UNIVERSITY OF BRITISH COLUMBIA
FOOD SYSTEM PROJECT 2008

Scenario 1:
Climate Action Partnership
Moving UBC beyond Climate Neutral

Group 21

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I. Abstract

This report will address the social, environmental and economic concerns associated with greenhouse gas (GHG) emissions from the food system at the University of British Columbia. We, group 21 of the 2008 UBC Food Security Project, have explored GHG reduction initiatives at other universities around the world, as well as the emissions associated with the various sectors of the global and national food system in order to reduce the carbon footprint of UBC's food system. Our research methodology focused on literature review and discussion with stakeholders. Based on our findings, we developed recommendations revolving around the concepts of local food, increased energy efficiency in buildings and appliances, and increased composting, and set feasible targets as a starting point for moving UBC *beyond* climate neutral by 2010. This report provides a valuable knowledge base, and with the continued support of all stake-holders involved in the UBC Food Security Project, will be useful in future efforts working towards creating a sustainable food system on campus.

II. Introduction

The UBC Food System Project (UBCFSP) is a collaborative, community-based action research project, which aims to develop the social, economic and environmental sustainability of the UBC food system. The project includes partnerships between UBC Food Services (UBCFS), AMS Food and Beverage Department (AMSFBD), UBC Waste Management (UBCWM), UBC Farm, UBC Campus and Community Planning, Sauder School of Business classes, UBC Sage Bistro, UBC Sustainability Office (SO) and it's Social, Ecological, Economic, Development Studies (SEEDS) program, and the Faculty of Land and Food Systems. The UBCFSP is part of Agricultural Sciences 450: Land, Food and Community III, and first began seven years ago.

One of the many UBC FSP projects this year evaluates greenhouse gas emissions and climate change within the UBC food system. Climate change is an issue that has recently gained increasing and unprecedented publicity, and there is a need for urgent solutions. Although UBC has been considered a leader in campus sustainability since the 1990's, the university has not yet fully incorporated the issue of climate change into the campus

community. Opportunities exist for UBC to continue to show leadership in sustainability by moving the campus *beyond* climate neutral. The Climate Action Partnership (CAP), created by the UBC Sustainability Office, is a recent initiative in which a group of campus stakeholders have committed to decreasing the greenhouse gas emissions of the UBC Campus. The goal of this paper is to conduct research on how the food system at UBC can decrease emissions and help CAP move the campus towards climate-neutrality.

III. Problem Statement

Where is the UBC food system in terms of greenhouse gas emissions, and how can we take it beyond carbon neutral by 2010?

Greenhouse gas emissions are responsible for accelerated climate change trends around the world. These trends include global warming, increased number and severity of storms, and melting of glaciers. Climate change has the potential to disrupt an already fragile food system by disrupting crop cycles, shortening growing seasons, and compromising the land and ocean ecosystems. International action on climate change has been increasing as more of these effects become noticeable in our daily lives. British Columbia has taken groundbreaking action in mandating that all public sector organizations, including universities, become carbon neutral by 2010 (Penner, 2007).

The University of British Columbia, as a public sector organization, must meet the carbon neutral goals set by the provincial government. The University of British Columbia has already begun integrating sustainability into campus plans and policies; however, innovative and dynamic plans will be necessary to find a solution for the "climate crisis". An example of what UBC has accomplished thus far is Ecotrek, the sustainability arm of the Trek 2010 campus development plan (UBC, 2006). The CAP has developed a greenhouse

gas emissions profile for UBC examining various contributors of campus emissions to move UBC toward climate-neutrality. Other greenhouse gas emissions associated with UBC, but not included in the emissions profile, include those from the food system. The UBC food system's emissions need to be estimated to address which sectors are the biggest contributors of emissions and where there are opportunities for reduction.

This scenario is not only associated with the UBC food system, but also with issues in the broader food system. As previously mentioned, internationally, awareness is growing around the importance of slowing climate change and reducing greenhouse gas emissions. This is evidenced by multinational agreements such as the Kyoto Protocol, which caps the amount of greenhouse gas emissions developed nations can emit, and will collect on each ton over the cap that a country exceeds. Support for Kyoto is strong albeit controversial, and 175 parties have ratified the protocol including 36 developed nations. Additionally, there has been a focus on the impact of agriculture on the environment and climate change in many parts of the world. The growth of the organic industry and buy local campaigns are just two of many examples of current industry and consumer preoccupation with the food system and its relationship with the environment.

Our task has been to research the sources of greenhouse gases in the food system, and use this information to develop a model of greenhouse gas emissions of the UBC food system. From this model, important sources of greenhouse gas emissions in the food system have been identified and recommendations for reducing them have been developed.

IV. Vision Statement and Identification of Value Assumptions

Before beginning the research process, our group members shared their perspectives on the 7 guiding principles that capture the UBCFSP's Vision Statement for a more

sustainable food system. Some of the principles were helpful in focusing our research and aligned with our own beliefs. A reliance on local inputs paralleled both the initial brainstorming, as well as research done by the group on methods for reducing greenhouse gas emissions in the food system. We also thought that the inclusion of locally processed waste was important, as we discovered that wastes are significant contributors to greenhouse gas emissions in the food system. Many of the group members have a nutrition background, so the guidelines concerning food security and healthy diets also resonated as important. Education and awareness was an idea that came up in many of our discussions on making GHG reduction initiatives at UBC successful; engaging consumers, food service businesses, and other faculties will be key to the successful implementation of the recommendations in this paper.

