Between field and table: environmental implications of local food distribution

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Abstract: Local food has been championed as a sustainable alternative to the industrial food system for many reasons, including a perceived environmental benefit through an expected decrease in the energy needed for transport from farm to market. The environmental benefit of local food, however, has been clouded by questions surrounding the energy footprint of small-scale distribution methods that do not enjoy economies of scale. Several studies have found local food to be as energy intensive as imported food due to very inefficient distribution methods; a case study of a Calgary, Canada restaurant, explores this issue. A description of FoodRoots, a local food distributor in Victoria, Canada, with a mandate to promote a local sustainable food system by creating the infrastructure link between consumers and growers and processors, illustrates one method of addressing this problem. Their 'Pocket Markets' represent a less energy-intensive distribution method for local food.

Keywords: sustainable food; local food; EF; ecological footprint; food distribution; farmers' markets.

Reference to this paper should be made as follows: Newman, L., Ling, C. and Peters, K. (2013) 'Between field and table: environmental implications of local food distribution', *Int. J. Sustainable Society*, Vol. 5, No. 1, pp.11–23.

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1 Introduction

Though the industrial food system has a near monopoly over the agricultural industry, real questions concerning the safety, security and sustainability of the industrial food system are being raised. The 'modern paradigm' of low prices, large quantities, homogenous products and simple purchase process has led to a system of high complexity that has been criticised for creating increased distance between producer and consumer (Nosi and Zanni, 2004). Organic and local foods are gaining in popularity, often through claims of improved taste, improved nutritional value and lower environmental footprint. Though, initially, a European trend, local food has become popular in other countries as well, including our case study region of Western Canada which saw a large increase in local interest in local food as shown by such publications as the '100 Mile Diet' (Smith and MacKinnon, 2007). The text, which follows a couple as they attempt to eat locally for a year, strongly encourages local production as a way of achieving environmental and health benefits and as a building block of sustainable communities. As has been argued elsewhere, short supply chains are 'in vogue' (Maye and Ilbery, 2006).

One of the central pillars of these shorter supply chains is the farmers' market. Farmers' markets have played a key role in the renaissance of local food. Defined as "a market at which farmers, growers or producers from a defined local area are present in person to sell their own products directly to the public" (Archer et al., 2003), farmers' markets are expanding to new areas; the number of farmers' markets doubled in the USA, e.g. between 1980 and 2000 (Griffin and Frongillo, 2003). Consumers seeking local food favour farmers' markets over traditional supermarkets primarily as the markets are seen as more 'trustworthy', particularly in cases where the farmer sells directly to the public (Winter, 2003). Local food is also seen as an important component in the construction of sustainable communities, creating local jobs and a sense of place through what has been called the 'rhetoric of terroir' (Meile and Murdoch, 2002). The need for this reconnection between producer and consumer is well documented; e.g. research by Dillon et al. (2005) found that most school children cannot name a single crop grown in their area.

The term 'local' has been applied in many ways: referring to products coming within a certain radius, e.g. or coming from within a geographical or political region as defined by the Slow Food Movement (Meile and Murdoch, 2002). The value of local food production has long been argued; it was trumpeted in 1898 (Howard, 1898 (1965 reprint)), and the term 'foodshed', which is in common usage today, was coined in 1929 by Walter Hedder, chief of the Bureau of Commerce of the Port of New York Authority (Pothukuchi and Kaufman, 1999) and repopularised by Arthur Getz. Getz used the analogy of the watershed to describe the specific area where our food comes from in a regional context. The term was adapted to describe the food-producing farms of a region because it implies that the area is a valuable resource that needs protection. Local food has been described as a bellwether for broader environmental concerns. As DeLind notes

> "local Food and local eating become both the symbol and substance for structural change from which flow enormous social and environmental benefit." (DeLind, 2006, p.123)

The concept of a foodshed combines well with the larger idea of bioregionalism, which stresses the need to live 'in place'.

