UBC Social Ecological Economic Development Studies (SEEDS) Student Report

Empowering eaters to make climate-friendly choices: A public education initiative.

Florence Laksmana, Carol Lam, Cynthia Lam, Iris Lam, Karen Lam, Philip Lau, Amanda Lee, Chi Man Lee

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Scenario 3B: Empowering eaters to make climate-friendly choices: A public education initiative.

Group 13
Florence Laksmana
Carol Lam
Cynthia Lam
Iris Lam
Karen Lam
Philip Lau
Amanda Lee
Chi Man Lee

Table of Contents

Abstract

Greenhouse gas emissions have become a large concern with regards to climate change and the environment. Research and the subsequent development of a Carbon Smart Food Guide, Carbon Smart Food Label and companion website materials can help to reduce GHG emissions by empowering consumers. Armed with the knowledge provided, consumers can begin to make a difference with the individual choices that they make each day. A carbon smart food is defined as a food selection that contributes the least amount of CO2, thus reducing the environmental consequences from GHGs. Suggestions to be carbon smart include eating vegetarian, consuming less meat, eating lower on the food chain, choosing local and seasonal foods when possible and choosing organic.

Recommendations for the future include experimental research into the GHG emissions of specific production methods and foods produced, practical teaching in classrooms regarding carbon smart choices, and further research into implementation of the food label. Specifically, how to measure and subsequently rank how carbon smart a food is based on distance traveled and production method.

Introduction

This paper will first discuss Scenario 3B, "Empowering eaters to make climate-friendly choices: A public education initiative" and how it is related to problems in the food system as well as other scenarios. The Vision Statement and 7 Guiding Principles will be discussed, leading into our findings, recommendations and summary. Following this is a reflection and list of recommendations for further research. Attached appendices will include the created food guide and label, and a companion file will have the website information.

Problem Definition

As stated in The University of British Columbia Food System Project (UBCFSP), "every meal we eat has a profound impact on the planet" (Rojas, 2009). Even basic human activities such as eating

are increasing atmospheric carbon (CO2), more commonly referred to as greenhouse gases (GHG), that traps heat in the atmosphere and impacts global climate changes that in turn disrupt ecosystems (PAS, 2008). GHGs also include methane, nitrous oxide (NO), hydrofluorocarbons, and perfluorocarbons. Previous research has concluded that in Canada and the U.S., 8% of total GHG emissions are from agriculture (Environment Canada 2007; EPA 2007) (Rojas, 2009), but this has not taken into account such components of the food system as transportation, processing, storage, and food preparation (Rojas, 2009). This paper will attempt to address the issue of GHG emissions not only from the initial aspect of growing food and raising livestock, but following it along its journey to a table. This will lead to what consumers can do individually to reduce their carbon footprint. To do this, a Carbon Smart Food Guide, label (see Appendix A) and a supporting website have been developed with information and suggestions for consumers. Carbon smart foods for these purposes have been defined as food selections that contribute the least amount of carbon dioxide, thus reducing the environmental consequences from GHGs. Both of these resources are aimed at residents of the Greater Vancouver Regional District, specifically to those residing in the city of Vancouver.

Links to Global Problems and Other Scenarios

From the food system alone, GHGs are released from agriculture from livestock production, crops production, food processing, transportation, and even refrigeration storage (Steinfield et al., 2006). Other specific activities that emit GHGs include the clearing of forests for grazing lands, carbon loss from soil on grazing lands, feed production, processing and transportation of livestock feed and meat, burning of fossil fuels in production processes, gases from animal manure, and enteric fermentation. While this is occurring all over the world, in 1997, Canada was responsible for emitting approximately 2 million tones of carbon dioxide just from burning fossil fuel to produce nitrogen fertilizer for feedcrops (Steinfield et al., 2006).

Although methane and NO contribute the most to GHG emissions and climate change in agriculture crop and livestock production, CO2 is also a major contributor and the gas that the public seems most familiar with (McMichael et al., 2007). Even though carbon emissions do not seem to play a huge factor in reducing GHGs, the fact that they are well known and publicized helps keep people aware. When people become aware, they then have the ability to change their actions, habits and norms to make a difference for the environment. For this reason, we are promoting a Carbon Smart Food Guide and label that can help consumers not only choose their foods wisely, but also give them tips in other aspects of their lives where they can reduce carbon emissions.

One would not think that a small trip to the grocery store or the expectation of exotic fruits at the supermarket would destroy the planet, but with everyone acting together, even small actions can have large negative consequences. We want this to work in a positive sense instead, where small positive actions will have even larger positive consequences. We want to increase awareness of GHG emissions and sustainable farming, while promoting local farms and food vendors. This will also decrease reliance on the Productionist paradigm that has brought us to this point in agriculture. Any positive change as a result of advice from the food guide will help to further the aims of other scenarios, including reducing GHG emissions, lightening Vancouver's overall ecological footprint, and hopefully encouraging more sustainable farming methods.

Group Reflection on the Vision Statement

As a group, we agreed with "Food is locally grown, produced and processed," (Rojas, 2009) as our project was based mostly on this topic. Through research, we each learned about the importance of supporting and choosing local foods. We also agreed with "Waste must be recycled or composted locally" (Rojas, 2009) as this promotes sustainability within a food system.