We found the carbon neutral scenario limiting when it came to consideration of some of the guiding principles. From our research, we discovered that some concepts we would have liked to include that are relevant to sustainability are controversial in terms of greenhouse gas emissions. For example, composting itself releases greenhouse gases, and depending on the method used can have a net effect of releasing more greenhouse gases than if the waste had been taken to a landfill (Sutton, 2007). We also felt that the vision statement needs to consider the ethical treatment of the animals involved in food production, as well as the people. Principle 1, which involves protecting the natural ecosystem, is not specific enough to address this issue. Given that animal studies and animal welfare are a large part of this faculty, it is essential to include these viewpoints in the vision statement.

Through our reflections, our group realized that it shares a weak anthropocentric viewpoint. We agree that human wellness is more crucial than that of other organisms;

however, in order to support future human well-being, the maintenance of a healthy environment is a prerequisite. Weak anthropocentrism is one way to promote the mutual flourishing of human and non-human nature. The degree of anthropocentrism did vary within the group, with some people being more strongly anthropocentric and a few others leaning towards biocentrism. We believe that the personal differences in our paradigms gave our group a more complete picture of sustainability, and helped us develop recommendations that are applicable to a broader audience.

V. Methodology

The overarching methodology for our group involved an intensive literature review on greenhouse gases, climate change and the food system. We initially researched into findings from previous Agsc 450 students, followed by internet searches of where UBC is at in respect to GHG emissions, as well as what other campuses are doing in North America and around the world. Our review of literature then focused on GHG emissions from the different sectors of the food system, how they are created, which are most important, and what can be done to reduce them. This research was applied to our project to set targets and determine recommendations for the future.

Our methodology also includes some partnership on research initiatives with other scenario one groups, as well as collaborative discussion on findings. Furthermore, essential information was gained through guest speakers to the 2008 AGSC 450 class, including representatives from AMS food and beverage, UBC food services, and the UBC sustainability office. Additionally, we arranged an appointment with Dorothy Yip (UBC FS) to examine the current UBC food system and discuss the possibilities of further improving

the campus's current status. Finally, the entire group participated in the UBC Climate Action Partnership Food Roundtable Discussion organized by Liz Ferris.

VI. Findings and Discussion

A. Introduction to climate change and the food system

Climate change and global warming are becoming increasingly recognized as perhaps the most significant environmental problems of our time. Over the last 50 years, the average temperature has increased 0.10-0.16 degrees Celsius per decade (IPCC, 2007). The International Panel on Climate Change suggests that "most of the observed increase in global average temperatures since the mid-20th century is *very likely* due to the observed increase in anthropogenic GHG concentrations" (IPCC, 2007, p. 39). There are four main types of GHG emissions including: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and halocarbons (IPCC, 2007). The global warming potential (GWP) of each source of emissions is different; however, GHG emissions are generally reported in terms of carbon. The GWP of methane and nitrous oxide are 21 times and 310 times that of carbon dioxide, respectively (Ferris & Best, 2007).

Every sector of the food system contributes to GHG emissions such as through the use of energy, fossil fuels and the production of waste. This section of the paper will discuss GHG emissions from the various food system sectors at a global, national and university level. For the purposes of this report, the food system has been broken down functionally in to several categories: agriculture, transportation, processing/packaging, and waste. According to a FCRN report, the GHG contributions from each sector relative to total emissions are outlined in Figure 1.

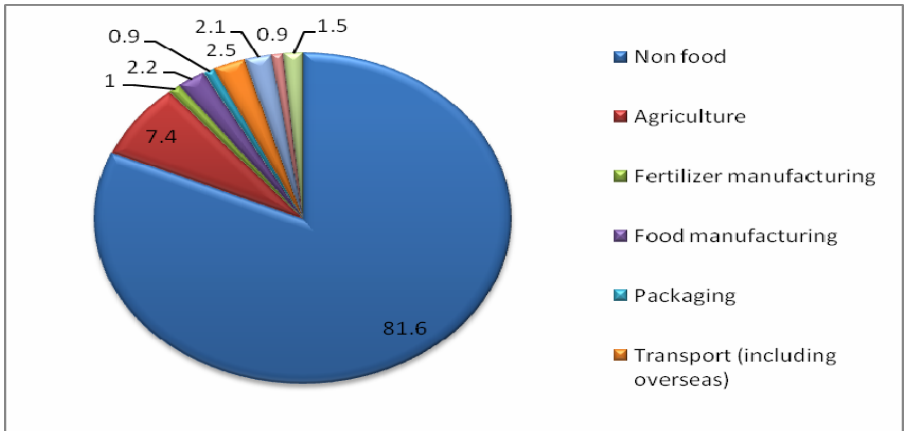

Figure 1. GHG contributions of food system sectors relative to non food GHG emissions in the UK (FCRN, 2007).

B. Emissions from food system sectors in the global, national and UBC food system

i) Agriculture

Before the industrial revolution, the climate was in a relatively stable state as anthropogenic GHG emissions were less intense, and did not exceed the Earth's capacity to transform them through natural mechanisms such as the conversion of carbon dioxide to oxygen by plants or absorption by the ocean (Cogeneration Technologies, 1999). However, since the inception of industrial revolution and the growth of large-scale agriculture, there has been rapid deforestation, which has accelerated the accumulation of GHGs in the atmosphere. According to Tara Garnett from Food Climate Research Network (2007), agriculture accounts for 17-32% of total GHG emitted globally. In Canada, agricultural practices are estimated to contribute 28% and 72% of total anthropogenic methane and nitrous oxide emission, respectively. Moreover, a GHG audit conducted in 2003 found that agriculture-related activity contributed to 8.4 % of Canada's total national emissions (Environment Canada, 2005).

