UBC Social, Ecological Economic Development Studies (SEEDS) Student Reports

The UBC Food System Project Summary Report 2009

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University of British Columbia

LFS 450

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THE UBC FOOD SYSTEM PROJECT -UBCFSP-

SUMMARY REPORT 2009

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• Synthesize the findings of 2009 LFS 450 students reports;
• Work with UBCFSP partners and collaborators to plan and ideally implement food system related initiatives;
• Conduct meetings with UBCFSP partners to gather input for the next iteration of the UBCFSP;
• Draft scenarios for the 2009-2010 year
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INTRODUCTION:

The University of British Columbia Food System Project (UBCFSP) is a collaborative, community-based action research project initiated jointly in 2001 between the UBC Faculty of Land and Food Systems and the Sustainability Office's Social Ecological Economic Development Studies Program (SEEDS). The Project involves multiple partners and collaborators, including: UBC Food Services (UBCFS), AMS Food and Beverage Department (AMSFBD), UBC Waste Management (UBCWM), Centre for Sustainable Food Systems at UBC Farm, UBC Campus and Community Planning (C&CP), Sauder School of Business classes, UBC Plant Operations, Alma Mater Society (AMS), UBC Sustainability Office (SO), and the Faculty of Land and Food Systems students and teaching team.

The UBCFSP is part of a Land and Food Systems (LFS) 450 Land, Food and Community (LFC) III course, a mandatory capstone course required for all 4th year Faculty of Land and Food System students. The project commenced eight years ago and has involved nine generations of LFS 450 students, with over 1,400 students (190 LFS 450 groups, four Sauder School of Business groups, and one Global Resource Systems group) to date.

Main Goals of the UBCFSP:

- To conduct a campus wide UBC food system sustainability assessment.
- To create a shared vision and a model among partners of a sustainable food system.
- To identify barriers that impinge on the ability to make transitions towards food system sustainability.
- To develop opportunities and recommendations to UBCFSP partners and collaborators.
- To implement measures to make transitions towards UBC food system sustainability.
- To give students opportunities to apply all learning from their program specialization and the Land, Food and Community (LFC) series in a trans-disciplinary real life project.

METHODOLOGY AND PROCEDURES:

METHODOLOGICAL PERSPECTIVE:

Community Based Action Research (CBAR) serves as the methodological perspective in the UBCFSP. CBAR can be defined as an "inquiry or investigation that provides people with the means to take systematic action to resolve specific problems"; it enables "people (a) to investigate systematically their problems and issues, (b) to formulate powerful and sophisticated accounts of their situations, and (c) to devise plans to deal with the problems at hand" (Stringer, 1999). The tasks of CBAR are to capture participants' pluralistic voices and to situate their experiences within larger contexts. The goals of CBAR are to produce knowledge through open discourse; produce action and change, and to give research back to the community in which it originated. The process of CBAR is an iterative one, whereby research is conducted through a "look, think, act" routine, which involves a "constant process of observation, reflection and action" (Stringer, 1999).

The significance of CBAR in the UBCFSP is manifold. The SEEDS Program and UBCFSP Project Coordinators apply basic principles of CBAR such as consensus building, and inclusiveness when meeting with partners to identify challenges in various areas of operations, and develop corresponding tasks needed to address them in drafting project scenarios. Furthermore, they strive to build consensus among project partners in identifying challenges and next steps of action. Every effort is made to *collaboratively* implement solutions. Students and members of the teaching team are able to participate in an already established collaborative process, where they can work with project partners to assist them in issues that affect them, and ultimately develop tools that will help address some of the challenges identified by participants.

METHODS OF DATA COLLECTION:

Methods of data collection that have been used by LFS 450 students throughout the project's duration have ranged from conducting reviews of literature, secondary sources, interviews and focus groups, to administering questionnaires and engaging in participant observation methods.

Methods of data collection varied amongst groups and scenarios. All groups were given the opportunity to obtain information from invited class speakers, who gave presentations and spent class time discussing and answering questions. Guest speakers throughout the term included representatives from UBC Food Services, AMS Food and Beverage Department, UBC Sustainability Office, UBC Centre for Sustainable Food Systems at UBC Farm, School of Community and Regional Planning, and the Alma Mater Society. All students were required to review a selection of previous related LFS 450 group papers, required course readings (resources selected on an ongoing basis throughout the term and posted on the course website (WebCT), and review summaries of project findings from previous years. Other methods of data collection included questionnaires, focus groups, interviews, participant observation, secondary data analysis, and literature reviews. Questionnaires were administered either face-to-face or electronically, with sample sizes ranging from 47 to 176 participants. Interviews and focus groups were held with various UBCFSP partners and collaborators, students, faculty, and staff, as well as a selection of off-campus participants – ranging from food distributors, producers, retailers, chefs, to staff and faculty from campuses across Canada.

PROJECT DESIGN:

In the UBCFSP, LFS 450 students are assigned in groups between six to eight people depending upon size of the class and are primarily responsible for designing, conducting research and planning initiatives. The LFS 450 teaching team primarily acts as resource persons, and as facilitators to help groups with their work. The Project Coordinator works with the principal investigator and co-investigators in planning the entire project based upon previous work, and meetings held with stakeholders and also to implement recommendations. Other UBCFSP partners are involved namely as acting as resource persons, reviewing and giving input on student work and in implementing proposed findings and action plans.

SUMMARY REPORT OBJECTIVE:

The purpose of this paper is to provide a summary of the 2009 iteration of the project. Specifically, this paper consists of an overview of central group tasks, findings and recommendations, as well as some central outcomes that emerged from group work and meetings with stakeholders.

OVERVIEW OF 2009:

2009 marked the eighth year and ninth iteration of the UBCFSP. The class consisted of 226 students who were divided into 30 groups to work on one of six scenarios (listed below in Table 1). The UBCFSP Coordinator worked closely with project partners and other food system actors to develop a series of scenarios that met the needs of staff working in our food system, fulfilled the learning objectives of the class and were manageable workloads for students in a three credit course. Each scenario contained a background and problem statement, a set of recommended tasks needed to address the problem, recommended resources and people to help groups begin their work.

Table 1: 2009 List of Scenarios	
Scenario	**Title**
1.	Climate Action Partnership. Contribution of Food GHG Emissions Reductions: Moving UBC Beyond Climate Neutral
2.	Exploring Ways to Lighten AMS Food and Beverage Department's Ecological Footprint.
3. A, B	Changing the Food System to Change the Climate: The UBC Farm as a Living Laboratory A) Implementing sustainable production techniques and landscape management at the UBC Farm: A hands-on approach B) Changing the Food System to Change the Climate: The UBC Farm as a Living Laboratory
4. A, B	Practicing Urban Agriculture Right Here: Integrating the LFS Garden with the Faculty of Land and Food Systems Community
5.	Investigating the Sustainability of University of British Columbia (UBC) Sprouts.
6.	Conducting a Sustainability Assessment of UBC Food Services Food Products

Based upon groups' assigned scenario, student groups were required to produce a 30 page report and a 15 minute PowerPoint presentation sharing their findings. All groups were asked to complete the following tasks: (1) Provide reflections on the project Vision Statement which outlines collectively agreed upon principles that should guide our transition towards a sustainable UBC food system; (2) Provide reflections and expand if necessary on the problem statement assigned to them; (3) Develop new and/or refine proposed research designs, campaigns, and action plans from previous years; (4) Engage in data collection and develop action plans for implementation in 2009 and 2010, and (5) Provide recommendations for the next steps to appropriate project partners and collaborators, as well as other relevant food system actors.

2009 Central Objectives, Findings and Recommendations

In the following section, specific scenario objectives are identified, and key findings and recommendations are summarized from 30 group reports. For more information on specific findings please contact the Project Coordinator. The top ten group reports can be found on the UBC Sustainability Office's website: http://www.sustain.ubc.ca/seedslibrary/

Scenario 1: Contribution of Food to Green House Gas Emissions Reductions: Moving UBC Beyond Climate Neutral

Community Partners: UBC Sustainability Office, UBC Climate Action Partnership
LFS 450 Groups: 1, 2, 3, 4, 5

Background:

The Integrated Climate Action Framework is based upon a multi-stakeholder collaborative approach, whose intention is to work with UBC staff, faculty, students, researchers and community stakeholders to generate the "Climate Action Framework" which will outline how UBC can move beyond climate neutral. A draft paper titled, "Climate Action for Carbon Neutral

Food Systems" was developed by a working group of UBC Food Systems Project participants with recommendations and targets for climate action within UBC's campus (UBC FSP, 2009).

SPECIFIC OBJECTIVES:

Students were instructed to gather community input and data to inform the development of the Climate Action Framework, particularly the food system component and to explain how linkages between climate change and the wider food systems manifest at the UBC campus. This is accomplished by assessing the draft targets from the draft climate action paper based on whether the targets have community support, are feasible and appropriate, and what the potential barriers to achieving the targets are. Short and long term recommendations are to be developed for implementation by 2009- 2010 and beyond.

CENTRAL FINDINGS:

All groups did a literature review. The following is a review of the information they obtained:

CLIMATE CHANGE AND THE NATIONAL AND GLOBAL FOOD SYSTEMS

- Over the last three decades GHG emissions have increased at an alarming rate with carbon dioxide, methane and nitrous oxide being the main contributors to climate change (Cohen & Hopwood, 1998). At the current rate of production we will be faced with irreversible consequences such as rising sea levels, severe floods and droughts, melting of glaciers and changing weather patterns (IPCC, 2007), all of which have negative long-term effects on natural ecosystems, agriculture and human health (Cohen & Hopwood, 1998) (Group 2, 2009).
- Methane remains in the atmosphere for 9-15 years and traps heat 21 times as effectively as CO_2. Fertilizers and manure release nitrous oxide, which is 296 times as good as CO_2 at trapping heat and remains in the atmosphere for 114 years on average (Trivedi, B. 2008). (Group 1, 2009)
- Food systems contribute to global warming by releasing GHG emissions through: agricultural and livestock production, transportation, food storage, processing, packaging and waste (Adams et al, 2008). The Food Climate Research Network estimates that 17-32% of GHGs emitted globally are attributable to agricultural activities and in 2003 Canada's agricultural sector was responsible for 8.4% of its total GHG emissions (Environment Canada, 2007; AGSC 450 Group 21, 2008). (Group 2, 2009)
- The relationship between food systems and climate change is complicated by the direct and indirect effects climate change will have on global food security, particularly food production and availability, stability of food supplies, utilization, accessibility and affordability. Climate change will also result in changes in temperature and precipitation that will have negative impacts on land's agricultural suitability resulting in wider variation in crop yields as well as the ability to produce healthy crops exacerbating problems of hunger and disease, particularly in developing countries where populations are already vulnerable (Schmidhuber & Tubiello, 2007). (Group 2, 2009)
- The change in rainfall patterns affects soil moisture level, as well as its erosion rate. Areas at higher altitudes suffer from precipitation increases, while subtropical regions experience a decrease, causing possible droughts. Higher rates of evaporation will degrade soil quality and makes it less feasible to produce quality crops. The overall events of extreme rainfall are rising globally. Accelerated soil erosion is lowering soil fertility, causing a decrease in agricultural potential (IPCC, 2007; Group 3, 2009).
- Increases of atmospheric CO_2 and water may enhance crop growth and productivity by acting as a fertilizer, however, the nutritional value of the crops decreases with accelerated growth rate (Group 12, 2007). (Group 3, 2009)
- Composting not only reduces GHGs (mainly CO_2, methane and nitrous oxide), but also allows the food system to work more efficiently by regenerating healthy soil which is essential for the further production of crops as it will be rich in nutrients. This soil also has a lower demand for

artificial fertilizers and pesticides. This reduction in demand is significant because artificial fertilizers and pesticides not only require energy to produce, but also because emission of GHGs during their production is inevitable (NJ Dept. Enviro. Protection, 2007). (Group 4, 2009)

