculture in Ontario

Audio Recording

If you consent, interviews may be audio-recorded for purposes of preparing accurate summaries. All recordings will be stored securely on an encrypted mobile computer, and will be erased upon transcribing them. Participants will have the right to stop the interview at any time. They will have the right to review transcripts and to change/withdraw answers at any time until December 2016 when analysis will commence. You will be informed via email when this data is available for review.

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

SIGNATURE OF RESEARCH PARTICIPANT

I have read the accompanying information letter provided for the study “Labour Requirements and Efficiency of Local, Organic Agriculture in Ontario”. My questions have been answered to my satisfaction and I agree to participate in the interview portion of the study. I have been given a copy of this form and the information letter.

________________________               _____________________               ___________
Name of Participant (Print)               Signature               Date

________________________               _____________________               ___________
Name of Witness (Print)               Signature               Date

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

Lucas Bramberger               Dr. Evan Fraser
MA Candidate               Department of Geography
Department of Geography               University of Guelph, Guelph ON
University of Guelph, Guelph ON               519 824 4120 ext 53011
lbramber@uoguelph.ca
Consent to Participate in Research: Case Study

Labour Requirements and Efficiency of Local, Organic Agriculture in Ontario

SIGNATURE OF RESEARCH PARTICIPANT

I have read the accompanying information letter provided for the study “Labour Requirements and Efficiency of Local, Organic Agriculture in Ontario”. My questions have been answered to my satisfaction and I agree to participate in the case study portion of the study. I understand my employees, interns or family members directly involved in leafy green crop production may provide information to the student investigator (Bramberger). I have been given a copy of this form and the information letter.

_________________________________________  ___________________________  ____________
Name of Participant (Print)  Signature  Date

_________________________________________  ___________________________  ____________
Name of Witness (Print)  Signature  Date

If you have any questions or concerns about the research, please feel free to contact:
Lucas Bramberger  Dr. Evan Fraser
MA Candidate  Department of Geography
Department of Geography  University of Guelph, Guelph ON
University of Guelph, Guelph ON  519 824 4120 ext 53011
lbramber@uoguelph.ca
Appendix E

Table 4: Descriptive data of diary-log participants, which includes total calculated servings, compiled work hours, cultivated area, type of labour model, crop diversity as well as rates of production (servings/hour).

<table>
<thead>
<tr>
<th>Participant</th>
<th>Servings</th>
<th>Work hours</th>
<th>Cultivated area</th>
<th>Labour model</th>
<th>Servings/Hour</th>
<th>Crop Diversity</th>
</tr>
</thead>
<tbody>
<tr>
<td>F01</td>
<td>146525</td>
<td>5762</td>
<td>5</td>
<td>Intern/volunteer</td>
<td>25</td>
<td>19</td>
</tr>
<tr>
<td>F02</td>
<td>1074908</td>
<td>8988</td>
<td>12</td>
<td>Migrant</td>
<td>120</td>
<td>6</td>
</tr>
<tr>
<td>F03</td>
<td>374138</td>
<td>4002</td>
<td>11</td>
<td>Domestic</td>
<td>93</td>
<td>22</td>
</tr>
<tr>
<td>F04</td>
<td>158058</td>
<td>2413</td>
<td>10</td>
<td>Domestic</td>
<td>65</td>
<td>5</td>
</tr>
<tr>
<td>F05</td>
<td>15053</td>
<td>872</td>
<td>6</td>
<td>Family</td>
<td>17</td>
<td>22</td>
</tr>
<tr>
<td>F06</td>
<td>32220</td>
<td>1806</td>
<td>3</td>
<td>Intern</td>
<td>18</td>
<td>5</td>
</tr>
<tr>
<td>F07</td>
<td>12747</td>
<td>698</td>
<td>n/a</td>
<td>n/a</td>
<td>18</td>
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</tr>
<tr>
<td>F08</td>
<td>270931</td>
<td>9956</td>
<td>12</td>
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<td>27</td>
</tr>
<tr>
<td>F09</td>
<td>851380</td>
<td>2626</td>
<td>11</td>
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<td>1</td>
</tr>
<tr>
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<td>4558186</td>
<td>22207</td>
<td>120</td>
<td>Migrant</td>
<td>205</td>
<td>2</td>
</tr>
</tbody>
</table>

- Compiled work hours: total hours worked by participants.
- Cultivated area: area cultivated in square meters.
- Labour model: internal/volunteer, domestic, family, migrant.
- Servings/Hour: rate of production in servings per hour.
- Crop Diversity: number of different crop species cultivated. 