Within the agricultural sector, enteric fermentation by livestock and soil eruption are the largest contributors to GHG emissions, and the majority of GHGs emitted are methane or nitrous oxide. Livestock manure contributes to methane emissions, and as methane has a high GWP, the climate change potential from livestock production is enormous (Ferris and Best, 2007). The UN FAO state that production of livestock may actually contribute more to GHG emissions than transportation (UN FAO, 2006). In the UK, meat and dairy production account for 8% of the total GHG emissions (Garnett, 2007). This is significant as it accounts for nearly 50% of the total food-related GHGs in the UK.

Many other agricultural practices also have impacts on global warming through the use of large amounts of fossil fuels to run farm equipment. One practice believed to decrease greenhouse gas emissions from agricultural soil is no-till or reduced-tillage practices. There remains some uncertainty; however, whether or not increased soil moisture and warmer winter temperatures may increase N_2O emissions thus off-setting gains in carbon storage resulting from the adoption of reduced-tillage (U of M, 2005). Furthermore, practices such as manure and fertilizer addition may interact with tillage system to generate increased N_2O emissions (U of M, 2005).

The extensive use of nitrogen-based fertilizer in conventional agricultural practices is another contributor of GHG emissions from the food system. The manufacturing of synthetic fertilizer is an energy intensive process, which ultimately leads to the release of large quantities of GHG emissions as nitrous oxide. According to Heller and Keoleian (2000), the production of synthetic fertilizers and pesticides accounts for 40% of the energy used within the entire agricultural system in the United States (Brodt, 2007). A report from Alberta Agriculture

and Rural Development accounts 42% of Alberta's total agriculture-related emissions to the production and use of fertilizer (Sutton, 2000).

UBC has the unique opportunity of having the last working farm in the City of Vancouver. UBC farm does not include any large-scale livestock production, and therefore emissions are bound to be lower than the national average for all agriculture. The only animals on the farm are a small flock of free range chickens, which are relatively low in their associated GHG emissions. As UBC campus does not solely rely on food from the farm, the university must accept some responsibility for contributions to global warming from off-campus agricultural practices. If all of the food consumed at UBC is considered, along with the presence of the farm, GHG emissions from agriculture are most likely very similar to the BC provincial average.

ii) Transportation

Since the advent of industrial agriculture (described previously) incredible yields, have allowed for rapid urbanization and more people to "migrate to the cities to look for employment and better economic prospects" (Lang & Heasman, 2004, p. 231). In fact, for the first time ever, more than half of the world's population is living in a city (Lang & Heasman, 2004). During this same period, advances in technology have allowed for food to be preserved for longer, and distributed en-masse, transforming agriculture into agribusiness, and food into a commodity. Consequently, cities today are flooded with a year-round cornucopia of food produced from a new global food system. In temperate regions, such as Canada, "global food" is especially prevalent as natural growing conditions are poor during nearly half of the year.

While this system is able to meet the constant demand for a large variety of produce, it relies heavily on fossil fuels for transportation. The use of fossil fuels is known to release various GHGs including CO_2, N_2O and CH_4 (Xuereb, 2005). Mass distribution of food has become so common that it is estimated that the average item in Canada travels approximately 4497 km, and generates 51,709 MCTE per annum (NCAT, 2008). For many food items, this journey begins at a farm, includes a stop at a processing plant and a distributor, before finally arriving at a supermarket. In the UK, food miles are estimated to contribute to 2.5% of total GHG emissions (FCRN, 2007).

It has been widely established that reduction of the distance traveled by food can significantly reduce GHG emission. The Leopold Centre for Sustainable Agriculture conducted a study comparing the emissions associated with local and non-local food items and concluded that the transportation of the latter generated 5 to 17 times more CO_2. Another analysis performed in Waterloo examined 58 foods items and found that if they were sourced regionally, GHGs would be lowered by 49,485 MCTE annually (NCAT, 2008). Figures such as these are universal and have spawned a new niche market surrounding local food.

Although British Columbia produces enough food to meet 56% of the populations needs; food production is not evenly distributed among food groups. For example, the province is 159% self-reliant for fruits, but only 14% for grains (BC MAL, 2006). This leads to 64% of the food consumed in BC to be imported from outside the province (BC MAL, 2006). The food sold at the UBC campus is part of the BC food system, and therefore, likely has comparable food miles. Purchasing only BC produce at UBC has the potential to significantly reduce GHG emissions.

Possibly more important than the distance traveled by food is the mode of transportation. Food is transported by four major methods of distribution: air, marine, rail and truck. Each form of transportation varies in terms of GHG contributions, however, generally rail, marine, truck and air respectively contribute 21.2, 130.3, 269.9 and 1,101.0 g/tonne-km of CO_2 emission equivalents (Xeureb, 2005). Variability also exists within each mode of transportation due to engine and load factor efficiency, and refrigeration. Interestingly, of all four modes of transportation, consumer car trips to and from grocery stores are believed to be the least efficient in terms of energy use as cars are rarely loaded to maximum capacity (Xeureb, 2005).