The popularity of local food, however, has created some difficulties. In many locations, including Toronto, Canada (Honey, 2008), the number of local farmers is not sufficient to provide the needed face-to-face presence associated with traditional farmers' markets. Markets can be a burden for farmers (Griffin and Frongillo, 2003) as they involve a large time and travel commitment for an uncertain financial outcome. The popularity of local food in general and farmers' markets in particular has also led to a more careful critique of the claim that local food has a smaller environmental footprint due to short transport chains. The concern over the length of the food supply chain is well documented (Lockie et al., 2002), with examples such as the lettuce with 50 calories that takes 400 calories to grow and 1,800 calories to ship from California to New York (Raeburn, 1995, p.199) being widely discussed.

The industrial food system is certainly transporting food products over larger and larger distances (Wallgren, 2006); e.g. between 1970 and 1990, the average distance that food travelled doubled in Germany (Borge, 2001). An early theoretical study suggested that a 15-fold savings in carbon emissions could be achieved through local production (Halweil, 2002); some 817 million tons of food are shipped around the world each year, consuming an enormous amount of energy. It is presumed that the shorter the distance travelled by our food products, the less energy will be consumed, and therefore fewer emissions released; however, more recent studies suggest that energy and emission savings are dependent on the growing method and most importantly on the efficiency of the transport to market. A Swedish study showed that for a small-scale market and for farm-gate sales, there was no energy saving over the industrial food system, except for some varieties of fresh fruit and vegetables sold during their growing season (Wallgren, 2006). European examples confirmed this puzzling result, demonstrating that energy use in the current system of small rural markets studied was about the same or higher as energy used in the industrial system (Van Hauwermeiren et al., 2007). However, these studies reported clearly that the problem was the inefficiency of individual customers driving to the farm or to a rural market to pick up food, or in the urban cases, with individual farmers transporting small amounts of food in private vehicles to urban markets. If local food becomes common and increase the volume of goods sold in this manner, significant energy savings could be realised as the amount of food being transported reaches levels where transport efficiencies begin to take effect (Stagl, 2002; Van Hauwermeiren et al., 2007).

The role of cities in sustainable development is critically important as cities serve a creative role in our society (Bithas and Chrsitofakis, 2006), acting as sites of diffusion for new ideas. A key urban site of diffusion for sustainable food options are restaurants willing to take on an educational role through the open utilisation of local products. The study described in this paper explores in detail the quantitative 'foodprint' of local food, and the further case study that follows suggests how an alternative distribution system for local food might function.

This study first uses a case study (Yin, 2003) to explore the foodprint of a local food system, and through the process of the case study, draw out other issues relating to local and direct market food systems, supporting some assertion found in other research (Van Hauwermeiren et al., 2007; Wallgren, 2006) that local food systems are perhaps not as clearly more sustainable as more established food systems, in contradiction to what a number of sustainable food advocates would suggest. The study then introduces an alternative model of local food distribution that may serve as a solution to some of the concerns raised by the foodprint analysis described below and other research.

2 River Café: a case study

River Café is a mid-size restaurant in the city of Calgary, Alberta. River Café is a fine dining restaurant in Calgary, Canada and is dedicated to supporting local farmers and ranchers in its foodstuff purchases. Described by proprietor Sal Howell, "This philosophy for seasonal and regional ingredients has expanded over the years of our operation into a philosophy committed to promoting sustainability in the kitchen and beyond" (2008 personal interview). The foundation of the focus on regional ingredients is rooted in the chef's belief that products grown locally and naturally simply tasted better. As the restaurant philosophy evolved, the focus on regional ingredients broadened to include the environmental benefits of buying locally. In 2005, this philosophy further expanded to include some of the social and economic sustainability characteristics of supporting the local food system.