Note: Servings include total calculated servings for each participant.
Table 5 Descriptive data of participant observation participants - which includes total servings, servings/minute per task, rates of production (servings/hour) and labour model

<table>
<thead>
<tr>
<th>Data Categories</th>
<th>Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Farm 1</td>
</tr>
<tr>
<td>Servings</td>
<td>613.38</td>
</tr>
<tr>
<td>Servings/Minute (Planting)</td>
<td>2.01</td>
</tr>
<tr>
<td>Servings/Minute (Harvest)</td>
<td>0.71</td>
</tr>
<tr>
<td>Servings/Minute (Wash/Pack)</td>
<td>2.07</td>
</tr>
<tr>
<td>Servings/Minute (Mean)</td>
<td>1.60</td>
</tr>
<tr>
<td>Servings/Hour</td>
<td>96</td>
</tr>
<tr>
<td>Labour Model</td>
<td>Intern/Volunteer</td>
</tr>
</tbody>
</table>
Appendix G

Table 6 Comparison of required labour to estimated available labour - as designated by area parameter of the study. Available work forces were calculated according to min., max., median., quartiles and average rates of production from diary-log and participant observation data. Estimated available work forces were calculated according to total available agricultural labour by area, and proportional to farms reporting horticultural, certified organic and certified organic horticultural production (Statistics Canada, 2017d).

<table>
<thead>
<tr>
<th>Sector of production</th>
<th>Available labour</th>
<th>Estimated workforce</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Required Workforce</strong></td>
<td><strong>Total</strong></td>
<td><strong>Horticulture</strong></td>
</tr>
<tr>
<td><strong>Participant observation</strong></td>
<td>96</td>
<td>20</td>
</tr>
<tr>
<td><strong>Servings/ Hour</strong></td>
<td>7567</td>
<td>6511</td>
</tr>
<tr>
<td><strong>Minimum</strong></td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td><strong>1st Quartile</strong></td>
<td>17</td>
<td>6511</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>155</td>
<td>111</td>
</tr>
<tr>
<td><strong>3rd Quartile</strong></td>
<td>111</td>
<td>111</td>
</tr>
<tr>
<td><strong>Maximum</strong></td>
<td>7567</td>
<td>6511</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>1361</td>
<td>155</td>
</tr>
</tbody>
</table>
### Appendix H

Table 7 Calculated z-scores by labour model for both diary-log and participant observation data

<table>
<thead>
<tr>
<th>Servings/hour</th>
<th>Labour models</th>
<th>Z-score</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Diary-log (DL)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>DL - Family [1] (n=1)</td>
<td>-0.787</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>DL - Intern/volunteer (n=2)</td>
<td>-0.745</td>
</tr>
<tr>
<td></td>
<td>DL - Waged, Domestic (n=3)</td>
<td>-0.358</td>
</tr>
<tr>
<td></td>
<td>DL - Migrant (n=2)</td>
<td>0.330</td>
</tr>
<tr>
<td></td>
<td>DL - Family [2] (n=1)</td>
<td>2.149</td>
</tr>
<tr>
<td><strong>Participant observation (PO)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average</td>
<td>PO - Intern/Volunteer (n=1)</td>
<td>-0.928</td>
</tr>
<tr>
<td>Std. Dev.</td>
<td>PO - Waged, Domestic (n=1)</td>
<td>-0.131</td>
</tr>
<tr>
<td></td>
<td>PO - Migrant (n=1)</td>
<td>1.059</td>
</tr>
</tbody>
</table>
Appendix I
Calculations

1. Calculation of total servings (i)
   - \( i = (x_{n1}y_{n1} + x_{n1}y_{n1} \ldots x_{n1}y_{n1}) + (x_{j1}y_{j1} + x_{j1}y_{j1} \ldots x_{j1}y_{j1}) \)
   - Where:
     - \( x = \) serving requirements by age group
     - \( y = \) population size by age group
     - \( n_{1,2 \ldots 6} = \) female population by age group
     - \( j_{1,2 \ldots 6} = \) male population by age group

2. Required workforce (w)
   - \( w = \frac{(a/b)}{c} \)
   - Where:
     - \( a = \) total servings of fruits and vegetables required by Guelph on a daily basis
     - \( b = \) servings/hour
     - \( c = \) average Canadian agricultural work day in 2016 - 8.474 hours

3. Proportional calculation of labour (r)
   - \( r = \left( \frac{t}{u} \right) v \)
   - Where:
     - \( t = \) Total agricultural labour
     - \( u = \) Total reporting farms
     - \( v = \) Reporting farms by production

4. z-score standardization (z)
   - \( z = \frac{(b-m_{dl,po})}{\sigma_{dl,po}} \)
   - Where:
     - \( b = \) servings/hour
     - \( dl = \) diary-log
     - \( po = \) participant observation
     - \( m = \) average rate of servings/hour group dl or po
     - \( \sigma = \) standard deviation of servings/hour from group dl or po

5. Wilcoxon rank sum test
   - \( U_1 = n_1n_2 + \frac{(n_1(n_1+1))}{2} - R_1 \) and \( U_2 = n_1n_2 + \frac{(n_2(n_2+1))}{2} - R_2 \)
   - Where:
     - \( U = \) test-statistic
     - \( R = \) sum of ranks
     - \( n = \) sample size