# Fighting Global Warming at the Farmer's Market

## The Role of Local Food Systems In Reducing Greenhouse Gas Emissions

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***A FoodShare Research in Action Report***

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**At FoodShare we work on food issues "from field to table" - meaning that we focus on the entire system that puts food on our tables: from the growing, processing and distribution of food to its purchasing, cooking and consumption.**

**We operate several innovative grassroots projects that promote healthy eating, teach food preparation and cultivation, develop community capacity and create non-market-based forms of food distribution.**

**Public education on food security issues is a big part of our mandate: we create and distribute resources, organize training workshops and facilitate networks and coalitions.**

**We believe that food is vital to the health of individuals and communities, and that access to good, healthy food is a basic human right. FoodShare promotes policies - such as adequate social assistance rates, sustainable agriculture, universal funding of community-based programs and nutrition education - that will make food a priority at all levels of society.**

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*Fresh produce for sale at a Toronto farmer's market*

The concept of "food miles" --the distance our food travels from point of production to point of consumption and the environmental impact of getting it there--is an important quantitative analysis tool for food security. As we move onward in the 21st century, working toward food security requires not only addressing access to healthy food by people of diverse income levels, but also ensuring that food production and distribution occur in an environmentally sustainable and economically viable manner.

The continued use of massive quantities of petroleum, both in the production of synthetic fertilizers and machinery used in food production and in transporting our food across the globe, is clearly unsustainable. Not only is oil a finite natural resource, but greenhouse gas emissions from a petroleum-based food economy also contribute to air pollution, related health problems, and global warming. This report examines the production of greenhouse gases through globalized food transport and suggests that all levels of Canadian government should take a more active role in supporting more sustainable food economies.

There are significant ecological barriers to Canada becoming completely self-sufficient in food production. However, a visit to a Toronto farmer's market at the end of November of 2003 revealed that even this late in the season, a diversity of fresh, locally grown food items were still available. We compared transport distances, energy consumption, and carbon dioxide ($CO_2$) emissions from seven locally produced items and equivalent imported items. Our findings were quite shocking: carrots from California, for example, travelled 59 times further than carrots sourced from a farm near Hamilton. While a half a kilogram of local lamb generated seven grams of carbon dioxide through transportation, the same quantity of fresh New Zealand lamb yielded over eight kilograms!

This report discusses the methodologies of calculating food miles, the findings of our study, and the study's limitations and implications. First, however, we examine the issue of food transportation within the broader context of global warming and Canada's strategy for reducing greenhouse gas emissions.

## Canada in the Context of Global Warming

Global warming is upon us. The so-called greenhouse gases (GHG) which are in small quantities naturally occurring and necessary for life on earth have risen dramatically in recent years, causing the temperature of the earth's atmosphere to rise. Research shows that carbon dioxide ($CO_2$) concentrations that had remained stable for 10 000 years have risen by 30% since the industrial Revolution.[1] As a result, scientists project that the global average temperature will rise an estimated 1.4 to 5.8 degrees Celsius by the year 2100,according to the United Nations Framework Convention on Climate Change.[2]

In northern environments, the effects of climate change are expected to be more pronounced than this global average. Canada has already experienced some of the effects of global warming: declining water levels in the Great Lakes and an increase in extreme weather such as droughts, ice storms, and heat waves, for example.[3] Such volatile weather patterns impact heavily on farmers who rely on good weather to produce the food we eat. Moreover, the smog that results from GHG emissions and associated health problems affects us all. Farmers in southern Ontario experience $70 million in crop damage each year due to smog, [4] while an estimated 16,000 Canadians die prematurely each year due to air pollution. [5]

Serious commitment and cooperation are needed at the global, national, regional and local level. The 1997 Kyoto Protocol commits participating industrialized nations, including Canada, to reduce their greenhouse gas emissions to at least 5% below 1990 levels by 2008-2012. The Canadian government's *Action Plan 2000 on Climate Change* states the federal government's intention to invest $1.1 billion over the next five years on initiatives aimed at reducing GHG emissions. The 2002 *Climate Change Plan for Canada: Achieving our Commitments Together* builds on the *Action Plan* by establishing a "made in Canada" approach to reducing greenhouse gas emissions by 240 megatonnes*. [6]