One of the principles our group embraced was "Food brings people together and enhances community" (Rojas, 2009). Throughout our many years as LFS students, this message has come up

over and over again. Food is more than just a substance to be eaten, but is an irreplaceable link between different ethnic groups, age groups, and backgrounds. Eating locally can bring people from a community together, with a real life example being the Wednesday Night Barbecues in Agora.

We feel the principles "Providers and educators promote awareness among consumers about cultivation, processing, ingredients and nutrition" and "Providers and growers pay and receive fair prices" (Rojas, 2009) must work symbiotically with each other. At the moment, people are undereducated and will not make the move to buy local and organic produce on their own. They must first be educated on the topic in order for positive changes to occur. However, as much as our group would like to envision a future of community and food that encompasses these principles, we must also consider the social economic status of the people in the community. Since local and organic foods are relatively more expensive, it puts a limit on their accessibility. Price is a large issue to less affluent individuals in any community and they might not be able to afford these foods.

Findings and Recommendations

Definition of Carbon Smart

Carbon smart foods for these purposes have been defined as food selections that contribute the least amount of carbon dioxide thus reducing the environmental consequences from GHGs. This definition is quite vague as it is difficult to state with certainty what foods are carbon smart. This is because there is great variation in production methods, distance transported, and overall energy inputs into a single food. There has not been enough research done on measuring such factors and thus they could not be included in our definition of carbon smart. The group came to the consensus that it was more beneficial to the consumer to keep the definition simple, and then provide additional information that the consumer can interpret as either support or opposition for our recommendations.

Vegetarian Diets

Many people have come to understand that consuming a vegetarian diet is healthier than an omnivorous or carnivorous diet. It used to be that being able to afford meat was a luxury while consuming vegetables was a prudent way to control one's budget. However, presently there are many people who choose a vegetarian diet for a variety of reasons, such as religion, ethics, or health.

There are three main types of vegetarians that are classified based on dietary limitations: vegans, who do not consume any animal based products; lacto vegetarians, who choose to also consume milk; and lacto-ovovegetarians, who also consume eggs in addition to milk. (White & Frank, 1994). The issues concerning various vegetarian diets are generally the same but increase in severity as food choices become more restricted. Some issues are that the diet will not easily provide all essential amino acids needed for bodily function and growth, it will not be able to meet the special needs of individuals at varying stages of development, it can lead to iron deficient anemia, and it is low in calcium and vitamin D (Dwyer, 1988). Even though these issues may seem serious, there are ways of working around them to provide all the nutrients needed for adequate growth and development if people choose a variety of foods and take supplements as necessary.

An advantage to vegetarian diets includes having higher proportions of micronutrients, excluding vitamin B_{12} which is found only from meat sources and vitamin D which is fortified in milk. The diet provides many more trace minerals than one that displaces vegetables with meats (Sabate, 2003). Also, vegetarians tend to experience a lower body weight, lower blood pressure and lower risks of developing diabetes, heart disease and colon cancer (Sabate, 2003). This could be due to a lower consumption of cholesterol, saturated fat, and overall calories that seem to occur naturally with a diet of plant based foods.

Based on these findings, it is recommended that consumers should attempt to eat vegetarian meals on a regular basis, perhaps once per week, for increased health benefits. Further findings in this paper will support vegetarian diets for other reasons.

Livestock Production and the Food Chain

In the food sector, livestock production contributes more GHG emissions than food miles (Steinfield et al., 2006). Raising animals generates excess emissions through the production of crop feed, meat processing and refrigerated transport (Steinfield et al., 2006). A relatively recent view to decreasing meat intake considers the effect it will have on reducing GHG emissions. The less meat is consumed, the less it needs to be farmed and raised, which will contribute to lower GHG emissions and our carbon footprint. A lot of resources that could go towards human consumption are wasted being fed to animals, which inevitably humans will consume. The concern is not just with feeding precious resources to animals, it is also the types of resources. For example, cattle are typically grain fed to increase their growth rate, but this diet leads to digestive problems which add to the carbon footprint made by raising these animals; not only do we feed them food that could directly nourish the population, they emit GHGs due to their difficulty digesting grains. Cattle are ruminants, animals that use multiple chambers in the stomach to digest their food. These animals tend to produce a large amount of methane during the digestion process (Nestle, 2002; Steinfield et al., 2006). To avoid all of this, humans could refrain from the large scale raising of animals, instead, raising small numbers on diverse farms and consuming meat less frequently.

So far this issue has been discussed using cattle, but nearly all mainstream meats and seafood pose the same problem: An accumulation of waste from the animals increases GHG emissions and takes up valuable farming space because it is not disposed of properly or used efficiently. This waste and other run-off from the conventional raising of animals contaminates land and water making it difficult for other species to grow, and inevitably, the carbon footprint of these practices increase.