- The Government of British Columbia implemented the Greenhouse Gas Reduction Targets Act in November 2007 which "legally (requires) all provincial public sector organizations to be carbon-neutral by 2010." Thus, public sector institutions such as UBC must report and reduce their GHG emissions. Remaining GHG emissions are to be offset by investing in research, technology, or projects that will help to reach carbon-neutrality (Penner, 2007). (Group 2, 2009)

Sources of GHG Emissions

- In 2005, approximately 3.7% of Canada's total GHG emissions resulted from the waste sector (Environment Canada, 2007). According to the International Alliance Against Hunger, an estimated 33-50% of all food imported to developed countries is wasted, which creates unnecessary GHG emissions from the production, distribution, processing and storage of food (Group 21, 2008). (Group 2, 2009)
- According to the Student Union Building waste audit performed by MJ Waste Solutions (2009) Food waste is a major component of waste material at landfills with every tonne of this waste material generating about 3 tonnes of CO_2 emissions (MJ Waste Solutions, 2009) (Group 4, 2009). Food waste sent to the landfill produces methane and CO_2 in approximately equal proportions (Ayalon et al., 2001). The resulting CO_2 is part of the natural carbon cycle but the methane produced increases GHG emissions (Adams et al., 2008) (Group 2, 2009).
- Methane from landfills accounts for 89% of the emissions from on land solid waste disposal in Canada (Environment Canada, 2007). Landfill methane emissions from food waste can be avoided through composting (Ayalon et al, 2001). Every percent increase of discarded food successfully redirected to a composter, will result in a 4.6 megatonne reduction of carbon emissions (UBC's Waste Management; Adams et al., 2008). (Group 2, 2009)
- Fossil fuel is one of the primary contributors to CO_2 emissions followed by land clearing and deforestation (IPCC, 2007). Deforestation also results in the loss of important carbon sinks as the forests no longer take in CO_2 (Bentley & Barker, 2005). (Group 3, 2009)
- The food system is a major source of GHG emissions due in part to transportation and processing (Halweil, 2003; Group 4, 2009). The average food item in Canada travels 4,497km and generates 51,709 metric ton carbon equivalent (MCTE)/year on its trip from farm to processing plant to supermarket to consumer. The majority of food products are transported by air and truck, which produce the most GHG emissions compared to boat or rail (Miles et al., 2008). Transportation accounts for only 11% of food's total GHG emissions (Trivedi, B. 2008). (Group 1, 2009)
- Processing operations, including packaging, dehydration and freezing, depend heavily on energy use, which contributes to overall GHG emissions (Adams *et al.*, 2008) (Group 3, 2009). Food processing methods include: canning, curing, pasteurizing, freezing, and dehydration. Canning uses twice the initial energy as freezing but because freezing requires continuous energy inputs it can use up to 35% more energy in the end (Miles et al., 2008). (Group 1, 2009)
- Livestock waste contributes as much as 16% to the annual global production of methane (Nierenberg, 2005). Of the animal products, beef and lamb are found to contribute the most to GHG (Bentley & Barker, 2005). (Group 3, 2009)
- Rice and soy are two of the most GHG-intensive crops (Group 12, 2007). (Group 3, 2009)

THE UBC FOOD SYSTEM AND CLIMATE CHANGE

- UBC campus emits approximately 145,600 tonnes of CO_2 through its operations annually (Rojas, A., & Richer, L., 2008). (Group 1, 2009)
- Food system emissions are difficult to quantify so UBC has classified these emissions as outside of UBC's technical boundary of responsibility. According to the UBC Sustainability Office (2008) sources of food related emissions at UBC include: (Group 2, 2009)
    - 0.05 tonnes of CO_2 per square meter per year from core academic buildings as a result of heating, lighting and electricity.

- Fertilizers used produce 149 tonnes of CO_2 per year.
- Waste emissions are estimated at 1,065 tonnes of CO_2 per year.

- The US Environmental Protection Agency notes that waste in the form of disposable containers and packaging represents 33.1% of the solid waste by volume in the USA food system (Lang & Heasman, 2004), whereas the estimate at UBC is 40% (UBCWM, 2008). These high levels of disposable waste use energy and emit GHGs in their production, distribution and disposal in landfills. (Group 2, 2009)
- The AMS food outlets in the SUB, together with numerous students, faculty and staff, generate about 96 kg of disposed waste each day, with about 32 kg as pre-consumer waste and 64 kg as post-consumer waste (MJ Waste Solutions, 2009). (Group 4, 2009) According to UBC Waste Management (2008) UBC produces approximately 1900 tonnes of compostable waste (residual paper products, food waste, etc.) each year (Group 1, 2009).

The UBC SUB Waste Audit

- Conducted on February 12, 2008 by MJ Waste Solutions in partnership with AMS Sustainability Strategy Coordinator, Carolina Guimaraes (Group 4, 2009).
- The primary components of solid stream consumer waste were: compostable food waste (46%), other plastics (13%), and compostable cutlery/dishes (12%)(MJ Waste Solutions, 2009). (Group 4, 2009)
- To improve waste reduction at the SUB, MJ Waste Solutions (2009) proposed a few recommendations, one of which was to develop communication with the student body by updating signs at recycling stations, developing new handouts with pictograms about what can or cannot be recycled or composted, and developing and distributing informational posters. (Group 4, 2009)

What UBC is Doing

- The following is a list of initiatives that UBC is currently involved in to reduce GHG emissions.

UBC at Large

- UBC has reduced campus generated GHG emissions by 84,514 tonnes since it was first monitored on April 1st, 1999 (UBC Sustainability Office, 2008). (Group 2, 2009)
- UBC had developed a composting system (UBC Waste Management, 2008). This has increased the total waste stream diverted from landfills from 41% in 2005 to 46% in 2008. The UBC in-vessel composter has digested approximately 300+ tonnes of waste since 2004. It gathers material from 46 sites including all food services, private housing and institutional buildings (UBC Public Affair, 2007). (Group 1, 2009)
- In 2008, UBC diverted 75,000 non-biodegradable containers from going into the landfill through the use of compostable containers. This contributed to a reduction of 175 tonnes of landfill waste (Richer 2009). (Group 1, 2009)

UBC Administration

- On March 13th, 2008, UBC signed the University and College President's Climate Change Statement of Action for Canada which acknowledged the significance of global climate change and agreed to take action to move UBC beyond climate neutral, through collaboration, innovation and sharing. In an attempt to achieve this objective, in 2007, the UBC Sustainability Office created the Climate Action Partnership (CAP) to develop a Climate Action Framework that will include a plan for achieving a carbon neutral food system at UBC (Adams et al, 2008) (Group 2, 2009). One of UBC's institutional goals is to produce "exceptional global citizens (and) promote the values of a civil and sustainable society" (UBC Trek, 2009), which corresponds to the goals of the Climate Action Plan (Group 3, 2009).
- UBC has implemented Canada's largest university energy and water retrofit (Group 2, 2009). UBC has established a "Community Energy Plan (CEP)" to categorize areas that need improvement. The plan is described as "(having) six plan goal areas: improve the energy efficiency of buildings, increase transportation efficiency, encourage energy efficient land use planning, diversify the power production portfolio, educate and engage residents and businesses and demonstrate local government leadership" (Adams et al., 2008). (Group 3, 2009)

The UBC Alma Mater Society (AMS)

- In January 2007, the AMS passed an environmental sustainability policy called "The AMS Lighter Footprint Strategy" with the goal of becoming an active leader in reducing the university's ecological footprint (AMS Lighter Footprint Strategy, 2008). The Lighter Footprint (EF) Strategy is derived from the Ecological Footprint Analysis created by Dr. W. Rees and M. Wackernagel of UBC to measure how much fertile land is required to support a population's resource consumption and disposal. The targets are divided into internal and interactive targets and are ranked by ecological impact. This strategy has been one of AMS's most important environmental achievements in helping reduce emissions by 16,000 tonnes per year around the UBC campus (AMS Lighter Footprint Strategy, 2008). (Group 4, 2009)
- The AMS implemented LOV (local, organic, vegan) labels to draw consumer awareness to what they are purchasing. Eco Friendly Day takes place on the last Thursday of every month during which the AMS food outlets feature LOV menu items. Collapsible, reusable Rubbermaid containers are available for purchase and think greener posters and recycling/composting signage is present throughout the SUB (Group 1, 2009).
- They increased recycling and composting bins at the SUB have been made possible by both UBCFS and AMSFBD (Toogood, personal communication, 2009). (Group 4, 2009)
- They diverted an estimated 603 tonnes of solid waste from landfills to reduce CO_2 emissions (MJ Waste Solutions, 2009). (Group 4, 2009)
- The AMS had created the UBC U-Pass transit ridership program, which has resulted in yearly GHG emission reductions of approximately 16,000 tonnes (Easton & Ferris, 2008; Group 2, 2009).