Canada's *Climate Change Plan* seems, on cursory review, to be a comprehensive document. Its instruments for making Canadians "the most efficient consumers and producers of energy in the world include building partnerships between different levels of government, non-governmental organizations (NGOs), and the private sector; making strategic investments; and using "targeted measures" like information, incentives, regulations and tax measures. The Plan's seven "action areas" include transportation; housing and commercial/institutional buildings; large industrial emitters; agriculture and forestry; renewable energy; and the international market.

A closer look at Canada's anti-global warming strategy suggests that Canadian resources might be spent more effectively if we are to make a real difference in reducing GHG emissions. While one might expect our strategy to focus on curtailing our own emissions, the largest share of Canada's greenhouse gas emission reductions (twenty-five percent) come not from undertakings within our borders, but rather at the international level. [7]

One way that reduction commitments are to be achieved is through the Clean Development Mechanism (CDM) of the Kyoto Protocol. Under this mechanism, emissions credits are obtained through public or private foreign investment in renewable sources of energy. While companies must demonstrate that their foreign investments reduce emissions below a "business as usual" baseline, critics have expressed concern over the fact that these investments may nevertheless be made in unsustainable projects such as large-scale hydro-electric dams. [8]

* One megatonne or MT = one million tonnes

While foreign investments in sustainable technologies are becoming increasingly important in the struggle to combat global warming, there is much that can be done to this effect within our own borders. Transportation accounts for one quarter of Canada's energy consumption[9] and produces one quarter of our greenhouse gas emissions, more than any other sector of the economy. Without further action, transportation emissions could rise to 206 MT, 32 percent above 1990 levels, by 2010. [10]

Just under a quarter of transportation emissions in Canada result from trucking, with about a third resulting from air, marine, rail and truck transport combined. Freight activity is projected to increase 60 percent by 2020, [11] and trends suggest that the increase may not occur by the most sustainable means. While energy consumption was on the rise in the air and ground transport sectors between 1991 and 1996, fuel consumption from the less polluting transportation modes, water and rail, actually decreased during this period. [12]

Despite the prominent role that transportation plays in contributing to greenhouse gas emissions in Canada, Action Plan 2000 states that only ten percent of our emissions are to come from reforms in the transport sector. The 9 MT of transport-related emission reductions that resulted from the first phase of Canada's climate change strategy do not even constitute a third of what Canada claimed in greenhouse gas deductions through carbon sinks in the agriculture and forestry sector. The latter 30 MT claim, moreover, was made under the premise of "business as usual," that is, made without any change in pre-Kyoto government policy. [13]

Of course, reducing greenhouse gas emissions requires more than simply privileging local solutions over global ones, since the problem itself is of international nature. In *Stopping the great food swap: Relocalizing Europe's food supply*, Dr. Caroline Lucas makes the point that traditional measures of national energy consumption do not consider the environmental costs of the production and transportation of goods to the importing country. Because "transport-related carbon dioxide emissions associated with international trade by sea and air are not included in national inventories and targets," Lucas reminds us, "(t)here is no incentive to reduce emissions from international transportation." [14]

Given the paucity of international data on GHG emissions from the transportation sector, national figures can be an important starting point. Unfortunately, information on the percentage of domestic Canadian transportation devoted to food and agriculture is currently unavailable. If statistics from Europe are any indicator, though, food transport is a significant environmental problem. From one-third to 40 percent of all road freight in Britain moves food.[15] Air freight, the most polluting form of transportation, grew by seven percent a year during the 1990s in England and is expected to rise 7.5 percent each year through 2010.[16] By weight, fruit and vegetables form the largest category (13 percent) of goods imported by air into the UK. In the absence of data on food transport in Canada, the use of Food Miles as a tool of analysis is helpful in understanding the relationship between global warming and a global food economy.