Although Canadian data on relative contributions from each mode of transportation are not available, a study in the UK conducted by DEFRA indicates that the tonne-kilometers for air, road, rail and sea were 0.5%, 34%, 0.01% and 65%, respectively (DEFRA, 2005). This study revealed that air freight was the fastest growing method of distribution, and as air transportation has the greatest contributions from transportation to GHG emissions, air freight will correspondingly contribute increasingly to climate change in the future. In Canada, the primary country produce is exported to is the United States, accounting for 64% of exports (Stats Can, 2004). Although Canada is connected to the US by land much food (such as perishable produce items) is still flown by air. The food in the UBC food system most likely has a similar breakdown of the contributions from different modes of transportation to the rest of Canada.

iii) Processing and Packaging

The global food market currently offers over 320,000 items, most of which have been processed in a multitude of ways including curing, canning and pasteurizing for reasons such

as safety, convenience or nutrition (Nestle, 2007). The processing and manufacturing of food is estimated to account for 1.2% of overall GHGs in Canada (Environment Canada, 2005). This assessment does not take into account the emissions associated with the end-stage of food processing. More than 80% of these emissions are directly tied to the utilization of energy, which is needed for the thermal and mechanical processes involved in transforming food. Consequently, related emissions depend on the energy source being used; in Canada, the primary fuel used is natural gas (64%), followed by electricity (26%) and fuel oil (4%), with the remaining energy generated from sources such as propane, butane and coal (AAFC, 2005). For the purposes of this report, we will focus on four major methods of food preservation: canning, freezing, refrigeration and dehydration, as well as the energy consumed in final food preparation.

Canning and dehydration are heat treatments used to increase the shelf life of food items, whereas freezing and refrigeration are used for preservation by cooling. Although cooling preservation only uses electricity, high temperature preservation can employ natural gases and petroleum-based products, which may generate more or less emissions depending on the source of electricity. For example, the canning of vegetables has been shown to use double the amount of energy as freezing in the manufacturing process due in part to the materials needed such as aluminum cans and glass jars (Brodt, 2007). On the other hand, cooling methods require continuous inputs of energy and in the long term can have higher GHG emissions. Overall, freezing is thought to require up to 35% more energy than canning (Brodt, 2007). Alternatively, the dehydration of foods may result in a net decrease in energy consumption of 15% as more food can be transported in a condensed form and there no refrigeration is required (Brodt, 2007). Refrigeration is particularly harmful because it

involves energy use, as well as the release of hydrofluorocarbons (HFC). HFC's have a GWP ranging from 140 to 11,700 times that of CO_2 (US EPA, 2006). In the UK, it is estimated that GHGs from refrigeration constitute 17-18% of all food-related emissions (Garnett, 2007).

In general, energy is relatively inexpensive and represents only 4-5% of the overall cost of food, thereby allowing manufacturers to continue to utilize intensive processing techniques as a means of adding value to their products (AAFC, 2005). To our knowledge, there is no information currently available regarding the relative proportion of fresh, frozen, canned and dehydrated foods in the UBC food system. Moreover, because there are many contingencies that must be considered when assessing whether any one method is more beneficial in terms of GHG emissions it is not practical to focus on one beneficial method for lowing overall GHG emissions.

On campus food preparation by residents and food outlets also consumes energy; in the UK food system, in-home food preparation accounts for 2.1% of the national GHG emissions (FCRN, 2007). Many of these emissions are indirectly generated by the use of energy through kitchen appliances, and lighting; however, this report will focus only on those emissions directly related to the preparation of food. The energy intensity of heating depends on the energy source, and the food being prepared. Gas heating is most efficient and generates 30-50% fewer emissions than other methods (AG DEWHA, 2006). For smaller food portions (less than six servings), a microwave is thought to emit 30-50% less GHGs as conventional ovens, and is 36-92% more efficient than a hotplate (AG DEWHA, 2006; ESRG & KB SCA, 2001). In a conventional oven, up to 90% of the energy used is wasted and switching to a convection style oven may reduce emissions by up to 35% (AG DEWHA, 2006). If the food product needs to be heated slowly for prolonged periods (ie. a soup), then a

hotplate would be superior to a microwave (ESRG & KB SCA, 2001). When boiling water, a pressure cooker produces half as much GHGs as a hotplate or microwave (AG DEWHA, 2006). For foods requiring water to be held at a simmer, a pressure cooker generally requires lower energy inputs (FEES, 1991). All of the aforementioned examples illustrate that the appliance chosen for heating can have a dramatic effect on energy use and therefore GHG emissions.

At UBC, it is in the best interest of the university to employ the most efficient methods at each specific food outlet as they will save on the direct and indirect costs of electricity. Currently, electricity and heating are contributing about 74% of registered emissions on campus, but more research is necessary to determine what proportion of this is produced from food production and storage.

Packaging offers great convenience to consumers and food businesses, but is another post-harvest activity that contributes to GHG emissions. Packaging materials include paper, plastics, glass and metals and the production of these materials using large amounts of energy. Paper packaging manufacturing requires energy inputs that are 1.4 times higher than the manufacturing of a plastic bag of the same carrying capacity (AAC, 2007). Metal packaging, especially the production of aluminum materials are energy intensive, however, recycling of aluminum can save up to 84 million tons of GHGs every year (Marks, 2003). Plastic, another widely used packaging material in the food industry, is also produced by an energy intensive process; however, plastic bags require less energy to produce than paper bags and they are also generally reusable increasing the efficiency of packaging (AAC, 2007).

iv) Waste

In 2005, the waste sector in Canada contributed approximately 3.7% of overall GHG emissions in the national inventory (Environment Canada, 2007). This includes the disposal of solid waste on land, wastewater, and waste incineration. Overall, 96.4% of these emissions were attributed to the disposal of solid wastes on land, with the handling of wastewater and incineration contributing only 3.3%, and 0.9%, respectively[1]. Human excrement in wastewater is a byproduct of the food system; however, because this source of GHGs is relatively small and is outside of the university's control, it will not be addressed in this report (Environment Canada, 2007).

At UBC, primarily the reduction of waste is most important, followed by reusing or recycling as a means of reducing the carbon footprint of the waste produced on campus. The most significant contributor to GHGs in the waste sector of the food system is the wasting of food itself. The International Alliance Against Hunger (2007) estimates that between one third and one half of all food shipped to leading developed countries is not consumed; this needlessly increases the amount of GHGs generated by the production, distribution, processing and storage of food. A waste audit conducted in 1998 at UBC concluded that landfill waste was 34% organic material such as discarded food (UBC WM, 2006). If this proportion is maintained, in 2004 it would represent 1843 tons of food waste[2].