With regards to consumption recommendations for fish, it is advisable to eat further down the food chain. The reasons for this are that it requires less feed for these small fish to grow and mature, they tend to reproduce more quickly than large fish, and there is a smaller chance of mercury accumulation

in their flesh (Nestle, 2002). The first two reasons will lessen the carbon footprint from consumption, because the amount of feed is more proportional to the amount of fish consumed, and the stocks are not being depleted due to their quick reproduction. The last reason is mainly for consumer health, and is valid because these fish live shorter lives with less time to accumulate mercury, and they do not eat many other fish that have high mercury contents. When purchasing fish, if the fish you desire is not available, try asking for by-catch, the fish that were unintentionally caught but need to be sold. Not only will it be slightly cheaper, it will also be using an already sunk resource that may otherwise be thrown out or discarded. Wasteful!

Recommendations for consumption of meat are to eat more heritage and antique breeds because they are healthier, taste better, and inevitably demand for these meats will keep them from going extinct and cause farms to become more diverse. This will hopefully lead to more sustainable farming methods. Also, try to replace ruminant red meats (such as cattle) with meat from monogastric animals (such as chicken or pigs), or even vegetarian farmed or wild fish to reduce GHG emissions. The next step after decreasing meat consumption would be to encourage local and seasonal produce selections.

Carbon Emissions Associated with Local and Imported Foods and Food Miles

When choosing foods, local tends to better for the food system than organic. This is because local is also considered to better than imported, and many supermarket organic foods tend to be imported, raising their food miles and carbon footprint. The reasons to choose local over imported foods become clear when the two types of foods are compared in their respective off-farm systems stage by stage. The first stage is the initial off-farm processing stage. Local foods require minimal processing and packaging, as they are usually sold fresh in farmers' markets. Conversely, most imported foods need to be processed immediately following their harvest to prepare for long distance transportation. Such processing inevitably involves the use of materials in packaging, chemicals in preservation, as well as energy in refrigeration, all of which lead to more carbon emissions.

The second off-farm stage is transportation. With few exceptions, imported foods require more transportation to reach their markets and destinations. Bearing in mind that fossil fuels are still the most common energy source used for transportation, it goes without saying that local foods are more carbon smart than imported foods. Research has revealed that the operation of vehicles burning fossil fuels is a significant source of CO2 production and has greatly contributed to global warming (Lakshmanan and Han, 1977).

In addition, an important aspect of food miles is what type of transportation is being used since different fuels will emit different amounts of CO_2. For example, 2.3 kg of CO_2 are emitted for every liter of petrol and gasoline used, while 2.7 kg of CO_2 are emitted for every liter of diesel. Also, if the food is transported via plane, 1 kg of CO_2 will be emitted for every 2.2 km traveled (Time for change, 2007). In comparing GHG emissions of different foods, previous studies have shown that it is not sufficient to account for the GHG emission from shipping and plane travel alone. Instead, it should be viewed as a food supply chain.

The next off-farm stage is the distribution or market stage, in which foods are stored and displayed immediately prior to sales. As opposed to local foods which are commonly sold fresh and in original form, imported foods are usually processed for a variety of purposes. The most important reason to process food is the need to extend the shelf life of the product (Ahvenainen, 1996). For example, many imported foods must be packaged and kept frozen. In comparison, fresh and local foods are likely to be more carbon smart, even in this store-shelf stage.

Finally, a common source of energy consumption regardless of food origin is the trucking of wastes to landfills. This could be avoided if consumers turn to composting their wastes. Other than distance, the form of transportation also has a large impact on GHG emissions. Air freights require ten times the amount of energy than road transport while road transport is six times more energy consuming than shipping. Similarly, shopping by car emits more GHGs than by bike or foot.

A study done by Pirog and Benjamin showed that estimated distance that local foods travel compared to non-local foods are 56 and 1,494 miles, respectively (ISU, 2003). This study was done for the state of Iowa, but the results can be extrapolated to apply to the city of Vancouver; the result will be the same though numbers will vary depending on where the food originates. Non-local foods have more food miles associated with them compared to local foods, travelling nearly 27 times as far (ISU, 2003). The differences in distance traveled between local and non-local produce can be seen in Appendix B1.

It is recommended that consumers should try to purchase foods that are both local and organic. If that combination is not possible, the next best option would be to purchase conventional local produce as opposed to organic.

The 100 Mile Diet and Benefits of Choosing Local and Seasonal Foods

Shopping locally benefits the environment by reducing transportation, food miles, packaging, processing and refrigeration and thus reducing carbon emission (Stagl, 2002; Bentley & Barker, 2005). To eat locally easily, one can join the 100 Mile Diet Society. The main objective of this organization is to eat foods only from within 100 miles of where one lives. Local foods are typically grown by small farms which tend to use less pesticides and chemicals during the production period. The idea of local foods also produces less GHG emissions from fossil fuels as the produce does not need to be transported from distant places to market (Bentley & Barker, 2005). To help consumers with 100 Mile Diets, the society has a foodshed map that will allow people to locate their individual 100 mile radii depending on where they live (see Appendix B2 for Vancouver's map). The definition of foodshed is "the flow of food from the area where it is grown into the place where it is consumed" (100 Mile Diet Society). The online version of the map shows the 100 mile radius and other sections of the website help consumers to identify farms and markets in the area. Using this tool, a consumer can easily find out which 100 miles he or she is situated in and which local venues are available to purchase from.