There are multiple methodologies for measuring food miles. Perhaps the most comprehensive one was that pioneered by Annika Carlsson-Kanyama, the Weighted

Average Source Distance (WASD). The U.S.-based Leopold Centre for Sustainable Agriculture used this methodology in its 2003 report "Checking the food odometer: Comparing food miles for local versus conventional produce sales to Iowa Institutions." The WASD calculates a single distance value that incorporate information on the weight of the food item and the distances between point of production and point of sale, based on the formula,

$$\textbf{WASD} = \frac{\textbf{Sum of } (m(k) \times d(k))}{\textbf{Sum of } m(k)}$$

Where: k=different points of production m=amount (weight) from each point of production, and d= distance from each point of production to each point of use or sale

The WASD is a useful indicator for the distances that our food travels because it incorporates data on all possible sources from which a given agricultural commodity may be produced. For its study, the Leopold Center used information from sales transactions for its locally-produced sample. For its conventionally produced sample, the Center used the United States Department of Agriculture's Agricultural Marketing Service data on produce arriving at the Chicago and St. Louis food terminals in the U.S. One-way distances from point of production to point of consumption were calculated using the internet site www.mapquest.com.

In the event that the data sufficient to calculate WASD are not readily available, an alternative methodology may be used. While the method used in this study does not produce an average distance, it is still a useful alternative because it allows us to compare both the distance traveled by particular food items and the environmental impact of their transportation.

For our study we selected and sourced seven food items on sale at the Dufferin Grove Farmer's Market in Toronto on November 20th and 27th, 2003. The points of origin for these items were obtained by asking the farmers who sold them where they were produced. The items were compared with equivalents on sale at a nearby No Frills supermarket. Points of origin were obtained by looking at labels on the various items. In a few cases, the labels did not indicate point of origin but did provide website addresses which identified origins.

The research and methodology used were based to a large extent on the work on Ann-Marie Marano who conducted a study in 2003 that compared emissions associated with the food used in FoodShare Field to Table's Good Food Box and Organic Food Box. Not only were different emission types compared for the different boxes, but also it was a seasonal study that illustrated the changing food-sourcing patterns. Mapquest was used to calculate North American distances. In cases where the location was too small to be listed on Mapquest, the nearest major town was used as point of origin. For imports sourced from overseas, "as the crow flies" distances were ascertained using the website www.indo.com/distance/ which makes calculations based on latitudinal and longitudinal coordinates. Where only the state or country of origin was known, we used cities located close to the centre of the state or major port cities as reference points in our calculations. A contact with the Ontario Food Terminal indicated that most items from the United States or South America in fact pass though Los Angeles, CA. This information was incorporated into distance calculations. Distances in miles were converted into kilometres (1 mile = 1.609 km).

Consistent with the method used by the Leopold Center, we charted the distances over which local food items were transported and compared these with the distances that imports were shipped. We expressed this figure in the form "number of times further that local items travelled than imported items." In our study, food items were weighed, and the weights converted into metric tonnes. Emissions and

energy consumption were calculated using the spreadsheet program Microsoft Excel.

Weight in tonnes of the sample items were multiplied by distance travelled, providing the unit of tonne-kilometres (T-Km). The T-km figure was then multiplied by the relevant energy/T-km or emissions/T-km factor, depending on means of transportation. The emission/T-km factor for each mode of transportation is:

- Rail: 41
- Boat: 30
- Truck: 207
- Air: 1,206 [17.]