UBC Food Services (UBCFS)

- UBCFS works with UBC to develop new sustainability initiatives that will help reach UBC CAP targets of becoming carbon neutral by 2010. These include: expanding recycling and organic waste program, providing biodegradable packaging, working with SEEDS and Ocean Wise on a seafood project, as well as providing local food options and selling only fair trade/organic/shade grown coffee. (Group 1, 2009)
- UBCFS participates in a farm to college program. The amount of produce sold to UBC by the UBC Farm has doubled every year since 2006 amounting to $5,000 in 2008 (Richer, 2009). (Group 1, 2009)
- UBCFS provides organic waste collection to all its food services units across campus (UBC Public Affair, 2007) (Group 1, 2009)

Other initiatives at UBC

- **UBC Waste Management-** works to educate the UBC campus community about recycling, composting, and waste reduction. Colour coordinated bins are located around campus to separate cans and bottles (black bin), paper products (blue bin), and compost (green bin) from litter. (Group 1, 2009)
- **SPROUTS –** is a student driven sustainability initiative that works as a non-profit food cooperative. They supply fresh, organic and local products, at an affordable price to the UBC campus community. Sprouts also heads Community Eats and the Bulk Buyers Club. (Group 1, 2009)
- **goBEYOND –** is a student run climate action project that works towards planning a low-carbon future. It is supported by the UBC Sustainability Office, Common Energy, and the Sierra Youth Coalition. (Group 1, 2009)
- **Faculty of Land and Food Systems (LFS)–** developed the UBC Food System Project (UBCFSP) in 2002 to analyse the sustainability of UBC's food system and to address identified issues. (Group 4, 2009)
- LFS created the LFS Orchard Garden as a volunteer run, student driven initiative. The garden provides marketable produce to LFS's Agora Café and plays an important role by helping connect LFS students to the food system. The Agora Café is a volunteer run café designed to train LFS students in food service and provide organic, local, healthy and affordable food options to the students, faculty and staff of LFS. (Group 1, 2009)

WHAT OTHER INSTITUTIONS ARE DOING

The following is a list of institutions and their programs that are working towards reducing GHG emissions in their food systems:

- **Bates College** (2009) – opened the "green" dining commons in 2008. Energy consumption is reduced through the use of recycled and certified-green building materials, occupancy sensors, dual-flush toilets and natural air ventilation. Bates has developed a program where students are able to remove mugs and dishes from the dining halls and return them to other outlets on campus. (Group 2, 2009)
- **Duke University** (2009) – has conducted a comprehensive inventory of the environmental impact of the university's dining facilities including GHG emissions. This was used to establish and implement environmental best practices. Dining services spends over 1/3 of its annual budget on local food. There is an annual sustainability evaluation of campus eateries. (Group 2, 2009)
- **University of California Davis** (2009) – home to the Reduce, Reuse, Recycle, Rebuy (R4) program. R4 partners with Sodexho, the major food supplier on campus, to organize "Zero Waste Events" and works to educate students, faculty and staff. R4 has developed unique marketing methods such as the use of the word "landfill" instead of "garbage" to label trash bins on campus. (Group 2, 2009)
- **University of Waterloo** - educates students about climate change through the Climate Change Education and Awareness Campaign. Campaigns include: Weekly Public Lectures that feature experts from a number of different fields all discussing Climate Change, Brown Bag Lunch Seminars, Interfaculty Symposium on Climate Change: a forum where experts from vastly different disciplines could pool their knowledge together and make connections outside their fields. (Group 1, 2009)
- **University of Northern British Columbia** (2008) - is maximizing local and organic food on campus, increasing vegetarian/vegan options at the cafeteria, minimizing food waste and throw-away service items by using creamers and milk jugs, and has introduced a green tax on bottled water. They plan to construct an on-campus greenhouse and expand their composting program. (Group 1, 2009)
- **University of Victoria-** has made students' education and involvement in sustainability a part of the new student orientation. Dining services offers meals that incorporate local foods, as well as organic options. Their recycling program has a 56 % diversion rate. In 2003, the university started composting all food wastes from operational activities on campus and now offers compost drop-off points for campus members (Report Card, 2009). (Group 1, 2009)
- **University of Toronto-** partners with Local Flavour Plus, a nonprofit organization that certifies local farmers and links them with purchasers. Dining services is currently putting a plan in place to offer as many sustainable and organic items as possible. Food waste from the dining hall is composted. The St. George campus has a diversion rate of nearly 60 % and intends to increase this rate to 70 % by 2012 (Report Card, 2009). (Group 1, 2009)
- **University of Saskatchewan-** food services purchases food from local businesses and suppliers, as well as a local dairy farm. A discount is offered for bringing a reusable mug, and biodegradable plates and cutlery are offered. Metals, glass, plastic, and paper can be recycled on campus. Most of the landscaping waste produced during the summer is composted and there are ongoing vermiculture composting projects (Report Card, 2009). (group 1, 2009)
- **University of Calgary-** food services purchases from 19 local farms and producers, spending approximately 10 % of its budget on local foods and contracts with 2 local dairies. Fair trade coffee is available and discounts are offered for bringing reusable cups. A pilot food composting program is underway (Report Card, 2009). (Group 1, 2009)
- **University of Tennessee, Knoxville**- requires that all new buildings constructed costing more than $5 million and any major renovations meet Leadership in Energy and Environmental Design (LEED) standards for ecological building set by the U.S. Green Building Council (The Charter-human-responsibilities, 2007). They have committed to limiting GHG emissions by signing the Tallories Declaration consisting of ten environmental principles that incorporate

sustainability into teaching, research, and operations, so the campus can be more environmental friendly. (Group 3, 2009)

RECOMMENDATIONS FOR IMPLEMENTING CAP TARGETS

Some groups reviewed the 2008 CAP Targets and all found them to be either adequate or they did not provide enough support for their recommended changes. From these analyses, groups proposed ways to implement the CAP Targets.

PROJECT: COMPOSTING- BEST PRACTICES

Based on the recommended target the following information outlines a recommended methodology for implementing a successful composting program in the SUB.

Vision:

- The new SUB is to be used as a pilot project for a composting strategy that can be generalized to the rest of campus. The new SUB is seen as an opportunity to incorporate composting and waste sorting into the building design and to potentially rework contracts with food providers to include environmental issues like composting. This strategy includes composting best practice guidelines and building design and layout guidelines that will facilitate composting. (Group 2, 2009)

Survey:

- The survey titled **"**The SUB Student Composting Awareness Survey: Assessing Students' Level of Knowledge and Awareness about Composting" was conducted at the SUB to assess student awareness of composting in order to determine the appropriate approach to increasing composting practices at the SUB. 80 students were interviewed at lunchtime and the following information was obtained: (Group 4, 2009)
    - 82% were aware of the presence of compost bins in the SUB.
    - How often do you compost? 51% answered 'sometimes,' 11% answered 'always,' 25% answered 'often,' while 13% answered 'never'.
    - What percentage of waste is organic matter that can be composted? 40% chose the right answer, 60% chose the wrong option.
    - What percentage of waste produced at food services outlets is made up of disposable containers: 29.49% out of those who answered chose the right answer.
    - What items can be composted: 79.8% chose the correct answer.
    - What happens when compost is contaminated: 63% chose the right answer and 36.25% chose the wrong option.
    - While the Composting Awareness Surveys distributed indicated that although the majority of students claimed to at least compost 'sometimes,' 10% of students who claimed to compost 'often' or 'always' did not seem to fully understand the idea of composting or were not aware of the compost bins in the SUB.
    - The survey suggests there is a misconception about compost contamination as 26% of respondents thought that waste management would sort the compost, indicating that proper composting initially was not an important step.

Best Practice Guidelines

- The following guidelines for implementing composting practices at food outlets were derived from stakeholder engagement, review of work by previous AGSC 450 students and analysis of a successful composting case study at UBC's Caffé Perugia: (Group 2, 2009)
    - <u>Program Leadership & Support</u> from the top down encourages responsibility for composting operations and acts as program support from staff or volunteers.
    - <u>Staff Training</u> provides staff with the knowledge to support composting initiatives and facilitates customer engagement.
    - <u>Customer Engagement</u> is the central factor behind the gradual changes in composting attitudes and behavior. Staff should educate customers about the composting program and the significance of compostable containers (Midha, personal communication, 2009).

- o Comprehensive Marketing Campaign utilizing promotional material will help expand the compost program. This promotional material may include: an informational brochure that is meant to accompany compost bins (Group 17, 2006); a series of posters, stickers and pamphlets that can serve as prompts and reminders to compost (Group 5, 2006); a composting incentive campaign such as Get Caught Composting that seeks to reward composting as a positive behavior (Group 2, 2006).
- o User Friendly Bin-Placement means bins should be easily accessible to staff (Midha, personal communication, 2009) as well as to customers. To achieve this garbage, compost, recyclables and paper bins can be grouped together to form "bin-quads." There should be equal or more compost bins than garbage bins (Group 17, 2006).
- o Approach- Use a Community-based Social Marketing (CSM) approach to target the behavioral patterns and attitudes towards composting. The CMS criteria categories include: prompts, norms, communication, incentives and convenience (TFCISE 2001).

Community Support:

- The support of a few enthusiastic individuals was noted but these individuals alone do not have the time or resources to implement the compost strategy (Group 2, 2009).

Barriers:

- Limited capability of the in-vessel compost unit. A maximum of 70% of the current campus food waste stream can be accommodated by the unit. It will be near capacity once composting services begins for the new developments in South Campus. Expanding the current in-vessel compost unit is cost-prohibitive due to increased labour and waste sorting machinery costs (Beaudrie personal communication, 2009). Other sources assert that composting is an economical and cost effective way of reducing GHG emissions—with costs around $10 per ton of CO_2 reductions (Ayalon et al., 2001). There is still uncertainty as to the actual net reductions achieved through UBC's in-vessel composting operations, as there has been no effort to quantify this reduction (Adams et al., 2008). (Group 2, 2009)
- The current CAP compost target places emphasis on diversion as opposed to source reduction of waste (Guimaraes, personal communication, 2009). (Group 2, 2009)
- Strict UBC Waste Management union contracts limit the extent of their engagement in new activities (Guimaraes, personal communication, 2009). (Group 2, 2009)
- There is a lack of funding for full time employees at Waste Management to implement the compost strategy (Group 17, 2006). Waste stream emissions are classified as discretionary "Third Scope" emissions under UBC's GHG inventory guidelines leaving UBC little incentive to invest in activities like composting in the new SUB (Group 2, 2009).
- The high proportion of staff relative to supervisors in the SUB could present barriers to effective staff training and negatively affect communication between staff and customers (Midha personal communication, 2009). (Group 2, 2009)
- Generally, there is a lack of municipal government policies and services for composting and a lack of public alternatives to air and truck transportation. (Group 4, 2009)

PROJECT: CLIMATE CHANGE PRESENTATION FOR UBC IMAGINE DAY AND LFS WELCOME BBQ

Vision:

- It is recommended that education be used to help consumers make more informed decisions and thereby dictate changes in available products. This was the model that encouraged the 25% annual increase in organic sales since the year 2000 due to the increased awareness of consumers concerning the negative effects of conventional agriculture (World Resources Institute, 2004). Educating students early in their academic career is important to maximize their individual contribution to the reduction of GHG emissions. (Group 1, 2009)

Presentation:

- A presentation on the UBC food system and climate change was prepared and includes information on how the food system has an impact on GHG emissions including information on food production, transportation, packaging, and waste, and how our choices as consumers can help to reduce our personal emissions. (Group 1, 2009)

- Lynn Newman (2009), an LFS associate dean, suggested that the presentation be presented in AGSC 100 to reach all LFS students. This was confirmed by LFS Dean Isman (2009), who will be teaching AGSC 100 next year. (Group 1, 2009)

Land and Food System Welcome BBQ:

- It is proposed that the LFS Welcome BBQ will feature a local organic menu, networking and activities with professors in the faculty, workshops and booths showing the many initiatives that are happening throughout the UBC campus, a farm tour, and fun activities. In order for the BBQ to become a yearly event the help of AGUS, UBC Friends of the Farm, UBC Farm Staff, LFS Faculty, and the Dean of LFS, is needed. A checklist, a budget that includes transportation, food, and portable toilets cost has been drafted and Dean Isman and other key stakeholders have been contacted to make this event a reality. (Group 1, 2009)