Another excellent resource is to visit a local farmers market. By definition, the produce sold is local and if the consumer is unsure of the distance traveled, he or she can ask the farmer in person. The consumer can also ask for such information as how to prepare and cook the produce if it is unfamiliar, or even what fruits and vegetables will be next in season. See Appendix B3 for a list of foods available seasonably in BC. It is true that in winter months the selection of produce available decreases. However, if this is considered a problem, it can be easily remedied by purchasing large batches of produce when they are in season and preserving them in any preferred method such as canning, drying, or even freezing.

Local produce should be fresher and of higher nutritional quality. More nutrients are retained compared to conventional foods that can be in transit for days or even weeks (Silva, 2007). Local foods also taste better because of this reason. They are picked at the peak of their ripeness and therefore have more flavour than imported foods. A good example is tomatoes. Imported tomatoes are picked and shipped while they are still green and are not as flavorful as locally grown ones that are allowed to grow until ripe (Silva, 2007).

A concern with imported foods has to do with their processing and packaging prior to consumer purchase. Research has proven that packaging is a major source of pollution in our environment (Robertson, 2006). As imported foods are more likely to be packaged and preserved than local foods, they are more likely to be less carbon smart. However, when comparing GHG emissions of imported versus domestically grown foods, it is worth considering how appropriate the area is for producing the food product as different foods are more suitable to certain environments and climates.

Attempting to eat produce that is in season may be another characteristic of a sustainable food system (Stagl, 2002). Purchasing and consuming local produce goes hand in hand with seasonal. If consumers choose local items more often, they are almost guaranteed to get foods at their peak of quality, or when they are in season. Eating foods when they are in season decreases GHG emissions that would have been used to produce or purchase the same food out of season. For example,

strawberries are in season in BC from June until September. Purchasing strawberries at this time would be more carbon smart than purchasing them in December because in winter the strawberries have either had extra energy put into their production or have been shipped from another country, inevitably increasing their carbon footprint. The additional inputs in production and increase in food miles are both are undesirable when trying to shop carbon smart.

It is recommended that consumers look into what foods are available within a 100 mile radius of their homes and also what produce is available in each season (see Appendix B3). Foods can then be chosen accordingly.

Benefits of Organic

Agriculture and Agri-Food Canada has reported that 10% of all GHG emissions come from the agriculture sector. Data shows that 24% of agricultural GHG emissions came from fertilizer use (Agriculture and Agri-Food Canada, 2009). Both organic and conventional farming methods release GHGs but the production and application of synthetic fertilizers release NO (Agriculture and Agri-Food Canada, 2009). Nitrous oxide has 310 times the global warming potential than CO2 and this is one reason why conventional farming has a larger impact on GHG emissions than organic farming.

All plants need nitrogen to grow but plants cannot fix nitrogen from the atmosphere unless it is in its "fixed form" (Newton, 2003). Conventional farms get their nitrogen from synthetic fertilizers while organic farms use forage legumes instead. Legumes are able to fix nitrogen from the rhizobial microsymbionts present in the soil (Newton, 2003). "Organically grown" means that commercial fertilizers and synthetic pesticides were not used during farming (Aldrich, 1977). Synthetic fertilizers use fossil fuels in their production and transport which requires a higher energy input (Kanyama, 1998). The production process, called the Haber- Bosch process, fixes nitrogen by reacting hydrogen and nitrogen together to form ammonia (Newton, 2003). This process requires the burning of natural gas as an energy source which releases CO2 into the air. The transportation of fertilizers also requires the burning of fossil fuel which adds to emissions. The increased emissions of other GHGs such as

methane and CO2 are believed to be major contributors to global warming and are leading to subsequent rises in social economic costs (Fankhauser, 1994). Overall, organic farming produces foods that have emitted less GHGs and used less energy compared to conventional farming (Kanyama, 1998). An example using organic wheat production shows that carbon dioxide per hectare is 50% lower compared to conventional farming (Stagl, 2002).

Another benefit of organic farming is the increase the biodiversity of plants and animal habitats on the farms (Fuller et al., 2005). Organic farming will help restore farmland biodiversity that has been lost due to the development of monocultures, one crop that is mass produced in one area instead of having diverse species on a farm. One factor contributing to the higher biodiversity is that organic farms include more insect species' habitats, therefore increasing the number of birds and predators able to thrive (Fuller et al., 2005). In addition, organic farming is more food safe. Conventional farming uses large amounts of chemicals such as pesticides which could leak into foods and affect animals and humans alike. Increased human health risks and lowered regional crop yields are also believed to be associated with the presence of greenhouse gases (McMichael et al., 2006).

The drawbacks of organic farming are the price and quantity of the produce. The availability of fixed nitrogen is most often the limiting factor in crop production (Newton, 2003). Since synthetic fertilizers are readily available and can be directly used as a fixed nitrogen source, conventional farming has a higher yield than organic farming (Aldrich, 1977). "In terms of the amount of potential human food, the conventional system exceeds the organic system by 41 percent" (Stagl, 2002). There would be worldwide implications to changing conventional farms to organic farms. For example, it would "reduce the amount of grains available for world export, thus cutting off a major item in [the] balance of trade with which to purchase oil" (Aldrich, 1977). Furthermore, organic farming has a higher cost of production in terms of dollars due to the lower yields (Aldrich, 1977) which leads to a higher cost in supermarkets. Because of this, some argue that organic farming is not a viable system as it will not be able meet the food demands of the world (Aldrich, 1977).