The research project utilises ecological footprint analysis (EFA) as an ecological accounting tool for food purchases, and refers to the corresponding footprint as a 'foodprint'. The term foodprint is used to help visualise dependency on natural resources, the land area and the ecosystem services needed to produce and transport food (Johansson, 2005). The main substantive difference between a footprint and a foodprint is that the latter only considers land areas required for growing and transporting food (Wilson and Anielski, 2005).

Based on the principles of the ecological footprint (EF), the corresponding foodprint can be used as an indicator of food system sustainability. Restaurants are capable of introducing foods and influencing consumer choice by highlighting specific ingredients on menus. For many consumers, the first exposure to local ingredients is through restaurants, which highlight regional farm ingredients by identifying the farm with the corresponding ingredient on the menu. In addition to this, restaurant chefs are trained in culinary recipe and preparation techniques that can elevate local ingredients, such as heirloom carrots, to celebrity status.

Developed by William Rees and Mathis Wackernagel of the University of British Columbia in the early 1990s, EFA is a method used to measure human demand on natural resources. The premise behind EFA is that human beings require the biological services of the Earth to produce the goods needed for survival. This study uses the component-based method for calculating, what in this case is, the foodprint. This approach separates consumption into a series of categories, such as food, housing, transportation, services, waste and consumer goods. Each category can then be subdivided into more detailed components, from which a foodprint can be calculated using life cycle data, which trace the components from resource extraction to waste disposal. A component-based approach facilitates a detailed breakdown of regional consumption patterns using data appropriate for the organisation under study (Chambers et al., 2000). The component-based model of foodprinting highlights the differences in consumption patterns. In the case of this research, a component-based approach will potentially illustrate any difference in the environmental impact of purchasing local vs. imported food products.

A note of caution is that it is widely acknowledged that the accuracy and detail of the data used is typically quite low, and the resulting accuracy of any footprint analysis is deemed to have a 20–30% error margin (Chambers et al., 2000; Wackernagel and Rees, 1996). One reason for this error margin is the limited life cycle analysis information

available for many products. This lack of data contributes to questions in the accuracy and comparability of studies.

Calculating the foodprint for the River Café included the following steps:

Scale of analysis and data set: the food purchased by the restaurants in March (a time of scarcity) and August in 2007 (a time of abundance) was obtained. These data were categorised and presented as a matrix according to the analytical model described by Wackernagel and Rees (1996) and Chambers et al. (2000). The data derived the amount of food purchased in kilograms. Data on delivery methods were obtained by interviewing the farmers that supply the restaurant.

Derivation of foodprint multipliers: food purchased was categorised into seven groups: grains, produce, fish, meat, beef, dairy and cheese. The amount of land required to produce that mass of food for each category was calculated from data published in Chambers et al. (2000). Food category mass (kg) is divided by land requirement (m^2) to obtain a footprint multiplier. This is then multiplied by 0.0001 to convert the land area from m^2 to hectares.

Derivation of energy land requirements (the amount of land needed to sequester carbon generated in transportation of the food) (Wackernagel and Rees, 1996): Transport energy = 2 × distance × fuel efficiency × 2.4 kg CO_2. Distances were obtained from distance tools in the MapQuest tool (www.mapquest.com). Fuel efficiency was based on Transport Canada (2006) data for small, medium and large trucks. It was assumed that small trucks and vans are used for local deliveries, medium trucks are used for regional transport, and it was assumed that large trucks are used for long-distance transport. Each litre of fuel in a road vehicle generates 2.4 kg of CO_2 (Natural Resources Canada Office of Energy Efficiency, 2011). For air freight for international produce only the one-way distance was used, and a fuel efficiency of 0.5 kg of CO_2 per litre was used (Chambers et al., 2000; Smith et al., 2005). The average annual assimilation rate in tonnes per hectare for CO_2 is 1.8 or 1,800 kg (Wackernagel and Rees, 1996, p.74). Therefore, to determine the energy land needed to sequester the transport CO_2 emissions, transport energy is divided by 1,800 kg.