PROJECT: ROOFTOP GARDENS & ON-CAMPUS FOOD PRODUCTION

Considerations:

- The main issues to consider when operating a sustainable rooftop garden include accessibility, nutrient management, irrigation and crop zones and rotations (Cathcart personal communication,2009). (Group 3, 2009)
- Volunteers with basic agricultural knowledge are the preferred labour because the products of edible landscape do not yield enough profit for hired help (Cathcart personal communication, 2009). (Group 3, 2009)
- The garden should be located in a place where it is highly accessible to promote ideas, concepts and awareness to be used as a dynamic learning tool. (Group 3, 2009)
- The essentials for growing food, such as vegetables, include soil (temperature, aeration, organic matter, nutrition, pH, moisture), climate (temperature, humidity, atmospheric gases, wind), water, sun, plant selection, and plant and insect diversity are all present at our campus (Moreau personal communication, 2009). (Group 3, 2009)
- Limitations include size restrictions, weight restrictions, and the need for a more complex irrigation system (Cathcart, personal communication). (Group 3, 2009)
- The rooftop needs a drainage system that can be retrofitted with a low energy pump to be used as a means for localized irrigation. Harnessing the storm water collected on a roof means less carbon emissions will be produced as a result of transporting water to the garden. Using storm water as irrigation also improves sustainability in which storm water will no longer be sent to suburban water treatment facilities, thus limiting carbon emissions from transportation and operation of such facility (Cathcart personal communication, 2009). (Group 3, 2009)
- The structural integrity of buildings needs to be addressed. When planning a rooftop garden, the blueprints of the building's roof should be analyzed to figure out how the weight of the planters can be most effectively distributed (Cathcart personal communication, 2009). (Group 3, 2009)

Appropriateness:

- It is unknown whether rooftop gardens will lower GHG emissions.
- Sample calculations were done using potato crops as a model to evaluate the emissions that are associated with its transportation to campus for consumption (Group 3 & 5, 2009). According to calculations, transporting the 45,371 lbs of potatoes used by UBC Food Services each year to UBC emits more than 1.2 tons of CO_2. By producing the potatoes on UBC campus there is an energy saving of 0.013 tons of CO_2 or 1.22%. The calculations were done assuming a one-time, one-way trip by one truck, when in reality more trips would be necessary. More calculations and research should be done to quantify the actual savings. (Group 3, 2009)

Feasibility:

- Joe Stott (2009), director of the UBC Campus and Community Planning, emphasizes the importance of the buildings' infrastructure because that determines if the rooftops can support the load of soil, plants, and water.

- Currently, there are no rooftop gardens at UBC, but there are green rooftops indicating that rooftop gardening may be feasible (Moreau personal communication, 2009; Stott personal communication, 2009). (Group 3, 2009)
- The rooftop microclimate must be studied as many plants will be exposed to harsh weather conditions such as extreme heat and wind (Moreau personal communication, 2009). (Group 3, 2009)
- Based on calculations performed by Group 3, 82 UBC rooftop gardens would be necessary to produce all the potatoes used by UBC making the contribution of any one rooftop garden very small. (Group 3, 2009)

Community Support

- A survey was administered to 60 students to gauge the level of community support for on campus food production. 66% of student respondents said they would be willing to participate in growing food on campus and about 80% of respondents supported locally grown food. (Group 5, 2009)
- The Director of UBCFS, Andrew Parr, indicated that if projects on campus were able to increase food production to supply to UBCFS in a financially feasible way, the organization would be willing to assist in start-up costs for the projects (personal communication, 2009). (Group 5, 2009)

Barriers

- Approximately 437 buildings at UBC were built in the 1920s, and they are not constructed to support rain or snow load, to allow public access and they do not have emergency exits (Stott, personal communication, 2009). (Group 3, 2009)
- Rooftops have a weight restriction that severely limits the types of foods that can be feasibly planted. For example, planning heavy, water-dense foods such as potatoes and carrots does not optimize the use of the limited space of rooftop gardens (Cathcart, personal communication, 2009). (Group 3, 2009)
- The budget set for a building is very limited and if there is any left over it will be spent on indoor structures, like improving classrooms, labs and offices (Stott, personal communication, 2009). (Group 3, 2009)

KEY RECOMMENDATIONS

TO AMS FOOD AND BEVERAGE DEPARTMENT:

- Supply food service outlets with "Best Practices" solutions for decreasing compost contamination and facilitate customer engagement to increase compost volume and quality. (Group 2, 2009)
- Have a representative at the LFS Welcome BBQ to give a short presentation on what the AMS has done to become more sustainable. (Group 1, 2009)
- For the first month of school, have volunteers and/or staff stand at compost bins in the SUB to help educate students on composting and to help prevent contamination of the compost. (Group 1, 2009)
- Use prompts to remind students what, how and where to compost. Develop these materials by Community-based Social Marketing standards to facilitate effective communication. Future compost marketing should be noticeable, brightly colored, eye-catching, self-explanatory, and close to the compost bins (TFCISE, 2001). (Group 2, 2009)).
    - Use the television screens next to Blue Chip Cookies to feature 'Compost Factoids' where compostable items are shown and proper waste sorting is encouraged (Guimaraes, personal communication, 2009).
    - Use prompts, such as customer education, posters, brochures, buttons and stickers to remind people to compost (TFCISE, 2001).
- Use labels to mark food containers that are compostable to help eliminate contamination. (Group 4, 2009)

Recommendations for the New Student Union Building (SUB)

- In the current SUB, implement more compost stations (Toogood, personal communication, 2009). (Group 4, 2009)
- Reinstate the "Get Caught Composting" campaign and the composting 'draw' as incentives for students to compost (AGSC 450 Group 2, 2006). (Group 2, 2009)
- Coordinate with new SUB planners to ensure building design facilitates waste sorting and composting using "bin-quads" and strategic allocation of bin space. (Group 2, 2009)
- Implement the composting best practices strategy in the new SUB through the creation of increased volunteer base and/or a part-time or full-time position to oversee and manage composting operations in the new facility. (Group 2, 2009)
- Construct a rooftop garden at the new SUB to grow food and to educate those who are unfamiliar with rooftop gardens. The fresh produce could be sold at a booth in the SUB (Moreau personal communication, 2009). (Group 3, 2009)

TO UBC FOOD SERVICES:

- Supply food service outlets with "Best Practices" solutions to decreasing compost contamination and facilitate customer engagement to increase compost volume and quality. (Group 2, 2009)
- Use labels to mark food containers that are compostable to help eliminate contamination. (Group 4, 2009)
- Use composting incentives which may include a composting stamp card. After correctly composting, students are rewarded stamp cards which are then redeemable for a prize or discount at participating outlets. (Group 4, 2009)

TO UBC WASTE MANAGEMENT:

- Put more composting bins across campus in more locations. Despite the size of the UBC campus, there are currently only 70 locations with compost bins for the UBC organics collection program. Over the next 2 to 3 years, all buildings and all events should have compost bins. By making composting more convenient, it will help students and staff make the choice to compost. (Group 4, 2009)
- Use labels/stamps or other identifiers on compostable containers to help cut down on compost contamination with other non-compostable products. These labels should be eye-catching, information rich and easily recognized. (Group 4, 2009)
- Administer a compost audit like the SUB waste audit done in 2008 for the AMS. It is very evident that composting can play a major role in the reduction of GHG emissions and an audit would help focus future composting efforts. (Group 4, 2009)
- Have a booth at the LFS Welcome BBQ to talk to students and provide information about composting, recycling and waste disposal at UBC. (Group 1, 2009)
- Revise policies that specifically address waste disposal practices at UBC, specifically those associated with the food system, to help lower GHG emissions. (Group 1, 2009)
- Provide finished compost to emerging community gardens on campus. (Group 3, 2009)

TO CAMPUS AND COMMUNITY PLANNING:

- Ensure UBC Farm remains at its current location and maintains its full size. (Group 1, 2009)
- Work with UBC Waste Management to expand and develop more efficient composting and recycling programs across campus. (Group 1, 2009)
- Construct new building and retrofit existing buildings to meet greener standards. (Group 1, 2009)
- Include edible landscapes in the planning of the UBC community. Incorporate roof top gardens and container garden sites while development of campus buildings and housing is occuring. (Group 3, 2009)

- **TO UBC SUSTAINABILITY OFFICE:**
- Research and develop literature on carbon sequestration constants for vegetable crops and their role in achieving carbon neutrality. (Group 3, 2009)
- Give Imagine MUG leaders a short (15 min) orientation on sustainability issues to increase their ability to transfer this information to the incoming students. (Group 1, 2009)
- Present information on composting during Imagine UBC day to target first-year students of all faculties as they will have the most impact in correct composting. (Group 4, 2009)
- Have a booth at the LFS Welcome back BBQ to provide important sustainability information. (Group 1, 2009)
- Set up booths on Eco-friendly Day to answer frequently asked questions about composting and provide tips on how to compost correctly. (Group 4, 2009)
- Design a Sustainability Quiz to be administered to all UBC students via email. To encourage students to take the quiz sustainable prizes can be offered. (Group 1, 2009)
- Work to establish a policy declaring compost bins mandatory at all special events with food present on the UBC Campus. (Group 4, 2009)
- Hold composting workshops. http://www.rrfb.com/pages/compost/Complan.html contains instructions on building your own compost. (Group 4, 2009)
- Lobby for composting service from the municipal government. In order to maximize the efficiency of composting at UBC, it is crucial to gain the government's support and involvement in providing a composting service similar to garbage collection. (Group 4, 2009)

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SCENARIO 2: EXPLORING WAYS TO LIGHTEN AMS FOOD AND BEVERAGE DEPARTMENT'S ECOLOGICAL FOOTPRINT

Community Partners: UBC Alma Mater Society (AMS) Food and Beverage Department
AGSC 450 Groups: 6, 7, 8, 9, 10

BACKGROUND:

In January 2007 the AMS Council passed the AMS Environmental Sustainability Policy which triggered the creation of the AMS Lighter Footprint Strategy to reduce the university campus's Ecological Footprint. The AMS Lighter Footprint Strategy aims to make the UBC campus more sustainable and serve as a model for other organizations and institutions to follow.

OBJECTIVES:

Students were requested to further inform the growth of the food system component of the AMS Lighter Footprint Strategy including development and implementation of alternative 'lighter footprint' menu items that do not contain dairy or beef products and/or contain seasonal, local and/or organic ingredients as part of the new Local, Organic, Vegan (LOV) food line being developed by the AMS.