The food system also generates a lot of waste in the form of disposable containers and packaging. The US Environmental Protection Agency estimates that this represents 33.1% of the solid waste by volume in the USA food system (Lang & Heasman, 2004). At the food service outlets at UBC, approximately 40% of the landfill waste is made up by disposable

[1] These values total more than 100% due to rounding in the initial paper.
[2] This value represents 34% of the 2005 total tonnage of solid waste.

containers (Wastefree UBC, 2008). The biggest opportunity to minimize emissions in the waste sector at UBC, therefore, involves decreasing the amount of waste produced.

In 2004, 54% of the total solid waste from UBC was taken to a landfill (UBC WM, 2006). These wastes include both organic and inorganic materials, each with a different impact on GHG emissions. When organic materials are landfilled, they are decomposed by anaerobic bacteria, which generate both CO_2 and CH_4, in approximately equal proportions. The CO_2 produced is part of the natural carbon cycle; however, the CH_4 produced is considered an anthropometric source of GHGs, and constitutes 89% of the emissions from solid waste disposal on land in Canada (Environment Canada, 2007). At some facilities, the CH_4 is trapped and converted into energy which can help reduce this source of GHG emissions (US EPA, 2006).

An alternative disposal route for organic wastes from the food system is composting. UBC operates an in-vessel composter capable of handling 5 tons of organic waste per day. In 2004, this composted was operating well-below capacity as just over one ton per day (UBC WM, 2008)[3]. During composting, decomposition of organic matter occurs aerobically, producing only CO_2 (UBC WM, 2008). These emissions are not included in GHG inventories because they are part of the natural carbon cycle. Composting also reduces emissions by adding trapped carbon to the soil and decreasing the need for fertilizers (and the associated emissions with application). For every percent of discarded food that can be diverted to the composter at UBC, the net reduction in GHG emissions would be 4.6 MTCE (UBC WM,

[3] Value is based on 200tons/yr from grounds organic waste, 130tons/yr from UBC farm animal waste, and 50.5tons/yr from food discards

2006)[4]. The emissions associated with transportation to, and operation of an in vessel machinery were found to be lower than or comparable to that for transportation to a landfill (US EPA, 2006).

Alternatively to composting, many other solid wastes from the food system can be recycled. Recycling involves the processing of wastes to form new secondary products. For example, aluminum and steel cans have a 93% and 98% recovery rate, respectively, and belong to a closed-loop cycle, meaning that they produce entirely new cans (US EPA, 2006). Some plastics can also be used to produce secondary products such as boxboard and asphalt filler (US EPA, 2006). The processing of these materials does generate GHGs; however, these processes displace the production of materials from primary sources and therefore "recycling has lower GHG emissions than all other waste management options except for source reduction" (US EPA, 2006, p. 35). It is important to note that the GHG emission reductions from recycling vary among products. For example, aluminum cans recycling is more efficient than glass recycling (US EPA, 2006). The emissions associated with transportation of recycled material would be similar to those from landfilling, and at UBC, both facilities are located off-campus in Vancouver (UBC WM, 2006).

C. University initiatives on climate neutrality

Many universities and colleges in the U.S., Canada, and around the world are working towards the creation of a sustainable campus through climate neutrality. This involves interactions between students, faculty and campus operations to promote sustainability through education, communication, research and professional development. Although each university faces unique challenges, most institutions planning for climate

[4] Value is based on 1% of 1843tons of discarded food, and a net benefit of 0.25 MTCE/1wet ton (US EPA, 2006).

neutral have created a climate action plan combining emission reduction and carbon offsetting. Currently, over 325 institutions across North America have joined the American University and College President's Climate Commitment, and are dedicated to climate neutrality (ACUPCC, 2007). Signatories of the commitment are expected to inventory all GHG emissions, and create a plan to move towards a climate neutral campus. The ACUPCC does not however, define a specific scope of climate neutrality, potentially meaning that not all emissions may be accounted for in campus inventory reports.

Through the ACUPCC and other organizations many universities are planning for a climate neutral campus. The College of the Atlantic (Maine) has set goals for 100% reliance on energy from renewable resources by 2015, and is the first university to achieve carbon neutrality through reduced emissions and purchased offsets (COA, 2007). Similarly, Arizona State University has committed to carbon neutrality within two years of completing a GHG inventory (ASU, 2007). Research at the University of Florida has revealed that the campus could achieve carbon neutrality with no net cost to the university within two decades (UF, 2004). The University of Victoria has also demonstrated leadership on the issue of climate change by proposing the idea of *beyond* climate neutral to emphasize solutions for climate change. Oberlin College (Ohio), as well as numerous other institutions across North America, have committed to climate neutrality by a definite year (anywhere from 2015-2050) and are currently in the planning stages of mapping out the challenges and opportunities of the process (Rocky Mountain Institute, 2002).

There are various sources of GHG emissions that are outside the scope of inventories completed by most institutions; many of these unaccounted emissions relate to the food system. Oberlin College is one of the few universities that included agriculture and food in

their GHG inventories. They found that agriculture and food accounted for 91 tons of CO2 per year, or 0.18% of the total campus emissions (RMI, 2002). These estimates do not include emissions from food service buildings, which were instead part of the total energy use by buildings that accounted for more than 90% of Oberlin's total emissions (RMI, 2002). The college also provides some recommendations for reducing food system emissions, including retrofit options for vending machines that can decrease energy consumption per vending machine per year by 2,000-3,500 kWh (RMI, 2002). Furthermore, Oberlin recommends reducing waste sent to landfills by diverting organic waste to compost, and waste reduction efforts (RMI, 2002). These recommendations aid in the reduction of GHG emissions from the college food system.