Global hectare equivalence and biodiversity consideration: the energy land value is adjusted based on each land type (cropland, pasture, forest, energy land and bioproductive sea space) according to the biological capacity globally. This allows for global comparison of the results. The results are further adjusted by 14% to allow for space for biodiversity to be maintained. This then creates the ability to add the various components of the foodprint together to create an aggregate foodprint that can be compared with others (Chambers et al., 2000; Wackernagel and Rees, 1996).

In addition to the quantitative data used to derive the foodprint, suppliers to the restaurant were interviewed to determine their distribution methods and their attitudes to direct marketing.

3 Results

Calculating a foodprint using the component approach provides a detailed breakdown of production and transportation environmental impacts for each food item. The analysis

shows that River Café has a foodprint of 177.04 global hectares for food purchased during March 2007, and a foodprint of 288.92 global hectares for food purchased during August 2007. The foodprint encompasses the land required to grow and produce the food purchased, as well as the land required to assimilate CO_2 emissions produced from transport.

The variance in the two foodprints is less meaningful as a comparison due to increased business levels in August compared to March. The foodprint becomes more meaningful and can be analysed more accurately when it is examined as per guest (5,009 in March, 12,703 in August) footprint figure. The foodprint per guest in March 2007 was 0.04 global hectares. The foodprint per guest in the month of August 2007 was 0.02 global hectares. The majority of this foodprint is from the transportation of the food, rather than from the production of the food. In March, the transport share of the foodprint was 0.023 global hectares per guest and 0.012 global hectares per guest in August.

The expectation is that the shorter the distance travelled from farm to consumer, the less implication transport emissions have on the environment. However, the results of this study did not entirely support that hypothesis. Although the aggregate foodprint per meal in August 2007 was 0.02 ha, half of the March 2007 per meal foodprint of 0.04 ha; this is not as large of a drop as expected given the difference in the percentage of local food available. These results show a foodprint in order of magnitude higher than those of the study conducted by Baynham and Dalton (2005) of the Pendulum Restaurant in Vancouver, British Columbia, which derived as per guest foodprint of 0.003 global hectares. This may reflect the importance of geographical distances, such as climate and growing season, and the proximity of restaurant to producers.

Of the farms contributing produce to the restaurant eight out of ten delivered their products to River Café in a personal cargo-type vehicle. The other two farms utilised a local distributor to transport their products. Three of the farms are located within a 100 km distance of River Café, and five of the farms are located further than 100 km away. According to Wallgren (2006), "the effect of the short distances is in many cases counteracted by the low loading capacity" (p.247), meaning the small inefficient vehicles to carry small loads delivered by individual farmers to individual purchasers offset the perceived gains of local food. The data from the River Café study show that despite the August supply chain being 95% more local, the reduction in foodprint in only about 50%.

There are transport efficiencies resulting from the larger distribution network utilised by the conventional food system. These networks typically consolidate many different products coming to Calgary from faraway places, and wholesalers then deliver food products from a central warehouse to the restaurant once or twice a week. So the imported foods often travel great distances to reach the restaurant, the logistics are very efficient. If the energy land footprint is compared for items imported from California and items purchased locally, the footprint for imported items is invariably larger. However, the energy land footprint for the month of August is much higher than anticipated given the increase of local food purchased. As a restaurant operates at a higher volume than what is purchased by individuals, the numbers are not quite as bad as those in the European studies of individual purchases. However, they still suggest that local food should not be assumed to be low energy.

4 Discussion

This analysis suggests that given the short distances foodstuffs travelled from farm to consumer, the transport foodprint of local food products in Calgary was much higher than data reported from Vancouver, and although though it was smaller than that for imported products (as evidenced by the difference between March and August foodprints), it was not as low as may have been expected. One explanation for this finding is the inefficient distribution logistics utilised by the local food system. Imported food products may travel farther to reach consumers, but food products are consolidated for transport in large trucks, so fewer trips from farm to consumer are made. Local farmers are most often not part of a larger distribution network that might utilise more organised and efficient transport logistics for delivering products.