## Summary of Results

### 1. Distance

**Figure 1A) From the Dufferin Grove Farmer's Market, Toronto November 27th, 2003**

| Product/Produce | Point of Origin | Distance Travelled (km) | Weight (tonnes) | Tonne-Kilometres (T-Km) |
|---|---|---|---|---|
| Mixed Baby Salad Greens | Hamilton | 72 | 0.00025 | 0.018 |
| Swiss Chard | Millgrove, ON | 72 | 0.000375 | 0.027 |
| Carrots | Millgrove, ON | 72 | 0.001 | 0.072 |
| Sweet Potatoes (4) * | Alymer, ON | 209 | 0.001 | 0.209 |
| Bosc Pears (6) | Milton, ON | 56 | 0.0009 | 0.05 |
| Apples (8) | Collingwood, ON | 144 | 0.0008 | 0.115 |
| Tomatoes (3) | St. Jacobs, ON | 113 | 0.0009 | 0.102 |
| Lamb Chops (4) | Flamborough, ON | 72 | 0.0006 | 0.043 |
| **Average** | | 101 | 0.000728 | 0.0795 |

*Sample purchased on November 20th

**Figure 1B) From the Dufferin Mall No Frills Supermarket, Toronto November 27th, 2003**

| Product/Produce | Point of Origin | Distance Travelled (km) | Weight (tonnes) | Tonne-Kilometres (T-Km) |
|---|---|---|---|---|
| Mixed Baby Salad Greens* | New Jersey (through Montreal) | 1231 | 0.00025 | 0.308 |
| Swiss Chard | Texas (through L.A.) | 8044 | 0.000375 | 3.017 |
| Carrots | California (through L.A.) | 4242 | 0.001 | 4.242 |
| Sweet Potatoes (4) | Mississippi | 1976 | 0.001 | 1.976 |
| Pears, Bosc | Ontario | | 0.0009 | |
| Pears, Rocha | Portugal (through Halifax) | 6243 | 0.0009 | 5.618 |
| Pears, Anjou | Washington (through L.A.) | 5887 | 0.0009 | 5.298 |
| Apples, Macintosh | Ontario | | 0.0008 | |
| Apples, Granny Smith (4) | Washington (through L.A.) | 5887 | 0.0008 | 4.71 |
| Apples, Royal Gala | Washington (through L.A.) | 5887 | 0.0008 | 4.71 |
| Tomatoes (3) | Pelee Island | 361 | 0.0009 | 0.325 |
| Lamb Chops (6) | New Zealand | 13882 | 0.0006 | 8.329 |
| **Average** | | 5364 | 0.000769 | 3.8533 |

* Sample purchased at Dominion supermarket (source unavailable at No Frills)

While locally produced food items in the sample set travelled an average of 101 km, equivalent imported items moved an average of 5364 km. On the whole, the imported items were transported 81 times further than the local items. Fresh lamb chops imported from New Zealand traveled the farthest, an estimated 193 times the distance of their local equivalents. It is worth noting that pears and apples from Washington State – right across the Canadian border – mage a longer journey than carrots from California. Swiss chard from Texas, which is significantly closer to Toronto than California as the crow flies, also traveled further than the California carrots. Both the pears and the carrots traveled to the Los Angeles Food terminal before being trucked up to Canada.