Many other colleges and universities in North America, including UBC, have chosen not to quantify emissions from the food system in GHG inventories as they can be difficult to measure and define. Most institutions are, however, concerned with the general sustainability of the food system, which indirectly acts to decrease GHG emissions. This generally includes promotion of local foods, decreased use of fertilizer, composting, biodegradable containers, and more energy efficient appliances – all of which aid in reduction of emissions. For example, Pomona College is one of many working towards increasing the use of seasonal, local produce in dining halls (Pomona College, 2007). This decreases the emissions related to the food miles of produce. Pomona College is also concerned with reducing the need for pesticides and fertilizers around campus, switching to manual weeding and the use of compost from campus food waste (PC, 2007). Furthermore, all paper products provided by the dining halls are made from 100% recycled materials and are also biodegradable (PC,

2007). The college also introduces sustainability every fall in a new student orientation 15 minute presentation on how to be green on campus (PC, 2007).

In Canada, the University of Manitoba (U of M) has produced some valuable research demonstrating methods for decreasing energy use and carbon emissions in agriculture. U of M has revealed that a system with low or zero tillage, when compared to a conventional tillage system, has lower emissions and lower energy requirements (U of M, 2005). Furthermore, the U of M (2005) shows that additions of leguminous forages to rotations will reduce long-term energy inputs, as well as carbon emissions. Other universities, such as Princeton, Yale, and the College of the Atlantic, have focused on bringing farming to campus. This includes selling a percentage of food from the farm to campus food services, as well as using the farm to organize special events, lectures and educate other students about the environmental impacts of food. The College of the Atlantic recommends (with respect to emissions) to avoid, reduce, and offset in the food system by composting, purchasing local foods, and choosing products with less packaging to minimize trash and associated landfill methane emissions (COA, 2007).

The University of Santa Cruz has committed to local food for dining services that must be grown 250 miles of the university (UC Santa Cruz, 2004). This includes a progressive increase every year for the percentage of local food incorporated into the menu, as well as an education outreach campaign to students (UC Santa Cruz, 2004). UC Santa Cruz (2004) has also outlined the challenges involved in bringing local food to campus; barriers include the continued education of meal plan holders, addressing the costs of purchasing more sustainably produced food, working with local farmers to bring more local food to campus, and competing with corporate food providers for influence over food

services. Conversely, Northern Arizona University has collaborated with the Arizona Department of Agriculture and the Arizona Farmers Association in order to overcome some of the challenges faced with bringing local food to campus (NAU, 2003).

D. CAP Food Roundtable Summary

The food roundtable brought together members of the UBC community to discuss the GHG emissions associated with the UBC food system. This was an opportunity for students, staff, and faculty members to identify sources of emissions, and offer strategies for reducing the impact of the UBC food system to contribute to the goal of moving UBC *beyond* climate neutral. Liz Ferris, the Climate Action Partnership coordinator, began by introducing the topic of GHG emissions in the food system. This was followed by the roundtable discussion, which was carried out in "world café" format with four questions distributed around eight tables (two tables/question).

The questions included:

1. We know much better how to reduce emissions than we do how to measure them. What food items known to have lower emissions can be provided in the short run by UBC food providers?
2. What does a Beyond Climate-Neutral Food System look like at UBC?
3. What are the targets and indicators that we can set for a beyond climate neutral food system?
4. What are some food system best practices (at UBC or elsewhere)? What current opportunities do we have for immediate and long-term action? How can we act on this?

Discussions were carried out in four sessions of 15 minutes each, and participants were asked to shuffle themselves to address each question once. Each table had a note taker that recorded what was said and at the end of the session the entire group was brought together, and note takers reported the three main points from each question.

The first question asked which food items contribute fewer emissions. The discussion on this matter seemed to generate more questions than answers. Most groups felt that foods that are animal-based, processed, cold stored, packaged, intensively produced (tillage, hothouse, and fertilizer), and distributed long distances or by plane are primary contributors to GHG emissions; however, there was much debate about each of these factors. It was pointed out that not all animal-based products are equal in their contribution to emissions. The impact on the environment depends on the type of livestock, as well as the type of feed used and the disposal of wastes. Also, alternative protein sources such as heavily transported and processed soy products that were produced on deforested land may not be any better than a local source of animal protein.

This contingency exemplifies many of the questions that were asked at these tables. For example, as BC is a temperate zone, is it better for us to preserve a local food items by canning and freezing, or to purchase fresh food from elsewhere that needs to be transported and preserved using refrigeration? One of the more interesting discussions centered around whether the food miles were less for a system that had one truck from a large distributor deliver food once per week, or many small scale, local producers bringing in food continuously. These are the tradeoffs that need to be considered, which makes the task of purchasing the 'best' food items at UBC a challenge.

Question number two asked participants to envision a UBC food system that went beyond climate neutral. Many people described a campus that maximized its food production by utilizing edible landscapes and rooftop gardens. Also, at this fictitious UBC, there are no franchises, and food service outlets use energy efficient technologies and promote local and seasonal foods. Food items would carry labels that indicate their carbon footprint, and there

would be less demand for high GHG food items such as meat. To reduce wastes, all organic materials are composted, and packaging is reusable rather than recyclable. In the classroom, students learn about GHGs, and how to limit emissions in their field of study and lifestyle choices. The discussion at these tables was very inspiring as some of the aspects of this vision are achievable, and steps are already being taken to see this happen.