Although it may be true that organic farming practices do not use synthetic fertilizers and pesticides, there are now the "big organic" firms that use the same large-scale farming techniques as conventional agribusinesses and ship their products over long distances (Time, 2007). By shipping over long distances, the food miles negate the benefits of not using any synthetic fertilizers and pesticides. Traveling over long distances implies that the food products will require further packaging and refrigeration (Silva, 2007). In other words, the benefits of organic farming disappear. The general population is now becoming more health-conscious as is evident by the fact that nearly 25% of American shoppers are now buying organic products once a week, compared to only 17% in 2000 (Time, 2007). Similarly, the Canadian organic market has experienced double-digit growth in the past few years (COG, 2008). This increasing trend for organic products makes organics a profitable branch of the food industry, leading to the large-scale production of organic products as previously mentioned.

Recommendations are not clear in this category, as some organic farms are more carbon smart than others. There would need to be more information available regarding production methods to consumers to make this choice. The general suggestion should be to choose organic when possible.

Global Awareness

A few countries such as the United Kingdom, France, and the United States have started to become aware of the ecological footprints left behind by food production methods and consumer food choices (PAS, 2008; Brenton, Jones, & Jensen, 2008). The main issue is GHG emissions from production methods including food transportation, packaging, and storage. In recent years, the momentum to reduce carbon emissions has grown and is evident through the increase of carbon smart websites and countries that have taken action by developing their own system of carbon smart labeling and a carbon smart guide.

The United Kingdom's carbon guide focuses on reducing GHG emissions, reducing the cost of production, relating GHG emission impacts to the design and materials of production, being environmental friendly, and meeting the demands of customers for carbon emission information (PAS,

2008). First, the inputs and outputs of one unit of product are listed, followed by a calculation of the energy used to produce the product (PAS, 2008). The types and quantity of GHGs emitted are then recorded. Lastly, the average distance the product travels after it is produced is noted (PAS, 2008). After the results are calculated, suggestions to reduce emissions are made, such as increasing the percent of energy from renewable sources, decreasing waste, decreasing the amount of processing, improving efficiency, decreasing the distance travelled, and considering carbon emissions when making decisions regarding supplier, material and product design choices (PAS, 2008).

Discussion of the Carbon Smart Food Label and Food Guide

Our group designed a Carbon Smart Food Label and guide that can be seen in Appendix A. We wanted both to be simple and easy to understand. The label should be used for foods that are both grown locally and organic or just locally. The "CSF" on the label stands for 'Carbon Smart Food' and the check mark emphasizes this. At the bottom is the origin of the food product, in this case, Vancouver.

Our label currently does not incorporate numbers and is very general in terms of location and what defines a carbon smart food. As a preliminary step, a table seen in Appendix A4 can be used to further categorize foods and to direct further research into this concept. Suggestions for future research will be discussed in a subsequent section.

The food guide was designed as a 3 panel-double sided pamphlet that is intuitive to navigate through. After the title page, there is a definition of "carbon smart" and suggestions for what individuals can do to reduce their carbon footprint. These suggestions are broken down into different categories: food selection, storage, when to purchase and how much, and transportation. There is also a picture of our carbon smart label with a small description and an invitation for consumers to see the website for more detailed information. Next is a page with interesting facts to catch the reader's interest and the names of recipes that can be made using seasonal ingredients. On the final page, there are additional suggestions that did not necessarily fit into the previous categories. There is an

invitation to visit the 100 Mile Diet Society's website and also our own website, with a hyperlink listed. This invitation was prefaced by the question "Think you know everything about carbon smart foods?" to stimulate the competitive nature of readers and entice them to visit the website. The text was kept simple and concise to make it easy to read and to encourage consumers to read it in entirety.

Discussion of Website Materials

The website will have more comprehensive information than what is included in the food guide. It will also be more interactive including quizzes and a forum that can be utilized by all users to post their opinions and feedback to website materials. The website will be updated with current and relevant news articles when available to stimulate interest and discussion. The information included on the website will be based closely on what is written in this paper, and will include detailed information supporting the advice in the food guide. It will, however, have additional suggestions and instructions that are not included in the food guide due to space constraints. The website will act as a platform that allows readers to connect to existing resources like The 100 Mile Diet Society. The website materials can be view in a companion file to this paper.

Summary Statement

Our central findings are to consume more vegetables than meats, but if meats must be eaten, to eat less ruminant red meats and eat lower on the food chain. Examples are to eat monogastric animals, such as pigs and chickens, or choose small fish, such as sardines, over salmon. Choose local over imported foods and organic when possible. Also try to eat seasonally. Following common sense by recycling, reducing waste, and decreasing dependence on fossil fuels will also lower GHG emissions and reduce a person's individual carbon footprint.