The farmers in this study utilised direct marketing and deliver the food products to the restaurant themselves, often making several trips a week from farm to urban centre. Instead of large quantities of food transported in a small number of large transport trucks, the local farmers make many small deliveries utilising private vehicles. Furthermore, with a delivery frequency of several times a week to ensure optimal freshness, there are implications in the form of increased CO_2 emissions.

The transport footprint results from this study highlight that any sustainability benefits from purchasing local food could be outweighed by the environmental impact of the transport footprint supporting the assertions of Wallgren (2006). A switch to a more efficient method of distribution could decrease emissions and the transport footprint of the local food system. How a food product travels is just as important as how far that food product travels when considering environmental impact. The studies by Wallgren (2006) and Van Hauwermeiren et al. (2007), both focused on farmers' markets, where individual farmers brought small quantities of food to market over large distances on a regular basis.

Distribution plays a large role in how much energy saving is actually realised. Additionally, farmers indicated in the interviews that the delivery of products from farm to restaurant was a significant challenge and barrier to supplying to the Calgary food system. For these two reasons, delivery logistics have significant environmental and social implications for the local food system. Restaurants with an interest in directing purchasing power to minimising the environmental impact of food choices need to look further than distance from farm to restaurant and production practices. Encouraging farmers to consolidate deliveries coming from nearby farms or the same region would be a strong step towards reducing the transport footprint. However, a much more coordinated approach is needed to address this issue.

4.1 FoodRoots: a better distribution system?

Though factors of flavour, nutrition and community building are compelling, the studies showing the energetics of local food are not as favourable as imagined suggest that alternative models of distribution need to be explored. Such models could also be of benefit to farmers who cannot afford the time or risk of poor sales associated with direct attendance at farmers' markets. One such model has been developed in Victoria, British Columbia. FoodRoots is a coop distributor of local, naturally grown produce and foods processed in the Victoria region. Their vision statement gives three goals: to promote a local sustainable food system by creating the infrastructure link between the

eaters/consumers and the growers and processors in the region, to promote sustainable food grown and processed in the region and to educate eaters/consumers about local agriculture and food security issues. Details can be found at http://www.foodroots.ca.

We examined the FoodRoots using a simplified case study approach that involved visits to multiple Pocket Market locations and informal unstructured interviews (King, 1994; Robson, 2002, p.270) with both market users and with FoodRoots organisers during the summer of 2008. The purpose of the simplified case study method was not to be analytical but to describe, for discussion purposes, an alternative distribution model that attempts to address the concerns identified above (multiple inefficient road trips to deliver fresh local produce, time demands for farmers) without reducing the ability of consumers to access local, fresh produce.

FoodRoots holds travelling farmers' markets called Pocket Markets that maintain the community and intimacy created by the traditional farmers' market but eliminates the needs for many farmers to travel to a central site (and by bringing the market to the consumer also limits the carbon footprint of the customer as well). The aim of Pocket Markets is to provide neighbourhood scale access for communities to sources of local fresh food. The objective is to improve the health and access to good food for urban communities, and to increase the opportunities for small-scale independent producers to urban markets. The Pocket Markets are set up on a regular basis at university, work and community places. An initial pilot market was set up in partnership with the Vic West Residents Association (http://www.victoriawest.ca/) in 2005 as a trial 14 week run, then permanently as a weekly market in 2006. The main problem with it was the wastage of goods, that if not sold had to be disposed of. The single pocket market lacked refrigeration facilities on site and had no means of storage for the week between markets that would keep produce fresh. This market was started as part of an ongoing commitment by FoodRoots to local food and food security by members of the association stretching back many years – the main idea was to act as distributors for local farmers rather than expecting them to come and sell their goods themselves. Previous projects meant that established networks already existed between the association and the producers – this development was therefore fairly easy to organise, and other than a lack of storage for unused food, was a success. This prompted the expansion of the idea to other locations in the city. Start-up funding was provided by VanCity, the Vancouver Island Health Authority and Vancouver Island Feast of Fields.