**Figure 2) How Many Times Further did Conventional Produce Travel than Local Produce?**

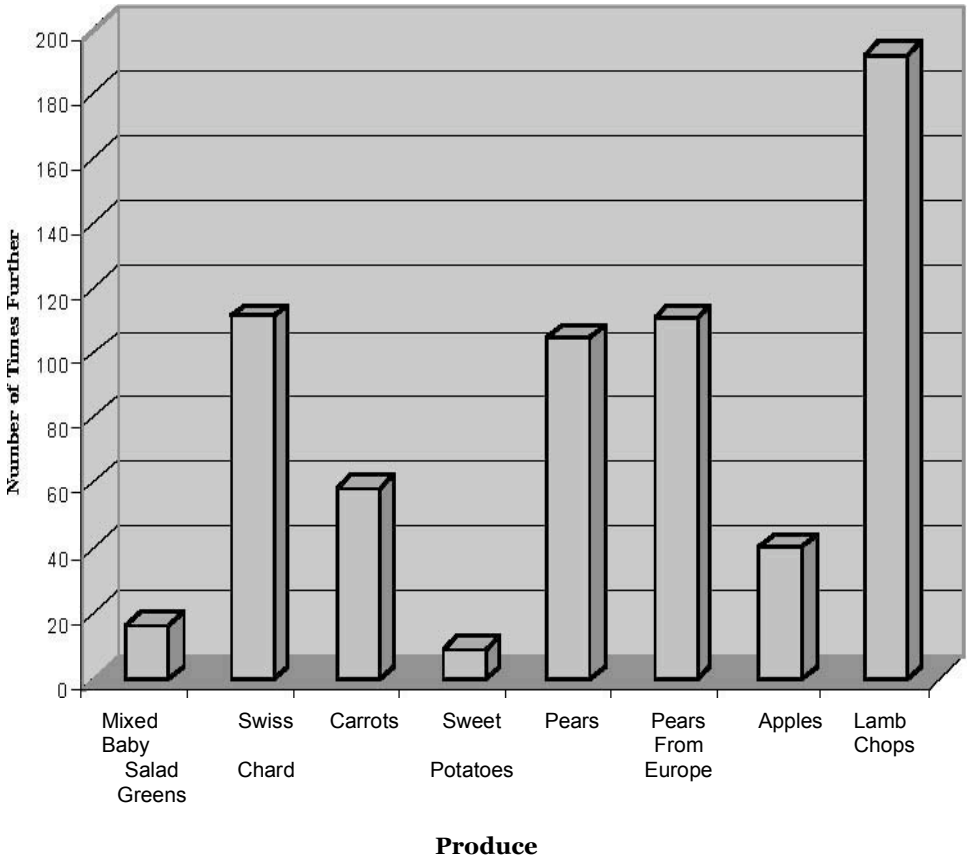


**Figure 3A) $CO_2$ Emissions from Various Selected Local and Imported Foods**

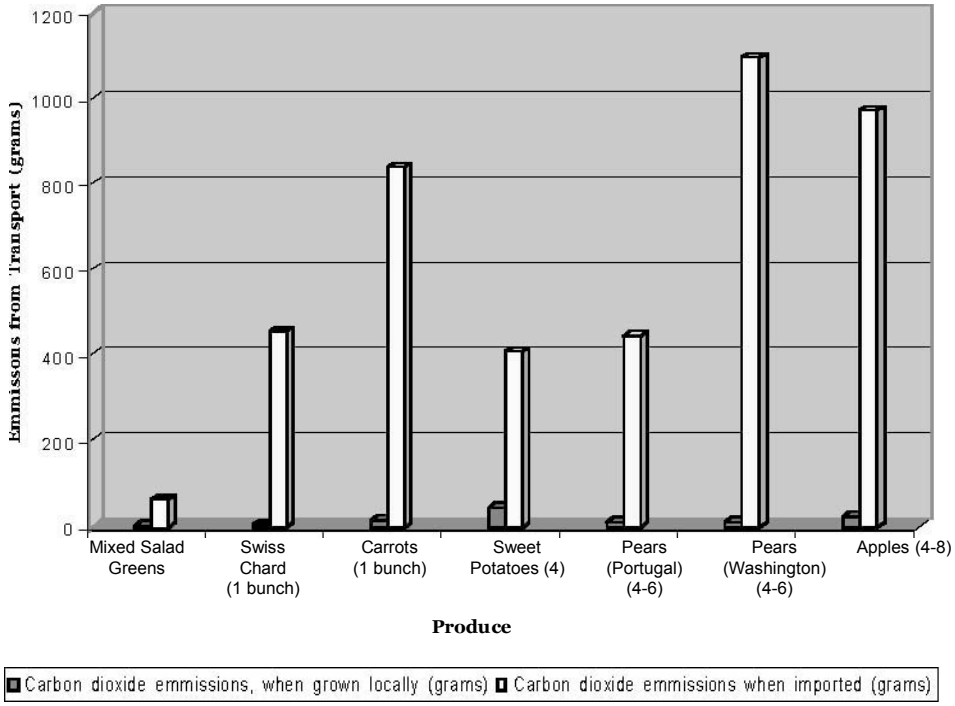
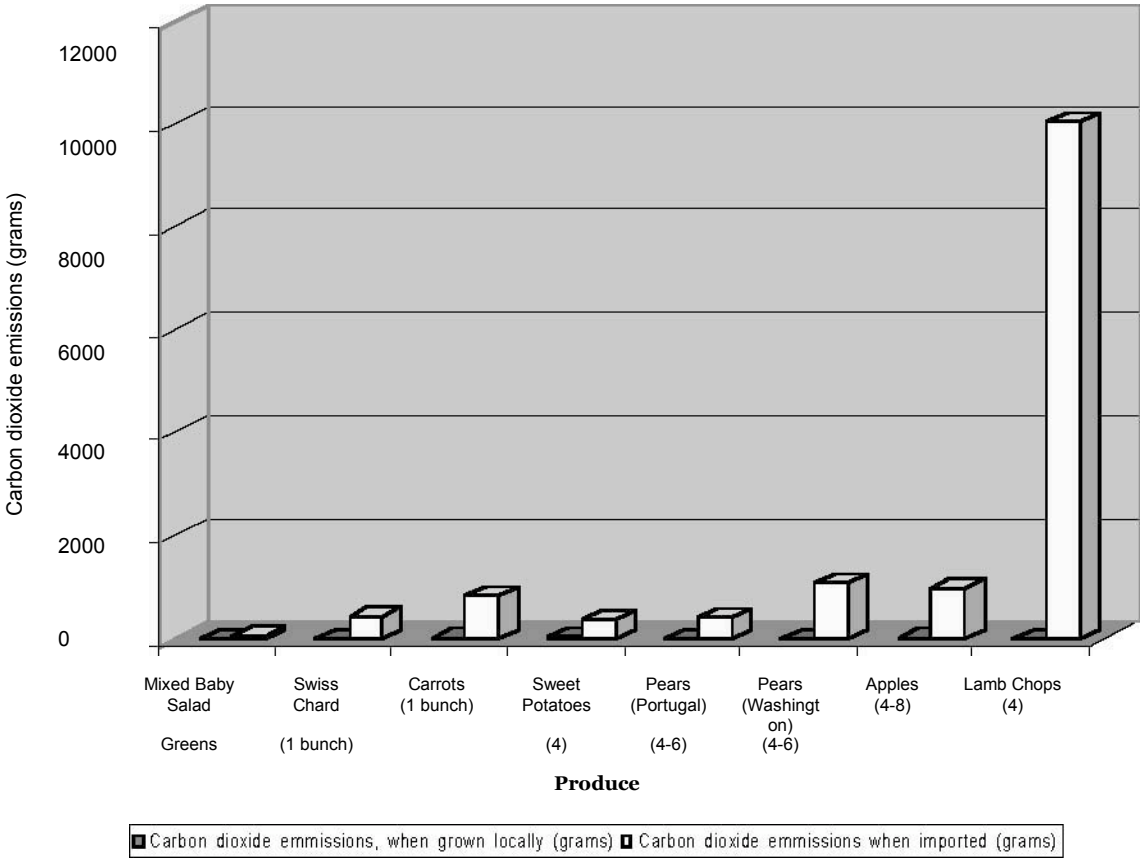



**Figure 3B) $CO_2$ Emissions from Various Selected Local and Imported Foods (Including Lamb)**



## Figure 4 A) Carbon Dioxide Emissions from Selected Local Foods

| Product/Produce | Point of Origin | Tonne-Kilometres (T-Km) | Method of Transport | Carbon Dioxide Emissions (grams) |
|---|---|---|---|---|
| Mixed Baby Salad Greens | Hamilton, ON | 0.018 | Truck | 3.726 |
| Swiss Chard | Millgrove, ON | 0.027 | Truck | 5.589 |
| Carrots | Millgrove, ON | 0.072 | Truck | 14.904 |
| Sweet Potatoes (4) | Alymer, ON | 0.209 | Truck | 43.263 |
| Pears (6) | Milton, ON | 0.05 | Truck | 20.35 |
| Apples (8) | Collingwood, ON | 0.115 | Truck | 23.805 |
| Lamb Chops | Flamborough, ON | 0.043 | Truck | 7.032 |
| **TOTAL** | | | | **118.669** |