CENTRAL FINDINGS- SCENARIO 2:

LITERATURE REVIEW:

All groups performed a literature review. The following is a summarization of their findings:

The Ecological Footprint of Different Food Items

- The term "Ecological Footprint" (EF) is a measure of one's impact on the ecosystem. EF measures the amount of land and water area that is required to produce the resources a population consumes and the planet's ability to reabsorb the generated waste products (Global Footprint Network, 2009). Canada's approximate EF is 7.6 hectares per person, compared to the global average of 2.2 (Doherty, 2008) (Group 6, 2009). In 2005, the World Wide Fund for Nature (WWF) calculated that in a world of 6 billion people, the available bio-capacity (available supply of natural resources) was about 2.1 global hectares per person (WWF, 2005). (Group 10, 2009)
- Diet accounts for nearly 25% of the overall EF of an individual (Collins, 2007). Animal proteins are considered high EF foods because of the large amount of energy and resources that go into their production. These foods correspond with items that are higher up on the food chain. Among these, beef and fish have significantly higher EF than pork or poultry. For dairy products, butter and cheese are ranked with the highest EF, while yogurt and whole milk are ranked the lowest. Vegetables, fruits, and whole grains generally have much lower EFs than meats and animal products (Collins, 2006). (Group 6, 2009)
- The following is a list of influential factors for EF of food items ranked in descending order of impact. This ranking is based on the approach taken by Group 28, 2008. (Group 7, 2009)

Factor	Rationale
Location of production	Locally produced foods reduce EF by decreasing transportation miles, supporting local farmers and businesses, and giving consumers more say in land use, processing techniques, etc.
Plant vs. Animal source	Foods from plant sources are less input intensive to produce.
Organic production methods	Organic foods have a lower EF because they do not use chemical pesticides and fertilizers resulting in reduced energy input (The Benefits of Organic, 2007; Group 6, 2009).

Certifications: eg shade-grown, free-range, fair trade	Other certifications are often less regulated than organics and/ or are applicable to a narrower range of foods
Degree of processing/ packaging	More energy inputs are required to process and package foods, often resulting in more carbon emissions.
Nutrition considerations	Part of a sustainable food system is the health and nutritional status of the people within the system.

WHAT UBC IS DOING:

Groups identified the following food system sustainability initiatives already underway at UBC:

UBC at Large

- UBC remains one of the few institutions striving to incorporate all facets of environmental, social and economic sustainability relating to food including waste management, food procurement, ethical payment to growers and producers, ethnic appropriateness, nutrition, and the role of food in building/strengthening community (UBCFSP, 2009). (Group 9, 2009)
- A number of UBC Food Service outlets source local and organic ingredients to help reduce their ecological footprints. Place Vanier's residence dining kitchen incorporates UBC Farm produce, local products, and organic apples into their menu items (Chef Steve Golob, personal communication). (Group 9, 2009)
- There are two student-volunteer-run outlets on campus that have committed to sourcing local, organic and vegan food items. Agora Café, located in the McMillan building, offers menu items featuring produce grown on the UBC Farm and the LFS Orchard Garden. The on-campus food co-operative Sprouts sells local organic produce, local eggs, UBC Farm produce, fair trade coffee, vegan items, and operates a bicycle delivery service for their weekly produce box (Sprouts, 2009). (Group 9, 2009)

UBC Alma Mater Society Food and Beverage Department (AMS FBD)

- *Bernoulli's Bagels-* offers local ingredients and uses organic flour (AMS n.d.). (Group 6, 2009)
- *The Honour Roll-* offers local and vegan menu items (AMS n.d.). (Group 6, 2009)
- *Pie R^{2}-* receives some produce from the UBC Farm (AMS n.d.). (Group 6, 2009)
- AMSFBD adopted the LOV (local, organic, vegan) lighter footprint food line/label and showcases LOV dishes during Eco-friendly day (AMS n.d.). (Group 6, 2009)
- *A*ll AMSFBD and non-franchise UBC Food Service (UBCFS) food outlets offer fair-trade, organic coffee (UBC food service). (Group 6, 2009)
- The AMSFBD offers compostable takeout containers made of bamboo fiber and corn at $0.25, they offer a $0.25 discount for bringing your own food container and a $0.15 mug discount, and they use compostable cups and compostable air injected paper cup covers (Group 15, 2008). (Group 6, 2009)
- The AMS maintains composting bins throughout the SUB making use of UBC's in-vessel composting facility for biodegradable waste. (Group 9, 2009)
- The AMS has switched to using electronic copies when possible to reduce paper waste and now uses 30% recycled paper. (Group 9, 2009)
- AMSFBD outlets use "Green-Seal" certified cleaning products in all food outlets (AMS, 2008). (Group 9, 2009)

WHAT OTHER INSTITUTIONS HAVE DONE:

- Many local restaurants now offer seasonal menus, they use organic and local ingredients and they lists local suppliers for customers to see (Green Living, 2009). (Group 6, 2009)
- Restaurants and university cafés now often have rooftop gardens as chefs and food providers are becoming increasingly aware of the importance of using fresh, local, and organic ingredients (City Farmer, 2007). (Group 6, 2009)
- **Green Table** certifies restaurants to be "Green" if they compost, recycle, use energy efficient appliances, reduce water use, use ecologically friendly products, and sell local and/or organic food. Green Table currently has a 42 member organization in the Lower Mainland and Whistler (Green Table, 2002). (Group 9, 2009)

- **John Hopkins University's** main food outlet grows and uses their own herbs, uses free range eggs, serves artificial growth hormones and antibiotics free milk, serves only dolphin-safe tuna, serves seafood recommended by the Monterey Bay Aquarium Seafood Watch Program and no veal is served in the facility. Additionally, paper bags are provided instead of plastic bags, biodegradable and recyclable to-go containers are used, water saving devices are used in all facilities, and energy-saving devices are used in the vending machines. Their "Meatless Monday" program supports vegetarian eating (JHU Dining, 2009). Since 2001, the university's initiatives have reduced 13% of greenhouse emission, 32 % of air pollutants, 17% in solid waste and water pollution, and 35% trees for paper production (JUHPH-ESC, 2009). (Group 10, 2009)
- **University of New Hampshire (UNH)** dining service strives to maximize use of organic, locally produced and processed sustainable food including vegetables from the UNH Organic Garden Club, Humane Animal Care Program approved eggs, and Fair Trade certified coffee. The dining halls use china and recyclable or biodegradable flatware and discounts are offered for reusable mugs. Food waste is composted and used by the Organic Garden Club. Other initiatives from UNH include: Energy Star equipment for the dining service, Low-flow taps, efficient lighting, air-cooled refrigeration, non-caustic washing chemicals, efficient dishwasher reducing at least 60% of water used, and waterless urinals (UNH Sustainability, 2009). (Group 10, 2009)
- **Simon Fraser University** is currently implementing the Local Food Project, which aims to increase the amount of locally produced food on campus, to increase awareness of the benefits of eating locally produced food, and to encourage and support food production and distribution projects on campus (SFU, 2006). (Group 9, 2009)
- **McGill University** operates an organic farm on campus which provides fruits and vegetables for the students and staff at affordable prices. The volunteers at the farm also provide workshops to raise awareness and build support for their farm (McGill University, 2008). (Group 9, 2009)

SPECIFIC FINDINGS- SCENARIO 2:

The following are the groups' findings in regard to their projects focusing on specific AMS Food and Beverage Department food outlets:

BLUE CHIP COOKIES (BCC)

Defining the Ecological Footprint (EF) of Ingredients

- Ingredients used at Blue Chip Cookie (BCC) that contribute to a high EF are butter, eggs, flour, processed fruits and processed vegetables (Group 28, 2008). (Group 6, 2009)

Follow Up from Past AGSC 450 Projects

- In 2008, AGSC 450 Group 28 suggested BCC should use organic flour. Organic flour is double the price of normal flour and is therefore financially unfeasible according to the AMS Food purchaser Nick Gregory (2009). (Group 6, 2009)
- In 2008, AGSC 450 Group 15 developed the vegan *Ginger Spice Cookie* which is no longer offered due to the lack of interest by customers. A modified ginger spice cookie that is not vegan is being sold in its place according to Blue Chip manager Teh (2009). (Group 6, 2009)

Observations at Blue Chip

- The two vegan products BCC offers are Vegan Brownies and the Vegan Olive Bun with rosemary, olive oil, and herbs. These two products are located inside the left corner of the outlet where they are difficult to notice making it hard to attract customers. (Group 6, 2009)

Locally Sourcing Blueberries

- Nick Gregory (2009), the AMS Food Purchaser, reported that most blueberries are currently shipped from outside of Canada. (Group 10, 2009)
- The UBC Farm has planted Blueberry bushes for harvest in summer 2010. 99% of blueberries in B.C. are grown in the lower mainland and B.C. produces 90% of Canadian grown blueberries (AAG, 2008) making blueberries an easily accessible local ingredient. The following local blueberry suppliers were contacted and many expressed interest in doing business with the AMSFBD. (Group 10, 2009)

Potential local suppliers of dried and fresh blueberries (Group 10, 2009)

- Honeyland Canada (Pitt Meadows) - Fresh or dried organic blueberries
- Westberry Farms (Abbotsford) - Organic fresh, frozen, or dried blueberries
- Maan Farms (Abbotsford) - Fresh seasonal blueberries
- Purewall Blueberry Farms Ltd. (Pitt Meadows) - Fresh and frozen blueberries
- DFG organic blueberries (Richmond) - Fresh or frozen blueberries

Lighter Footprint Product Development:

Results of Interview with Bev Teh – Blue Chip Manager (2009)

- Teh felt the use of organic ingredients is too expensive and may deter students from buying cookies. The only locally processed product being used is *Roger's Sugar.* (Group 6, 2009)
- Teh expressed interest in recipes that would incorporate whole wheat flour for nutritional purposes and was open to the idea of increasing the vegan cookie selection at *BCC* since there are only two vegan products offered for the "AMS Eco-Friendly day". (Group 6, 2009)
- Teh conveyed that any new products need to be affordable, profitable, and tasty. (Group 10, 2009)

Vegan Cookies

- Two vegan cookies were developed for addition to the BCC menu. Cost, flavor, seasonal availability and supplier availability were considered. The actually cost of the cookies to the AMS would be significantly less than listed here due to their purchasing power and use of conventional non-local and non-organic products. (Group 6, 2009)
  - Vegan Chocolate Chip Oatmeal Cookie- The nutrient analysis for approximately 80g of *Vegan Chocolate Chip Oatmeal Cookie* is 424.55kcal, with 3.64g protein, 57.25g carbohydrate, and 20.67g fat. The cost for a single cookie (each weighing about 100g) is approximately $0.76 per 100g of cookie, with over 50% of ingredients being local or organic (Diet Analysis Plus 7.0, 2005). (Group 6, 2009)
  - Vegan Oatmeal Raisin Cookie- The nutrient analysis for a single Blue Chip Cookie sized Vegan Oatmeal Raisin Cookie yields 446.33kcal, with 3.82g protein, 66.94g carbohydrate, 19.3g fat, and 2.75g dietary fibre. The cost for a single cookie is approximately $0.46, with over 50% of ingredients being local or organic (Diet Analysis Plus 7.0, 2005). (Group 6, 2009)
- A taste test and questionnaire were given to 47 participants throughout a week in front of Blue Chip Cookies. It suggests that the Vegan Oatmeal Chocolate Chip Cookie is slightly preferred by participants than the Vegan Oatmeal Raisin Cookie and the majority of survey respondents indicated they are willing to buy the cookies if sold at BCC, suggesting a possible increase in business for the outlet. (Group 6, 2009)
- Feedback was received from the BCC staff regarding the cookies: Bev Teh and staff members felt that the cookies needed to be moister; no comment was made about the taste of the cookie; the staff commented that it would be feasible to produce the cookies as time and cost would be comparable to the non-vegan cookies (personal communication, 2009). (Group 6, 2009)