Reflections

The findings and recommendations stated above can be seen as quite vague and they are. It is difficult to be very specific because there are always exceptions to the rules. For example, while we recommend eating organic produce because synthetic nitrogen is not used and the food was probably grown on a diverse farm, there is organic produce being grown using large-scale methods that negate the carbon-reducing benefits. The same can be said for eating local rather than imported foods. The imported foods might be grown using highly sustainable and low carbon-emitting methods that, in the end, have lower GHG emissions than conventional produce grown locally. For these reasons, it may then be wise for the recommendations from this paper to not be made into steadfast rules, but instead general guidelines. The recommendations and suggestions should be used as points of consideration for consumers when choosing what foods to purchase. Even though we rank produce in terms of how or where it was produced, it would be best if the consumer could also take into consideration additional inputs and individual variation in methods of production. However, this seems to be beyond the scope of an ordinary consumer. If implementation of the food label could be researched more thoroughly, this might be possible. However, until then, these general guidelines will have to suffice.

Despite this, we believe that these are simple enough for most people to be able to follow at least a few of them. Many of them, such as reducing plastic bag usage and recycling, are ideas that are becoming ingrained into our society. Others, such as driving less often, can be difficult to follow if an individual must travel far distances for something such as work and lives outside of a convenient public transportation route. Suggestions for actual lifestyle changes, such as consuming less meat and becoming involved in a community garden are even more difficult for individuals to implement if they are unmotivated to make the change. However, making any of these changes can have a positive impact on climate change. It may be small, but everyone contributing a small amount can make a difference. This is why our definition of carbon smart foods is those contribute the least amount of carbon dioxide and thus reduce the consequences from GHGs.

Our project was built on the guiding principle that food should be local beginning from cultivation all the way through processing into an end product. The AGSC courses have opened our eyes to the idea that food is not only a necessity but also serves as a medium for people of various ages, ethnicities and backgrounds to interact and build unique relationships. This leads to the opportunity of food outlets and educators to take the role of educating consumers about how cultivation, processing, ingredients and nutrition are inter-related with practices of fair trade between food outlets and farmers. We feel that knowledge is the key to overcoming the obstacles to achieve the consumption of local organic products we contribute by designing the carbon-smart food guide and label designed to raise awareness on the impacts of transportation during food purchase, cooking methods adopted and the treatment of wastes has on our environment. Lastly, beyond promoting informed food purchases we strongly encourage recycling and composting wastes to achieve sustainability in our food system

The ultimate goal of this project was to tailor a food guide that would appeal to the consumers that shop at farms or markets to educate them about the impacts of food on carbon emission. In our attempts to be simple, informative and appealing, we could only touch on a few important points largely underlining sustainability issues, but we believe the guide can help conscientious consumers make carbon smart choices in the future. While we do not expect the people who read this pamphlet to follow through with each recommendation to the letter, and many may not even consider any of the suggestions, the fact that we exposed people to these thoughts and ideas is a good first step in making a change. People may not take these suggestions to heart, but just knowing about them and having some information at the back of their mind might spur them on to question their current practices or make a carbon friendly change in their life. Having people actually make changes would be a fabulous outcome for this project; however, we believe that awareness might be the most feasible outcome. Through this project, we were able to see the bigger picture of the connections of food and our

environment at every step of the way from production to consumption shedding light on the cascade of events that follows with the simple act of eating.

Recommendations for Further Research

In this paper, we attempted to compile the current knowledge regarding the relatively new topic of carbon smart foods. More experiments need to be done to provide general guidelines towards what methods are less carbon intensive, an example being the differences between freeze drying, vacuum drying, and air drying. Thus, there can still be much room for groups in the future to look at the technology and production methods that can alleviate the resulting carbon footprint. In addition, there can still be more research on the benefits and drawbacks of consuming seasonal or organic foods as this was a topic of interest during our group's discussions. To further our scenario to educate the community about eating climate-friendly foods, groups in the future may consider going into schools and community settings to perform presentations with feedback. We hope that groups in the future can physically realize the experience of educating the community in a personal way as members of the UBC community.

For further research into the carbon smart food label, it would be best to research actual numbers in terms of food miles and production methods and decide a cut-off point for carbon smart foods. An example of a preliminary ranking scheme incorporating these two aspects can be seen in Appendix A4. Based on this, one would advise consumers to purchase foods that are lower in number and with a plus whenever possible. The lower the number, the less the food has traveled to its destination and the plus means the food product is organic. However, this system would only apply to consumers living in the Greater Vancouver Regional District. With much more research and development, the label could incorporate such additional information as specific distances traveled, farming methods used, the type of farm food was produced on, and a summary of how much energy went into its production and transportation.

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Appendix A: Carbon Smart Resources

A1. Side one of the Carbon Smart Food Guide.