## Figure 4 B) Carbon Dioxide Emissions from Selected Imported Foods

| Product/Produce | Point of Origin | Tonne-Kilometres (T-Km) | Method of Transport | Carbon Dioxide Emissions (grams) |
|---|---|---|---|---|
| Mixed Baby Salad Greens | New Jersey (through Montreal) | 0.308 | Truck | 63.756 |
| Swiss Chard | Texas (through L.A.) | 3.017 | Truck | 457.47 |
| Carrots | California (through L.A.) | 4.242 | Truck | 840.213 |
| Sweet Potatoes (4) | Mississippi | 1.976 | Truck | 409.032 |
| Pears (3) | Portugal (through Halifax) | 2.809 | Ship | 223.0835 |
| Pears (3) | Washington (though L.A.) | 2.649 | Truck | 548.343 |
| Apples (8) | Washington (through L.A.) | 4.71 | Truck | 974.97 |
| Lamb Chops | New Zealand | 8.329 | Airplane | 8370 |
| **TOTAL** | | | | **11,886.867** |

Obviously, carbon dioxide emissions resulting from imports were higher than those associated with locally produced items. Our analysis demonstrated that greenhouse gas emissions are not simply a factor of distance travelled, but also of the means of transportation used. Lamb chops from New Zealand may have travelled 193 times as far as their Canadian counterparts, but they produced over one thousand times as much $CO_2$ because they were flown in. As mentioned in the introduction, transporting half a kilo of fresh NZ lamb to Toronto by plane produces over eight kilograms of $CO_2$, as compared with seven grams of $CO_2$ produced from trucking the meat in from Flamborough, Ontario. Though pears imported from Portugal travelled 350 kilometres further than pears transported from Washington through L.A., transporting the European pears actually produced less carbon dioxide. The reason for this is that we assumed that the pears from Portugal would have travelled across the Atlantic by boat while the Washington pears made the entire journey by truck, which is about seven times more polluting. [18]

Looking at the total carbon emissions associated with local food and imported food, the differences become even clearer. The entire $CO_2$ emissions created by transporting the local food is less than the $CO_2$ emissions for any single imported product except the New Jersey mixed baby salad greens. As a result, the $CO_2$ emissions caused by transporting food locally is 0.118 kg, while the emissions caused by importing those exact same foods is 11kg. Over the course of a year, if you were to buy only locally produced food, the associated $CO_2$ emissions would be .006316 tonnes. If instead you were to buy only imported foods like those studied here, the associated $CO_2$ emissions would be .573 tonnes. This means that if you switched from eating all imported food to eating only locally produced food, you would already be half way towards achieving Canada's one

tonne challenge.

## Discussion

As discussed above, transportation by boat and rail is actually decreasing, while the more polluting airfreight and trucking are on the rise. Only focused political action will reduce the greenhouse gas emissions that result from the transportation of food. To its credit, the Canadian government launched its Freight Efficiency and Technology Initiative in November 2001. This project promotes greater efficiencies in transportation through cooperation with the provinces, territories, and the private sector. Canada's *Climate Change Plan* proposes that further changes be made through "intermodal freight movement" and further efficiency improvements. Current and proposed initiatives to reduce emissions through the development of alternative energy sources such as hydrogen fuel cells and biofuels are likewise praiseworthy.