Chocolate Blueberry Granola Bars

- 2008's ASGC 450 Group 15 identified granola bars as something that current BCC customers would like to see offered (Group 15, 2008). Chocolate was chosen to increase marketability based on the observation that many BCC products have chocolate (Group 10, 2009).
- A taste test and survey was given to 47 participants in the SUB. A selection of both BCC customers and non-customers were asked to participate. 66% of participants indicated that they would buy the Chocolate Blueberry Granola Bar. (Group 10, 2009)
- Customer comments included: some liked that it was not too sweet and that it contained blueberries; some felt the bar was too dry and needed to be moister. (Group 10, 2009)

Marketing Strategies

- A survey was given to 176 people in the SUB regarding the AMS Lighter Footprint menu items. 55% of one survey's participants said they were and 31% said they might be willing to purchase vegan and eco-friendly cookies (Group 6, 2009). Another survey with 47 participants showed that 70% of survey participants would purchase a product they knew had a "lighter ecological footprint" (Group 10, 2009). Therefore, it is important customers know how LOV items represent food choices with a positive environmental impact.

- The LOV "Save Yourself, Save the World" Educational Pamphlet was developed to draw customer attention to the ecological and anthropocentric importance of choosing LOV items. These posters could be hung from the ceiling or as a table tent to improve customer understanding of and support for the label.
- Other marketing materials developed include simple and catchy "eco-facts," LOV label pins for employees to wear, and a "compost me" stamp for use on all compostable items. (Group 6, 2009)
- Very few survey participants expressed willingness to pay more for vegan foods potentially due to supposed bad taste and the belief that foods without animal products should not cost more. (Group 6, 2009)

PENDULUM CAFÉ

- Nancy Toogood, the AMS Food and Beverage Department Manager, suggested that promoting the items already meeting the local, organic or vegan (LOV) criteria would have the greatest positive impact on the Pendulum at this time. (Group 8, 2009)

Survey Results

- A survey was administered to 95 Pendulum restaurant patrons to assess whether the patrons of the AMS Pendulum restaurant were aware of eco-friendly options offered at the Pendulum, to asses if the advertising was working, and if the eco-friendly value of a food would influence customer choice. Overall, the survey suggests that the majority of Pendulum customers do care about their own ecological footprint but that the advertising mechanisms for the Pendulum's eco-friendly options have not been successful. Some specific survey results follow (Group 8, 2009):
  - The majority of patrons surveyed indicated that taste and prices were the most important factors when choosing a food item. Meat was considered an unimportant factor in choosing food items.
  - Only 7% of interviewees did not make an effort to reduce their carbon footprint, and 32% did not make an effort to reduce their footprint by choosing eco-friendly food options.
  - 64% of survey participants indicated that they have not noticed eco-friendly options throughout the AMS Food Services and 70% indicated they had not noticed eco-friendly options at the Pendulum.
  - Of those who were aware of the Pendulum eco-friendly options, the results suggest the footprint symbol was the most recognized marketing intervention.
  - 61% of the Pendulum customers interviewed indicated that they would like to see more ecologically friendly options at the pendulum. 57% indicated that they would be interested in learning more about the AMS lighter footprint label. 48% indicated they would specifically order an item because it was more eco-friendly.

Marketing Strategy

- Any new marketing strategy should consider that the SUB is already covered in too many signs according to Toogood and Pendulum manager Rick Kellough (personal communication, 2009). The following marketing strategies were developed to more appropriately promote current LOV items (Group 8, 2009):
  - A modified LOV label was developed in the shape of a bright pink heart to catch the eye of the customer and to increase space to identify the ingredients of a particular dish as requested by Kellough, the manager of the Pendulum.
  - A portion of the large menu boards which advertise the Pendulum's daily features could be dedicated to identifying the LOV items available each day.
  - Collaboration with Kellough led to the development of information table cards that explains the LOV label. They are designed to sit flat on the small tables to avoid taking up space. The design capitalizes on the Pendulum's unique opportunity to reach its customers with the lighter footprint message as many of its patrons sit and eat their

meals in the restaurant. The AMS Lighter Footprint Strategy website and the Pendulum website would provide additional information.

- The Pendulum's website currently lacks an eye catching message about the LOV menu items and could be used to identify and promote these items. (Group 8, 2009)
- Facebook is an excellent tool for reaching students and a group called "*LOV at the Pendulum*" could be created to promote eco-friendly food choices to the broader UBC community. This may draw new eco-friendly clientele to the Pendulum. (Group 8, 2009)

THE HONOR ROLL

Defining the Ecological Footprints (EF) of Ingredients

- The EF of food items can be determined through a close analysis of the inputs, emissions, and wastes associated with the production, processing, storage, and transportation of the food item. The ingredients and food items used and sold by The Honour Roll were analyzed and arranged in a spectrum from high to low ecological footprints as shown to the right (Group 9, 2009).

FOOD ITEM	m²/kg
Fish	561.75
Cream Cheese	205.69
Beef	66.33
Pork	29.83
Tea	25.17
Milk	20.92
Poultry	20.75
Beans	12.73
Oil/fat (solid)	9.34
Oil/fat (liquid)	7.41
Mayonnaise	7.14
Rice/noodles	4.65
Juice	1.42
Vegetables/fruit	1.06

Current Practices at The Honour Roll

- The Honour Roll serves approximately 1,200 people per day with the vast majority using the plastic pre-packed sushi containers that make for convenient pick-up, but the resources needed to produce, deliver and dispose of the packaging make the practice unsustainable (Toogood personal communication, 2009) (Group 9, 2009).
- The two recycle bins located in The Honour Roll dining area were observed during the lunch rush between 12 to 1pm on Monday, March 9, 2009 and it was noted that the recycle bins were used only 5 times indicating that customers may not know which items are recyclable (Group 9, 2009).
- The Honour Roll offers several vegan items including seasonal vegetable rolls, kappa rolls, avocado rolls, salads and edamame. The Honour Roll uses local produce whenever possible and serves wild salmon (Group 9, 2009).
- The Honour Roll offers a discount for customers that bring their own containers (Group 9, 2009).
- Toogood (personal communication, 2009) reported that The Honour Roll was willing to serve free green tea for customers who bring their own mugs. This could be used as a promotional item for reusable containers. (Group 9, 2009)

Food Procurement at The Honour Roll

- Food procurement considerations at The Honour Roll include: purchasing policy and ingredient availability, quantity, and price (Group 9, 2009).
- The AMSFBD pools the purchasing resources of all of its food outlets in orders to satisfy the needs of all of its establishments (Toogood, personal communication, 2009). (Group 9, 2009)
- The Honour Roll specializes in foreign cuisine and therefore uses a variety of ingredients in its menu items that are imported from other countries because there are no domestic producers of the items or the item is only available seasonally (Toogood, personal communication). (Group 9, 2009)
- Many local producers operate small farms, and are unable to consistently produce quantities of products sufficient for the needs of the AMSFBD (Toogood, personal communication). The UBC Farm, in particular, sells organic fruit and vegetable items that are already in high demand and the potential for an increased quantity purchased by the AMSFBD is low (Frye, personal communication). (Group 9, 2009)
- The Honour Roll must maintain competitive pricing since the majority of its customers are students on limited budgets (Toogood, personal communication, 2009). (Group 9, 2009)

Survey Results

- Toogood (personal communication 2009) deemed promoting The Honour Roll's current sustainably oriented actions through improved signage would be the best way to reduce its ecological footprint. A survey was conducted with 100 participants at The Honour Roll to determine what signage would best capture the attention of the intended audience and influence the actions of that audience toward increased consumption of local food and reduced use of plastic packaging. The following information was obtained: (Group 9, 2009)
    - 45% of participants found the sign's image most important in conveying it's message. 33% found its message and its image to be important. 11% of participants found the signs message only to be important.
    - Based on the face-to-face interaction and written comments from participants, colour and money figures played a major role in grabbing an individual's attention. This is particularly true for undergraduate interviewees who were less inclined to read the signs due to time constraints.
    - No significant correlation between participant's sex and sign choice was observed. However, the majority of faculty members chose message and no faculty participant chose image as their reason for choosing a sign.

Barriers to Research

- Nancy Toogood, AMSFB Manager, acted as the primary contact for The Honour Roll because she had concern that there would be a communication barrier between the students and the manager of The Honour Roll who speaks English as a second language. While this arrangement may have had benefits, it was felt that it was difficult to conduct research without direct involvement of The Honour Roll staff. (Group 9, 2009)
- Culturally diverse foods present a particular challenge to sustainability initiatives as many of the main ingredients can not be locally sourced. (Group 9, 2009)
- A UBC Farm Yam Roll was considered but due to a lack of available growing space at UBC Farm the idea was abandoned (Bradbeer, personal communication, 2009). Suppliers from the Fraser Valley were considered as well but lack of transportation made the idea unfeasible (Toogood personal communication, 2009). (Group 9, 2009)

THE MOON

Defining the Ecological Footprints (EF) of ingredients

- Certain foods have inherently high EFs due to their high energy inputs. Main ingredients used by The Moon are ranked from highest to lowest EF: beef, pork, chicken, eggs, fish, grains and fresh greens (Fairchild and Collins, 2007). (Group 7, 2009)
- The AMS LOV Line uses three categories (Local, Organic and/or Vegan) to summarize many of the factors influencing the EF of food and this system of classification is a natural choice for The Moon because it builds on previous UBCFSP work, it is meaningful to our community partners and it can be applied to the Lighter Footprint recipes developed for the Moon. (Group 7, 2009)

Current Practices at The Moon

- The Moon orders their ingredients through the AMS from a list of available ingredients. (Group 7, 2009)
- Two vegetarian meal options and a vegetarian soup are offered at The Moon. The most popular dish is sweet and sour pork. Customers have requested more dishes with seafood, but currently the only item containing fish is a special, which contains both salted fish and chicken. (Group 7, 2009)
- According to the AMS website, The Moon offers a dish of Curried Tofu Vegetables on Eco-Friendly Day, which uses locally grown carrots, peppers and potatoes as well as locally produced tofu (AMS Eco-Friendly Day, n.d.). During one Eco-Friendly Day, it was observed that no special was offered at any point in the day. The regular vegetarian options were offered as per usual. (Group 7, 2009)

- It is standard operating procedure to serve dishes in Styrofoam containers, and to provide a compostable container only if requested (The Moon staff personal communication, 2009). (Group 7, 2009)