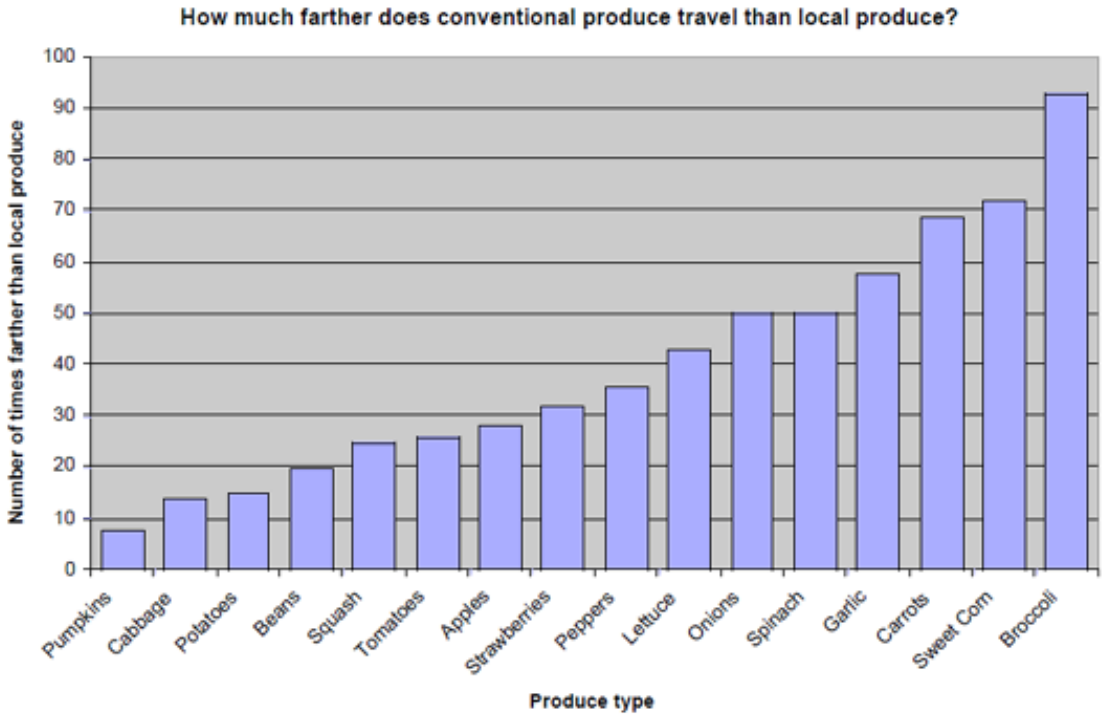
A2. Side two of the Carbon Smart Food Guide.

A3. Carbon Smart Food Label.

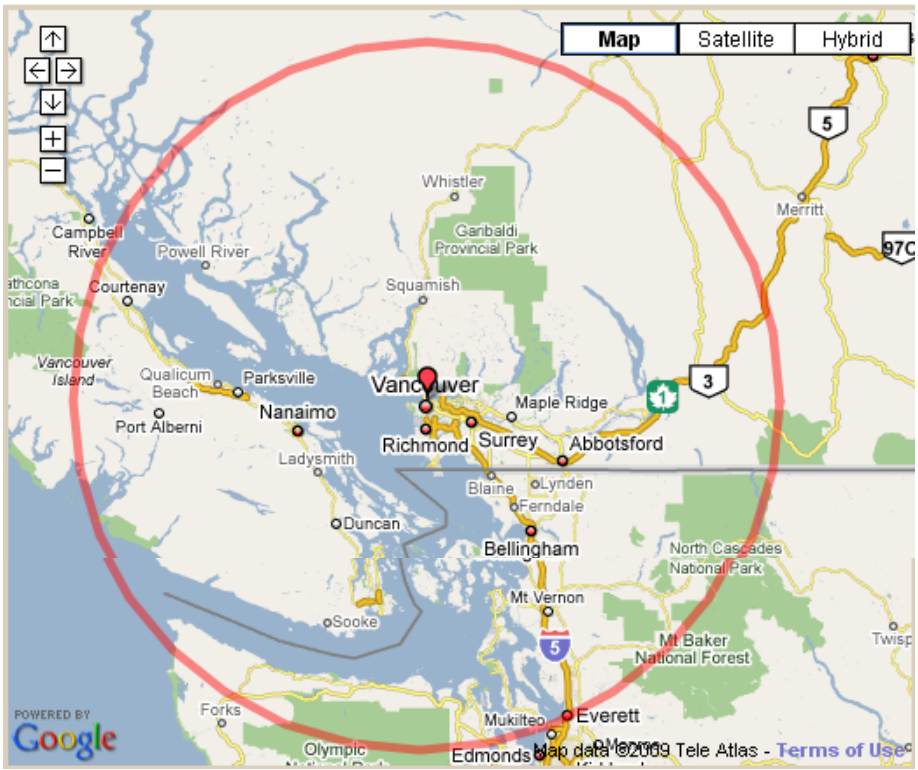
Origin	Number on the food guide
Local and organic	1+
Local	1
BC organic	2+
BC	2
North America organic	3+
Organic	3+
North America	3
America organic	4+
America	4
International organic	5+
International	5

A4. Example of categorizing foods based on origin and production method.

Appendix B: Charts and Diagrams



B1. Comparison between the differences in distance traveled between imported and conventional produce (ISU).



B2. 100 mile foodshed map around Vancouver (100 Mile Diet Society).

B3. List of seasonal produce in BC (What's in Season? BC Association of Farmers' Markets, 2009)

What's in season in March?

Apples, Pears, Rosemary, Sage.

What's in season in April?

Apples, Chives, Pears, Rhubarb, Rosemary, Sage, Spinach.

What's in season in May?

Apples, Chives, Radish, Rhubarb, Rosemary, Sage, Spinach, Turnips.

What's in season in June?