Pressure needs to be applied to governments to ensure that such mechanisms are in fact implemented. The push towards more fuel-efficient means of transportation, however, should not distract us from thinking critically about the overall efficiency of a food system that prioritizes long distance trade over more sustainable local alternatives. Our food system is generally considered efficient, even though the fossil fuel energy required to ship a head of lettuce from Salinas Valley, California to Washington D.C. is 36 times the food energy that the lettuce provides.[19]

Inefficiency aside, however, long-distance food trade is clearly on the rise. Between 1968 and 1998, international trade in food increased by 184%, while world food production increased 84%.[20] The majority of food trade, however, occurs between countries of similar natural environments that could be growing much of their own food instead of importing and exporting it.[21] Several European studies on food miles have demonstrated that, in many cases, food is merely "swapped," that is, a given country will both export and import the same item.[22]

A similar situation may be occurring in Canada. Our contribution to international agricultural trade is growing. Canada's agricultural exports increased by 50 percent between 1990 and 2001, with imports increasing more than 70 percent in the same period.[23] In 1998, Canadian Ministers of Agriculture set the goal of capturing four percent of world trade in agriculture by 2005.[24] While Ontario contributes a larger portion of Canadian food exports than any other province, it is also a net food importer. In fact, Ontario accounted for 57.5 percent of the Canadian agriculture imports in 2002, wracking up an agricultural trade deficit of 3.7 billion Canadian dollars.[25]

While Canada spends considerable sums on food imports, economic necessity is forcing many Canadian agricultural producers to quit farming as a full-time vocation. Between 1996 and 2001, the number of Canadian farms in operation decreased by eleven percent.[26] Among those farmers who remain in business, net farm income continues to fall as a percentage of total income.[27] Thus, farmers are becoming increasingly dependent on work from other industries to earn a livelihood. While opponents of the Kyoto Protocol often argue that ratification will cost jobs, they often fail to mention the jobs that will be created as we make the transition to a more environmentally sustainable economy. We recommend that some of the $15.6 billion spent on food imports in 2001 be used to support sustainable Canadian agriculture.

Eating more locally produced food will automatically reduce the greenhouse gas emissions that result from food transportation. The issue of food and the environment, however, is more complex than our food miles calculations have suggested. When trying to determine the environmental impact of the foods we eat, one must consider how they were produced, in addition to the distances they travelled and the means by which they were transported. As Tara Garnett, coordinator of Transport 2000's Wise Moves project in England has pointed out, more energy may be consumed growing tomatoes in local English hothouses then growing them in the sun in Spain and transporting them to England.[28] In Canada, the environmental cost of flying an estimated 18 000 Caribbean and Mexican migrant workers-who do the majority of tomato harvesting-in and out of the country each season should also be factored into the equation.

One potential strategy for supporting a sustainable local food system is the use of "ecolabels." Researchers from the Leopold Center for Sustainable Agriculture have proposed the use of food labels that include information on both food miles and $CO_2$ emissions to inform consumers about the environmental impact of imported foods. By incorporating Life Cycle Assessment (LCA), "a method for performing an integral analysis of environmental impacts in a 'cradle to grave fashion,"[29] eco-labels could include information of the environmental impact of production and storage, as well as transportation. To be sure, it is doubtful that sellers of foods whose production and transportation impacted heavily on the environment would voluntarily agree to label them as such. For farmers of sustainably produced local foods, however, ecolabels could be an effective marketing strategy.

Given the climate and diverse, sophisticated tastes of such a multicultural country as Canada, it would be far-fetched to claim that our food needs could be completely addressed through local agriculture. However, much of the food that is currently being imported into Canada, especially during the warmer months of the year, could be grown locally instead, with minimal environmental impact. Ethnic specialty vegetables such as calaloo, red okra, snakefruit, bitter melons and Ghanaian eggplants have already been cultivated in Toronto community gardens, producing virtually zero greenhouse gas emissions. Mechanisms that promote urban food production and direct marketing strategies such as farmers' markets and community supported agriculture (CSA) programs can go along way. Encouraging Canadian wholesalers and retailers to buy local foods when they are available could likewise play a significant role in reducing Canada's carbon emissions. Further research into season extension strategies could also lessen the impact of global warming by facilitating the development of a local, sustainable food system that operates for much the year.

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