The third question asked participants which indicators and targets should be set to achieve this beyond carbon neutral campus. Many useful indicators were discussed, but relatively few targets were offered because of a lack of information about the baseline values. Many people felt that the proportion of local, and high GHG producing food being sold at UBCFS and AMSFB was a good indicator, but no targets were offered. Other indicators brought up include the amount of food that is produced on campus, knowledge of GHGs from different food items, number of franchises, percent of organic waste being composted, and amount of electricity being used by food service operations. These are all good indicators, but it is important to have targets that accompany them. A simple target that could be used for many of these parameters would be to have a policy in place by next year that requires that they be measured and monitored.

The final question required participants look at the current situation, and identify some of the existing practices at UBC and elsewhere that are minimizing the carbon footprint. It also asked what opportunities there are at UBC for lowering GHG emissions, and for thoughts on how best to achieve this. Many of the participants recognized UBC as a leader in sustainability, citing unique operations such as the UBC farm, Sprouts, the in-vessel composting facility, the Sustainability Office, and practices such as the AMS lighter footprint strategy.

Overall, students felt that the university was committed to lowering its GHG emissions, which means that the opportunities for change are many. While the university was praised for its food production, and its dedication to composting and purchasing local food, these were also many of the areas for suggested improvement. Individuals stated that the campus could facilitate more on-campus food production and efforts need to be made to divert the relatively high levels of organic waste being landfilled that could be accommodated by the composter. Increased awareness and compost bins were suggested as ways of accomplishing this. Participants identified the vast emissions associated with food miles as something that might be reduced further by sourcing more local distributors such as SPUD, and setting transportation quotas for food outlets. Also, the energy used by the food system on campus could be limited by using more efficient technologies, and unplugging unnecessary equipment at night. Overall, many of the groups felt that UBC needed to invest in finding and developing new models and practices that reduce GHG emissions. With this, there was a great emphasis on the need for further education and transparency of emissions to promote awareness in the UBC community.

In general, the roundtable discussion was very successful, and enjoyed by those who participated. The very presence of such an event represents a significant movement toward reducing the carbon footprint of the food system on campus. We felt that the note takers did a good job of recording all of the information, but it would have been beneficial to have greater invigilation to ensure that the groups are staying on task and addressing the questions at hand. Nonetheless, we felt that the experience was informative, and inspiring for moving UBC towards climate-neutrality.

VII. Targets & Barriers

1) **Target:** Progressively increase the average percent of local food purchased annually by UBC Food Services and AMS Food and Beverage by 50% by 2015.

- 2008-09: 2.5% increase from current baseline
- 2009-10: 5% increase from current baseline
- 2010-11: 10% increase, etc.

Local is defined as within the province of British Columbia. A UBC SEEDS report (2004) determined that depending on the time of year, a minimum of 30% and a maximum of 95% of produce items used by UBC FS are available from sources within BC; Agsc 450 summer 2004 students determined that depending on the time of year, approximately 83% of AMS Food and Beverage produce items can be obtained from a BC source; based on these statistics current proportions have the potential to increase. A similar target has also been achieved by the University College of Santa Cruz, progressively introducing local food grown within 250 miles of the college (UC Santa Cruz, 2004).

Current Status:

- A maximum of 28% of UBC FS' purchases originate from local sources (SEEDS report, 2004).
- A maximum of 23% of AMS FB purchases originate from local sources (Agsc 450 Group 2, Summer 2004).

Indicator: Annual average percent of food used by UBCFS or AMS F&B that is obtained from local sources

Barriers:

- The demand cycle faced by the university is the inverse of the BC's growing season. This may affect the amount of food that can be purchased locally.
- Franchises may not be flexible in terms of food sourcing as they are subject to high demands and have to maintain a consistent product
- Local suppliers may not be able to keep up with the high demand required by the university
- Due to the high volume required by UBC food outlets they must buy from large distributers to ensure adequate supply, which may or may not purchase items from local sources

2) **Target:** Each non-franchise outlet should have at least one menu item that can be marketed as made from at least 50% local produce by 2015

Current status: unavailable

Indicator: Presence of a 50% or more local food item in each outlet

Barriers:

- Outlets will may have to create a product that can utilize seasonal local produce in order to keep on menu all year round (for example, squash pizza at Pie R Squared has been very successful)

3) **Target:** Decrease the amount of compostable or recyclable waste going to landfills from UBC by 2015

- Decrease organic waste from 35% to 15%
- Decrease disposable container waste from 40% to 20%

Current status: 75% of UBC's current waste stream can be composted or recycled

- 35% is organic material that can be composted
- 40% is generated from disposable containers (Wastefree UBC, 2008)

Indicator: Percent of waste from the food system on campus as determined by UBC waste management

Barriers:

- Many students are unaware what food waste can be composted and where compost bins are located around campus
- Students are also unaware of discounts for reusable containers and mugs, and unaware of the environmental consequences associated with disposables
- Students may not be willing to bring their own containers – requires a lifestyle change
- Franchises may not be supportive of compost bins or biodegradable material for containers, etc.
- There are high costs associated with collecting and maintaining specialized waste receptacles

4) **Target:** Increase the percent of vegan and vegetarian options by 10% in residence dining halls and all non-franchise food service outlets, thereby decreasing animal based items that are more GHG intensive

Current status: currently food service outlets have an average of approximately 44% vegetarian menu options and 13% vegan menu options (Agsc 450 Group 11, 2006)

Indicator: percent vegetarian/vegan options in menu

Barriers:

- May be difficult to create new menu items that are of enough interest to students for this to be economically feasible at all outlets
- Students may be unaware of the detrimental effects of animal-based agriculture on the environment
- It is difficult to differentiate between which animal products are produced in a manner that is less GHG intensive

5) **Target:** reduce energy use by 2015 in all food service buildings through the replacement of appliances, lighting and cooking practices with more energy efficient options

Current status: unavailable

Indicator: energy savings of building

Barriers:
- Difficult to measure specific contributions of each food service outlet
- May be costs associated with new energy efficient appliances and retrofit options

6) **Target:** reduce the percentage of income at UBC FS from franchises and snack bars to 26% by 2020. This will give UBC FS more control over purchasing and packaging used in food outlets.