Apples, Cauliflower, Cherries, Chinese Vegetables, Chives, Cilantro, Lettuce, Peas, Potatoes, Radish, Rhubarb, Rosemary, Sage, Salad Greens, Spinach, Strawberries, Thyme, Turnips.

What's in season in July?

Apricots, Basil, Beans, Beets, Blueberries, Broccoli, Cabbage, Carrots, Cauliflower, Celery, Cherries, Chinese Vegetables, Chives, Cilantro, Cucumbers, Kale, Lettuce, Peas, Peppers, Potatoes, Radish, Raspberries, Rhubarb, Rosemary, Sage, Salad Greens, Spinach, Strawberries, Summer Squash, Swiss Chard, Tomatoes, Thyme, Turnips.

What's in season in August?

Apples, Apricots, Basil, Beans, Beets, Blackberries, Blueberries, Broccoli, Cabbage, Carrots, Cauliflower, Celery, Chinese Vegetables, Chives, Cilantro, Corn, Cucumbers, Currants, Garlic, Kale, Lettuce, Melons, Onions (sweet), Peaches, Pears, Peppers, Plums, Potatoes, Radish, Raspberries, Rosemary, Sage, Salad Greens, Shallots, Spinach, Strawberries, Summer Squash, Swiss Chard, Tomatoes, Thyme, Turnips.

What's in season in September?

Apples, Basil, Beans, Beets, Blackberries, Blueberries, Broccoli, Cabbage, Carrots, Cauliflower, Celery, Chinese Vegetables, Chives, Cilantro, Corn, Cucumbers, Currants, Garlic, Kale, Lettuce, Leeks, Melons, Onions (sweet), Onions (cooking), Pears, Peppers, Plums, Potatoes, Pumpkins, Radish, Raspberries, Rosemary, Sage, Salad Greens, Shallots, Spinach, Strawberries, Swiss Chard, Tomatoes, Thyme, Turnips, Winter Squash.

What's in season in October?

Apples, Beans, Beets, Blackberries, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Chives, Cilantro, Corn, Cranberries, Garlic, Kale, Lettuce, Leeks, Onions (sweet), Onions (cooking), Pears, Peppers, Potatoes, Pumpkins, Radishes, Rosemary, Sage, Salad Greens, Swiss Chard, Tomatoes, Thyme, Turnips, Winter Squash.

What's in season in November?

Apples, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Garlic, Leeks, Onions (cooking), Pears, Rosemary, Sage, Thyme, Turnips, Winter Squash.

What's in season in December?

Apples, Brussels Sprouts, Cabbage, Garlic, Pears, Rosemary, Sage, Turnips, Winter Squash.

What's in season in January?

Apples, Cabbage, Pears, Rosemary, Sage, Turnips, Winter Squash.

What's in season in February?

Apples, Cabbage, Pears, Rosemary, Sage, Turnips.

Product	Season
APPLES	AUGUST - JUNE
APRICOTS	JULY - AUGUST
BASIL	JULY - SEPTEMBER
BEANS	JULY - OCTOBER
BEETS	JULY - OCTOBER
BLACKBERRIES	AUGUST - OCTOBER
BLUEBERRIES	JULY - SEPTEMBER
BROCCOLI	JULY - OCTOBER
BRUSSELS SPROUTS	OCTOBER - DECEMBER
CABBAGE	JULY - FEBRUARY
CARROTS	JULY - NOVEMBER
CAULIFLOWER	JUNE - NOVEMBER
CELERY	JULY - OCTOBER
CHERRIES	JUNE - JULY
CHINESE VEGETABLES	JUNE - SEPTEMBER
CHIVES	APRIL - OCTOBER
CILANTRO	JUNE - OCTOBER
CORN	AUGUST - OCTOBER
CRANBERRIES	OCTOBER
CUCUMBERS	JULY - SEPTEMBER
CURRANTS	AUGUST - SEPTEMBER
GARLIC	AUGUST - DECEMBER
KALE	JULY - OCTOBER
LETTUCE	JUNE - OCTOBER
LEEKS	SEPTEMBER - NOVEMBER
MELONS	AUGUST - SEPTEMBER
ONIONS (SWEET)	AUGUST - OCTOBER
ONIONS (COOKING)	SEPTEMBER - NOVEMBER
PEACHES	AUGUST
PEARS	AUGUST - APRIL
PEAS	JUNE - JULY
PEPPERS	JULY - OCTOBER
PLUMS	AUGUST - SEPTEMBER
POTATOES	JUNE - OCTOBER
PUMPKINS	SEPTEMBER - OCTOBER
RADISH	MAY - OCTOBER
RASPBERRIES	JULY - SEPTEMBER
RHUBARB	APRIL - JULY
ROSEMARY	YEAR ROUND
SAGE	YEAR ROUND

SALAD GREENS	JUNE - OCTOBER
SHALLOTS	AUGUST - SEPTEMBER
SPINACH	APRIL - SEPTEMBER
STRAWBERRIES	JUNE - SEPTEMBER
SUMMER SQUASH	JULY - AUGUST
SWISS CHARD	JULY - OCTOBER
TOMATOES	JULY - OCTOBER
THYME	JUNE - NOVEMBER
TURNIPS	MAY - FEBRUARY
WINTER SQUASH	MID SEPTEMBER - DECEMBER