According to the Lee Fuge, the coordinator of FoodRoots, Pocket Markets are designed to increase the linkages for food grown by local producers to local consumers. It is different to the more conventional farm gate and farmers' market mechanisms by which smaller producers typically sell their produce. The aim is to enhance the region's food security by stimulating, improving the prospects for and encouraging small and local producers. The distribution network and markets are run in partnership with a number of other not-for-profit organisations, such as the Island Chef's Collaborative (http://www.iccbc.ca/public/index.html), a group of local restaurant chefs seeking to improve and protect the local supply of high end and organic produce; share organics (http://www.shareorganics.bc.ca/), a growers cooperative that has previously (and still) mainly distributed via a organic food box programme; and Lifecycles (http://lifecyclesproject.ca/), a social justice NGO that focuses on access to healthy food. Produce sold in the market consists of mainly fresh fruit and vegetables, but also includes higher value groceries, such as bakery products, cereals, jams, chutneys and pickles, etc.

Some markets also sell eggs, although the extent to which they can do this effectively is limited by the need for refrigeration at the point of sale.

Typically, farmers' markets and at-gate sales are the only practical sale points for small producers. As has been noted elsewhere, this results in many journeys by small vehicles and can represent a significant time commitment by the producer. The Pocket Market (for a small collection fee) picks up produce direct from the farmers, and encourages cooperation amongst producers in order to minimise the transportation costs (both financial and environmental) (Fuge, personal communication). This increases social capital and networking amongst farmers as well as increasing their access to nearby urban markets.

In order to provide stable and consistent selection, produce on offer is supplemented with goods sourced from a major organic distributor in the Lower Mainland that distributes produce to the region from North and Central America (thus allowing the sale of fresh produce in the winter and a selection of more exotic produce at certain times) as well as producers located in the Fraser Valley and elsewhere in BC. However, wherever there is a local alternative for a particular product, this is supplied by the Pocket Market regardless of cost. Where necessary the cost to the consumer is subsidised by profits made on the less local produce in order to maintain price points acceptable to the widest range of customers possible (Fuge, personal communication).

As the network of markets expanded, the turnover of produce increased; the increase in number of markets (up to 16 in a single week) means that produce not sold one day can be sold the next – reducing wastage – and through economies of scale solving the problems associated with the single pilot market in Vic West. This in combination with the increase in volume of turnover, and partnership with Saanich organics box program has led to the purchase of the refrigerated van and lease of refrigerated storage – this has significantly reduced waste and increase operational efficiency.

Prior to these developments, the food was stored in a variety of personal and community kitchens where FoodRoots borrowed space from organisations sympathetic to the goals of the markets. The progressive increase in refrigeration does a number of key things. Firstly, it increases the capacity of the network, allowing more Pocket Markets to occur as more stock can be held at any one time. Secondly, because it increases, the longevity and stock wastage from unsold items decreases. Finally, as produce can be collected from farmers a few days in advance of sale, collection and distribution are made more efficient, reducing the time and transportation requirements to supply the markets.

The markets have been situated according to invitation – every single location has been selected based on organisation approaching the market and asking them to provide a service. Some locations are weekly, others every other week – some more infrequently, or even as one-off occasions to tie in with events. These locations vary from the workplaces of private companies, educational institutions, recreation centres and provincial and municipal government facilities (although interestingly not the Ministry of Agriculture – one of the few examples of a Pocket Market that has been withdrawn through lack of interest). Some of these are open to the public; others are for the benefit of building users and occupants only.