Current status: 36% of total revenue for UBC FS is from snack bars and franchises (Capyk, 2008)

Indicator: percent of revenue from franchises

Barriers:
- Franchises generally bring in more money than other food outlets and are also generally preferred by students – UBC FS may have to adjust to small drop in revenue and students will have to adjust eating habits to accept new non-franchised outlets

VIII. Recommendations

A. UBC Food Services

Short Term:
- Increase the amount of local food used in all food service outlets
- Increase awareness of discounts given for reusable containers and mugs through advertising in participating outlets (for example; changing the $0.15 discount for bringing your own cup to a $0.25 green "tax" for those that don't bring their own cup).
- When replacing worn out appliances, replace with energy efficient options, such as EnergyStar

Long Term:
- UBC FS should collaborate with the farm in order to create menu items that could be consistently produced year round with produce from the farm
- Decrease the proportion of franchises to UBC food service outlets

B. Alma Mater Society Food and Beverage Department

Short Term:
- Increase the amount of local food used in all food service outlets
- Increase awareness of discounts given for reusable containers and mugs through advertising in participating outlets
- When replacing appliances (i.e. refrigerators, stoves, ovens, etc.) replace with energy efficient options, such as EnergyStar

- Increase awareness of discounts given for reusable containers and mugs through advertising in participating outlets (for example; changing the $0.15 discount for bringing your own cup to a $0.25 green "tax" for those that don't bring their own cup).

Long Term:

- Increase the availability and usability of compost bins near all AMS food outlets
- Continue to work with UBC farm; incorporate promotion of the importance of UBC farm in to areas surrounding the outlets.
  - AMS FBD should continue to work with the farm to create menus that promote food items from the UBC farm

C. UBC Campus & Community Planning

Short Term:

- Use EcoTrek guidelines to retrofit all food service outlet buildings to increase energy effiency

Long Term:

- Increase on-campus food production including preservation or expansion of the farm and edible landscapes
- Incorporate a green roof or rooftop gardens on new developments, which will increase energy savings of buildings and potentially supply more on campus food production
- Work with the BC Ministry of Agriculture and/or the Provincial or Municipal government to develop a marketing co-op for local producers so they can supply large distributors and compete with industrial producers (Capyk, 2008)
- Try to increase campus use of renewable sources energy or "clean" energy (ex. solar, wind, etc.)

D. Future AGSC 450 Students & Teaching Staff

Short term:

- Create a pamphlet to be included in FROSH kit for all first years – this could detail how to be sustainable and decrease emissions while on campus
- Plan a 15 minute presentation for new students to be given during orientation to UBC on how to be "green" on campus, including advertising discounts for reusable containers and mugs
- Coordinate a "Buy BC" week in conjunction with AMSFB and LFS where all foods featured are purchased locally; integrate promotion of UBC farm simultaneously.

Long term:

- Engage other faculties in the project using their expertise for appropriate tasks
  - Business students to create a marketing campaign for local food, AMS composting/recycling, or the UBC farm
  - Engineering students to assess feasibility of retrofitting buildings, and developing more efficient food processing centres
- Develop a GHG emissions estimation tool that is specific to the food system
- Develop a quantified baseline of GHG emissions from the UBC food system
- Create a farm market on UBC campus to bring local farmers and their produce to students living at UBC or going to UBC. If enough farmers were interested this could

take place in the SUB, possibly on a weekday when there is a high volume of students passing through.

E. General Recommendations to all stakeholders

- Minimize packing of food purchased as the packaging process creates emissions and packaging creates most undegradable food waste
- Ensure that all organic food waste created during processing and cooking at UBC in placed in compost
- Increase availability, accessibility and awareness of compost bins
- Provide ongoing education and awareness on composting and recycling to the UBC community in order to raise campus participation for composting and recycling activities at UBC
- Collaborate with franchises to use less packaging on food items and more GHG friendly products
- Set up a system to sell foods according to priorities of which food items will produce most GHG emission. For example, set score points
- Replace all worn out appliances with more energy efficient alternatives (ex. with "Energy Star" label, alternative fluids for refrigeration and air conditioning systems like lower GWP HFCs, etc)
- Reduce the use of refrigerants (ex. eat more fresh foods) and air-conditioners whenever possible
- Unplug vending machines at night or use more energy efficient versions such as “VendingMisers”. Oberlin College found they could save up to 3,500 kWh per machine per year by retrofitting old machines with models such as “SnackMiser” and “Coolermiser” - vending machines installed with sensors that trigger power only when it senses someone within 25 feet of the machine
- Turn off lights when not in use and use long-lasting energy efficient light bulbs whenever possible

IX. Conclusion

Climate change is a pressing issue and requires immediate and decisive action by UBC in order to reach climate-neutrality by 2010. UBC has an opportunity to have a great impact in addressing the challenge of climate change within Canada through the possibilities of campus wide research and the development and use of new technologies. The research results of this report are only the initial stages of what is required to see the UBC food system move *beyond* climate neutrality. The targets set and recommendations made provide a valuable base of knowledge that will hopefully inspire future projects and aid in moving UBC towards a climate neutral campus.

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