Although the Pockets Markets are supported by not-for-profit organisations, they are, according to Lee Fugue, run as a business, and government grants are considered as investment. The long-term aim is to become self-sustaining. Although the business is not yet making a profit, the access to local food in the city is increasing and most market sites have proven sufficiently popular to maintain in the short and medium term.

The organisers predict that the business will break even with a 'reasonable time scale' and within the 'normal limits of other new business ventures' (Fugue, personal communication).

One of the obvious ways in which Pocket Markets fail to match the traditional scope of farmers' markets is in the lack of face-to-face meetings between producers and consumers. Although not started specifically to address this lack of meeting at the Pocket Markets, FoodRoots also hosts a monthly local food community dinner which, in addition to raising funds to support food-related projects in the Capital Regional District, profiles local producers and creates the space where producers and the communities they serve can meet.

The FoodRoots project decreases the carbon footprint of the local food it provides by adding a distributive function between farmer and consumer. Farmers do not have to make individual trips to markets, saving fuel and time; as well, the consumer does not have to travel to the food as it arrives at the consumer's place of work or study. In short, all of the very energy-intensive car journeys are removed from the delivery system, a key element in the attempt to make our communities more sustainable. Williams and Dair (2007) identified the need to make fewer and shorter journeys as a central element of neighbourhood level sustainability; Alker and McDonald (2003) also identified the need to reduce travel. Pocket Markets are one method that may address this issue in a sustainable way and certainly warrant further comparative study.

In addition, one of the interesting aspects of the FoodRoots project that we noted was its diverse appeal; people use FoodRoots because it comes to them and their demographic includes those would not otherwise be as exposed to local food. For the concept of local food production and consumption to be a viable alternative to industrialised food production for more than a few members of a community, it must demonstrate the ability to diffuse into the broader population; an example of the process of sustainable development at work. As Springett and Foster (2005) noted, implementation of sustainable development requires opportunities at all levels of society.

Incremental adoption of sustainable development only occurs if sustainable innovations, such as local food production, can move beyond isolated specialty markets. FoodRoots is encouraging what is known as 'niche accumulation'. This refers to the adoption of new technologies within specific sets of environments or circumstances in which they enjoy an advantage due to local conditions, allowing them to spread to other similar niches. Niches protect new ideas from early rejection (Raven, 2007). Given a willing audience, as Raven points out, this can lead to niche branching in which the idea spreads to a larger, less-specialised niche. Ideas and concepts spread through the process of diffusion. In the foundation text on diffusion, Rogers (1962) claims ideas must have trialability and observability. The FoodRoots Pocket Markets achieve these requirements by coming to the workplace and bringing new people to local food.

5 Conclusion: local food as a growing and viable alternative

As local food grows in popularity, there is a need for qualitative and quantitative study to be sure that assumed benefits, such as lower carbon footprints, are actually realised. The River Café case study suggests that there are both environmental and social flaws in the lack of transport efficiency within the local food system. The FoodRoots Pocket Market model demonstrates a potential solution of a local food distribution model that increases

transport efficiencies and reduces the time a farmer needs to spend on direct marketing; it is not too much of a stretch to imagine a system such as that supplied by FoodRoots being used to supply a group of restaurants in addition to a series of Pocket Markets.

What is clear that farmers cannot personally deliver and sell every item of local food as it is not practical from either an environmental or personal labour point of view. For the concept of local food production and consumption to be a viable alternative to industrialised food production for more than a few members of a community, it must demonstrate the ability to diffuse into the broader population by embracing a diversity of models. The struggle is to enable some of the possible efficiencies without losing the other benefits of local food. This is not an argument against farmers' markets (one could imagine farmers carpooling to improve transport efficiency and reduce costs); it is a reminder that if local food production is going to be a long term, sustainable solution for more than a very few members of the population, it will likely require a scale somewhere between industrial agriculture and individual consumers driving to a stand at a farm gate.

Acknowledgements

We would like to acknowledge the support of the Social Sciences and Humanities Research Council of Canada.

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