Potential Areas for Improvement

- A Moon employee (personal communication, 2009) reported that when creating a low EF menu item, a completely new dish would be better than replacing ingredients in an existing dish. Another employee (personal communication, 2009) said only a special could be considered at this time because there is not enough space on the serving counter for a permanent addition. Additionally, it was speculated that a new dish might not be possible this year because of a shortage of staff. The employee would like to receive recommendations and recipes that can be experimented with before the item is introduced. (Group 7, 2009)
- The Moon employee (personal communication, 2009) was open to suggestions of using organic local meats. (Group 7, 2009)
- Stamp cards and signs promoting the nutritional value and environmental impact of the new dish were also deemed to be a possibility (Moon employee, personal communication, 2009). (Group 7, 2009)
- Some reasons for resistance to change in AMDFBD outlets included language barriers, mindset, other priorities, and profit incentives (Toogood & Guimaraes, 2009). (Group 7, 2009)

Survey

- A survey was designed and administered to 82 participants in The Moon lineup and another 66 surveys were administered online to Land and Food Systems students through faculty list serves. The purpose of the survey was to assess whether or not respondents' food choices were affected by any of the determinant factors of low ecological footprint. 138 surveys were completed with 30% of respondents not being customers of the Moon. (Group 7, 2009)
- The survey indicated that 56% of respondents were familiar with the concept of an ecological footprint. Respondents were asked whether or not environmental impact, food miles, organic foods or local foods affected their food choices. In all cases, the majority of respondents indicated these factors only 'somewhat' affect their food choices with the mean value of responses falling between 'not often' and 'somewhat' affected by these factors. (Group 7, 2009)
- A majority of respondents consume red meat and seafood between once a month and once a week and consume poultry between once a week and once a day. (Group 7, 2009)
- Respondents were asked for preference of vegetarian options and to indicate all options that may apply. Eggs appealed to 62% of respondents, 59% like tofu and 51% like beans/legumes. 4% of respondents indicated that they would like other vegetarian options such as nuts and vegetables. No respondents indicated that all of the options were unappealing. (Group 7, 2009)
- 85% of respondents would choose more environmentally friendly food options if they were offered. Respondents who expressed a willingness to pay extra (54%) for these food options and not willing to pay extra (46%) were similar. On average, respondents are willing to pay $0.21 extra per item. (Group 7, 2009)
- 75% of respondents expressed that composting take-out containers is important to them. 69% of the respondents never bring their own container to save $0.25. (Group 7, 2009)

Using Organics at the Moon

- Organics have gained in popularity because they are deemed a safer food source for both human and environmental health (BCMAL, 2007). It is thought that human health can benefit from the consumption of organics produce due to the higher amounts of bioactive compounds (Niggli et al., 2008). A UK study conducted with 25 farms showed that organic meats and milk have been found to have higher amounts of important fat-soluble vitamins and polyunsaturated fatty acids (Niggli *et al.*, 2008). Lower levels of nitrates and pesticides benefit both human and environmental health due to a reduced pollution, increased biodiversity, and improved soils. In general, organic agriculture better supports natural wildlife growth within the surrounding environment (Hammermiester, 2007). These properties help mitigate climate change while stimulating the economy and increasing jobs (Niggli *et al.*, 2008). (Group 7, 2009)

- The price of some conventional produce used by The Moon was compared to their organic equivalents offered by Pro Organics. In general, conventional produce is less expensive with differences ranging from as low as -6% (potatoes) to as high as 264% (ginger). One suggested strategy is to introduce the organic produce with a smaller price difference in the new lower EF dish to help keep cost increases minimal. Although the increase in cost of an organic dish is currently inevitable, it was generally believed that a slight increase in the cost should not be a major barrier for implementing the new lower EF menu item. (Group 7, 2009)
- One of the main concerns regarding introducing a lower EF food menu item at the Moon was the cost and manageability of obtaining local and organic produce (Moon employee personal communication, 2009). The AMS Food Purchaser Nick Gregory (personal communication, 2009) stated that the Moon can order organic items and he will try to source the items from one of his suppliers. (Group 7, 2009)

Barriers

- Communication between the central managerial body of the AMS Food and Beverage Department to convey the purposes and benefits of creating a sustainable food system needs to be stronger. It is difficult for a small business to put time and money into investigating methods of reducing EF with its limited resources especially when the benefits of such practices are unknown. Moreover, The Moon staff did not know that it was possible to obtain organic ingredients from the central purchaser of the AMSFBD indicating a need for increased communication within AMS Food and Beverage Department. (Group 7, 2009)
- Language may be a barrier to communication as observed by the group and reported by Toogood. (Group 7, 2009)
- High staff turnover makes it difficult to properly train new staff on sustainability initiatives. New employees should be trained to inform customers of the existence of lower EF menu items and sustainable container initiatives. (Group 7, 2009)

Development of the Lighter Footprint Recipe

- The recommended Lighter Footprint LOV line recipe is a Spicy Seasonal Stir-fry. This dish features locally produced organic Sunrise tofu, locally grown organic vegetables from the UBC farm including carrots, beans, cabbage, bok choi and garlic, and Canadian non-GMO canola oil. We altered the Moon's original recipe (Spicy Tofu, 2009) to include more locally available vegetables, and chose to substitute almonds for cashews, since cashews are not produced in North America while almonds can be sourced from California (Davis, 1999; Almonds, 2009). Both walnuts and hazelnuts can be grown locally and should be looked into as alternative nuts for the recipe. (Group 7, 2009)
- The UBC Farm could potentially increase its production of carrots, cabbage, fava beans, pole beans, Maxibel bush beans, Chinese long beans, bok choi, gai lan, sui choi, and garlic (Groups 16 & 20, 2008). Further vegetables could be substituted into the recipe depending on what is in abundance at the UBC farm. (Group 7, 2009)
- Based on taste tests within the group and by fellow classmates recommendations to improve the trial recipe include: adding more spices/sauce for flavor, using medium tofu rather than firm to absorb more flavor, and increasing the amount of vegetables compared to tofu. (Group 7, 2009)

THE ISSUE OF TO-GO CONTAINERS

- Although all AMSFBD outlets offer compostable containers, the AMS is not convinced that biodegradable containers are a sustainable solution to the containers issue. A large portion of the costly compostable containers are being put in the landfill which results in zero ecological benefit. At this time, the AMS cannot absorb the cost of completely phasing out Styrofoam containers and using only compostable containers. It is also not feasible to implement only a small increase in the prices of the dishes in an effort to cover the increased cost of the containers (Toogood personal communication, 2009). (Group 7, 2009)

- The alternative to both Styrofoam and compostable containers is the use of reusable containers that students bring from home. This is being highly encouraged by the AMS by offering a $0.25 discount and by selling Rubbermaid® Collapsible Containers sold at The Outpost in the SUB (Toogood & Guimaraes, personal communication, 2009). (Group 7, 2009)

SOURCING INGREDIENTS FOR THE AMS FOOD AND BEVERAGE DEPARTMENT

- Nicholas Gregory (personal communication, 2009), the AMS Food Purchaser, commented that the AMS currently considers the source of ingredients unimportant because they are "commodity" items. Brands and ingredient origins are not considered when purchasing products. (Group 6, 2009)
- Suppliers do not notify the AMS of brand changes unless a certain one is requested. AMS purchases are based on availability and price (Gregory personal communication, 2009). (Group 6, 2009)

MARKETING STRATEGIES FOR THE AMS FOOD AND BEVERAGE DEPARTMENT

- In an interview with Nancy Toogood, the manager of AMS Food and Beverage Department, it was revealed that the AMS has been accused of "sign pollution." Toogood has requested information on whether current AMS marketing strategies are effective in delivering their messages to the students and consumers. (Group 6, 2009)

Survey- Effectiveness of the AMS Lighter Footprint Strategy

- The survey was conducted throughout the SUB resulting in 176 responses. The results showed that 55% of respondents are more inclined to buy foods that are local, organic or vegan if they are more ecologically friendly, while only 3% answered they were not interested. When asked whether they would be willing to pay more for local, organic or vegan foods, 39% of participants said yes for local, 55% for organic, and 6% for vegan. (Group 6, 2009)
- When asked about the $0.15-0.25 discount for bringing their own containers to AMSFB outlets, 53% of respondents said "yes" they knew about the initiative. (Group 6, 2009)
- Marketing strategies observed by survey participants in the SUB included: the recycling bins (81%), compost bins (75%), posters (57%), and the Eating Ecologically Stamp Card (7%). (Group 6, 2009)
- Only14% of students knew about Eco-Friendly Day on the last Thursday of the month, while 11% have taken part in an Eco-Friendly day activity, and 15% did not know whether they had taken part. Of the people who answered "yes" to taking part in an Eco-Friendly Day activity, only 35% of people changed the way they purchased food. (Group 6, 2009)
- When talking to survey participants about reducing EF and other sustainability issues, it was observed that a large majority is unaware of how LOV products are more eco-friendly, and how they are involved in lowering EF. It is suggested that awareness needs to be raised about the beneficial impacts of LOV products, as the survey suggests that more people are willing to purchase these products if they know about their benefits. (Group 6, 2009)

RECOMMENDATIONS

TO BLUE CHIP COOKIES:

- Incorporate proposed "Vegan Oatmeal Raisin Cookie" and "Vegan Chocolate Chip Oatmeal Cookie" into menu line. (Group 6, 2009)
- Implement proposed Blueberry Chocolate Breakfast Bar. (Group 10, 2009)
- Make vegan choices more visible in the display case and use the LOV label at all times. (Group 6, 2009)
- Encourage employees to prompt and inform customers about AMS eco-friendly initiatives. (Group 6, 2009)
- Incorporate proposed employee LOV pins, as well as 'compost me' stamps and eco-factoids by using them on beverage cups, sleeves and/or napkins, as part of larger marketing strategy to help raise awareness and support for AMS sustainability initiatives. (Group 6, 2009)

- Incorporate "Save Yourself – Save the World" marketing tool to help promote and raise support for LOV items. (Group 10, 2009)
- Further investigate the economic feasibility of replacing the current conventional flour used with organic flour in all baked goods. (Group 6, 2009)

THE PENDULUM:

- Increase awareness of existing LOV products by adopting the proposed marketing strategy which includes: implementing the new LOV labels in display cases, using table cards describing the LOV labels, highlighting daily LOV items on the chalk board, updating the Pendulum website to include LOV items and creating a Facebook group called "LOV at the Pendulum" to raise awareness campus-wide and beyond. (Group 8, 2009)
- Enlist an employee to take responsibility for online marketing ventures (perhaps a marketing student) and to keep website and Facebook group up to date. (Group 8, 2009)
- Explore revamping existing popular menu items to become more ecologically friendly and use local and/or organic ingredients whenever possible. (Group 8, 2009)
- Educate employees regarding LOV labels, Eco-Friendly Days in the SUB and criteria for vegan, local and organic foods. (Group 8, 2009)

THE HONOR ROLL:

- Increase signage promoting current eco-friendly dishes- including any LOV (local, organic or vegan) dishes. (Group 9, 2009)
- Repeat the 2008-2009 advertisements in the AMS Insider student agenda with the new eco-friendly theme to increase student awareness of how to be eco-friendly and what incentives the AMS provides. Make the advertisements noticeable, bright and repeat several times throughout the agenda. (Group 9, 2009)
- Display separate prices for dishes in "to-go" containers and the same dishes in "bring-your-own" containers to avoid ambiguity and to more effectively promote the bring your own container policy. (Group 9, 2009)
- Offer a free green tea when customers bring their own mug to increase sales at The Honour Roll and to further encourage students to engage in sustainability practices. (Group 9, 2009)
- Investigate the feasibility of developing a customer punch card to serve as an incentive for students who bring their own container, where after ten times they would receive a free roll. (Group 9, 2009)

TO THE MOON:

- Adopt the recommended Spicy Seasonal Stir-fry LOV recipe after adjusting to taste. Implement proposed accompanying poster to increase awareness. (Group 7, 2009)
- Verbally offer customers the compostable containers and display them more visibly (higher stacks of compostable containers than Styrofoam containers). (Group 7, 2009)
- On Eco-Friendly Day, have cashiers inform customers of the regular $0.25 discount for bringing their own containers to AMS food and beverage outlets. (Group 7, 2009)
- Increase total use of local and organic products – incorporate into everyday menu, not just specials. (Group 7, 2009)

TO THE AMS FOOD AND BEVERAGE DEPARTMENT:

Marketing and Advertising

- Implement the use of the LOV label in all food outlets on a daily basis. (Group 10, 2009)
- Develop effective informational signage and test using focus groups (Group 9, 2009). Focus on educating AMSFBD customers about EF products and developing marketing strategies for low EF products to increase their sales. (Group 10, 2009).
- Promote LOV products & Eating Ecologically Stamp Cards through different media such as school papers (i.e. The Underground, Discorder, and Perspectives etc.), AMS student planner and menu blackboards (Group 6, 2009) and the TV displays by Blue Chip Cookies.

- Display a poster about different AMSLFS initiatives in the employees break room to help raise employee awareness. (Group 6, 2009)
- Increase advertisement of available AMSLFS initiatives, such as pins/buttons that staff can wear on their uniforms, advertising and printing "eco-facts" on paper napkins. (Group 6, 2009)

Staff Training

- Increase communication with employees to make sure that they understand the AMS Lighter Footprint Strategy and its benefits. (Group 7, 2009)
- Prioritize training AMS staff members about sustainable waste management policies. If AMS Food and Beverage Department employees are on board with waste management policies, composting and recycling practices will likely increase. (Group 9, 2009)
- Continue to look for more ecologically-friendly disposable food containers. (Group 7, 2009)

Food Procurement

- Increasing the amount of local food products used by AMS food outlets, especially items like blueberries that are grown in large quantities here in BC. Further investigation is required to identify available BC sources and support will need to be supplied to AMS food outlets in the transition to incorporating these products into their menus. (Group 10, 2009)

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SCENARIO 3: CHANGING THE FOOD SYSTEM TO CHANGE THE CLIMATE: THE UBC FARM AS A LIVING LABORATORY

Community Partners: Center for Sustainable Food Systems, 100-Mile Diet Society
AGSC 450 Groups: Scenario 3A- 21, 22, 23, 24, 25: Scenario 3B- 11, 12, 13, 14, 15

OBJECTIVES:

The "Changing the Food System to Change the Climate" project called on the AGSC 450 class to synthesize action and education aimed at impacting the food system directly via sustainable farming practices and indirectly through creating a critical mass of "empowered eaters" with the knowledge and desire to make climate-friendly choices in their daily food consumption habits. This was done in two scenarios: Scenario 3A used hands on learning to implement sustainable production techniques and landscape management at the UBC Farm and Scenario 3B designed public education materials to empower UBC Farm market customers to make climate-friendly choices.

SPECIFIC OBJECTIVES- SCENARIO 3A:

Students researched and used hands-on techniques to help implement UBC Farm objectives and gain knowledge in the areas of farm landscape diversity, biofuels and energy crops, on-farm wood stands, agricultural plastics and Livestock in mixed farming systems.

CENTRAL FINDINGS- SCENARIO 3A:

LITERATURE REVIEW:

All groups conducted a literature review. The following findings support the scenario as a whole.

- In the Kyoto Protocol, Canada agreed to reduce GHG emissions to 575 million tones or 6% below 1990 levels by 2012 (UN, 1998). Currently, Canada's 2012 emissions are estimated to be 764 million tonnes of carbon dioxide equivalents, which is 33% above Canada's Kyoto Protocol target (Ontario Ministry of Environment & Ministry of Natural Resources, 2001). (Group 21, 2009)
- Soil plays the second largest role in the global carbon cycle next to the oceans and can act as a Green House Gas (GHG) sink or source depending on management (Follain *et al.*, 2007) (Group 25, 2009). Soil disturbances from land use changes are the most significant source of carbon emissions (Bellarby et al, 2008) (Group 21, 2009). Minimizing soil erosion is important to minimize soil contribution to GHG emissions (Albrecht and Kandji, 2003 & Follain *et al.*, 2007) (Group 25, 2009).
- Carbon sequestration is a long-term approach to climate change mitigation but it is very applicable to agricultural systems (Montagnini & Nair, 2004). Agriculture accounts for 8% of

total GHG emissions. These emissions are included in the evaluation of UBC's efforts to become carbon neutral (Environment Canada, 2007; EPA, 2007). (Group 21, 2009)

The following are a list of findings pertaining to each Topic Area of Scenario 3.

ON-FARM WOOD STANDS

- Agroforestry is the practice of growing trees and agricultural crops on the same land. It can result in decreased carbon release, when compared to converting forests to croplands (Sanchez, 2000) and it has the potential to help restore degraded soils. (Group 21, 2009)
- Soil carbon sinks have a much larger capacity to sequester carbon than living vegetative sinks do. Therefore, increasing soil organic matter can reduce agricultural contributions to atmospheric CO_2. Additionally, higher levels of soil organic matter (SOM) are proven to improve crop yield and stabilize soil carbon sink capacity (Oelbermann, 2004). (Group 21, 2009)

Carbon Sequestration as a Long Term Benefit

- The UBC Farm wood stands can act as carbon sinks by using CO_2 from the atmosphere for energy and growth. Young tree stands add more biomass than they lose thus increasing carbon storage. As the stand matures, growth and losses become balanced and the trees no longer sequester carbon but the carbon in litter and soil continues to increase (Ontario Ministry of Environment & Ministry of Natural Resources, 2001). Estimates of temperate area capacity for carbon storage based on a tree-stem biomass to carbon content of 1:2 indicates that potentially 63 Mg (metric tonne) of carbon be stored per hectare (Montagnini & Nair, 2004). (Group 21, 2009)
- The UBC Farm wood stand is situated within the Coastal Western Hemlock biogeoclimatic zone, submontane very wet maritime variant (CWHvm1) (BC Ministry of Forest, 2009). These conditions are not ideal for decomposition due to limited biological activity of acidophilic fungi and low-activity invertebrates (Krzic & Curran, nd). Soil profiles store about 2400 Pg (10^{15}) of carbon as soil organic matter in the surface litter horizons of forest soils. These stores can be increased through management practices that increase net primary productivity and the amount of plant material returning to the soil (Montagnini & Nair, 2004). (Group 21, 2009)
- At UBC Farm additional organic matter must be added to the soil in order for the tree stand to be considered a carbon sink. Turning the wood stand into an agroforestry production unit would increase marketable crops and the potential of the stand to act as a carbon sink through increased litter fall and root biomass, both sources of soil carbon. (Group 21, 2009)
- Tree thinning increases the amount of light and available nutrients which increases the growth rate of the trees (Montagnini & Nair, 2004). It is important that litter fall and brush remain onsite after tree thinning to maintain the ground cover and a source for nutrients as carbon sequestration is limited by soil infertility (Ontario Ministry of Environment & Ministry of Natural Resources, 2001, Montagnini & Nair, 2004). (Group 21, 2009)
- Extension of the harvest cycle length would add to the standing carbon of the wood stand and result in larger timber that can be used for longer-lived wood products- eg structural timbers (Brown et al, 2004). (Group 21, 2009)

Biodiversity and Marketable Crops as a Short Term Benefits

- The presence of wood stands within a cultivated farm system provides habitat for a variety of species through structural diversity (Kandtelhardt et al. 2003). Increased floral and faunal biodiversity contributes to overall ecosystem health and function (Hallman, R. and others. 2001). (Group 21, 2009)
- The UBC Farm wood stands have the potential to contribute to the UBC food system. Non-timber forest products are emerging as an economically viable area of forest stewardship (Cocksedge and Schroeder, 2006). Forest stands can produce: edible mushrooms, floral greenery, berries, seasonal bows and wood for on and off farm use (Gunter, 2004). (Group 21, 2009)
- Oyster mushrooms are consumed worldwide, are easy to cultivate, have a low start up cost to production, and a high nutritional value. There are a wide range of species available

under different climatic conditions, and there can be year-round production of the mushrooms using different varieties for different seasons. Inoculated alder logs will begin producing after 6 to 18 months and continue seasonally. The mushrooms reach maturity in 10-15 days. Three harvests can be gained per log per year. This cycle can continue for up to 6 years on the same logs (Craig and Miles, 2004). The market price for oyster mushroom is $12.00/lb fresh (Pacific Rim Mushrooms, 2007). (Group 21, 2009)

FARM LANDSCAPE DIVERSITY- HEDGEROWS

Benefits to Diversity

- Hedgerows play a key role in the preservation of the natural landscape in an agricultural setting through the incorporation of native species into the cultivated landscape and providing diverse species and structurally diverse areas for native insects and animals to reside in (Boutin et al., 2002, Bunce & Hallam, 1993). This ensures that native species richness and genetic pools in plants, insects and animals are conserved to some degree (Boutin and Jobin, 1998 and Maudsley, 2000). (Group 25, 2009)
- The following principles are excerpts from the BCMA document "Planning for Biodiversity: A Guide for BC Farmers and Ranchers" (2008). These 8 principles provide a framework for establishing and sustaining biodiversity in an agricultural landscape. (Group 25, 2009)
    - Maintain native habitat and species such as forests, riparian zones and grasslands as they are the most important contributor to biodiversity in the area.
    - Use semi-natural landscapes (such as hedgerows) to conserve biodiversity while enhancing productivity of adjacent agricultural lands.
    - The type and amount of biodiversity present fluctuates depending on the location of the agricultural land and the season.
    - Avoid habitat isolation by establishing a network of natural and semi-natural habitat to allow for uninhibited movement of wildlife without disturbing crops.
    - Structural diversity creates a variety of niches which will further enhance the biodiversity of the area.
    - Soil management is important to the health of an ecosystem which supports a wider array of biodiversity.
    - Eliminate invasive alien species as they can undermine biodiversity.

Agricultural Benefits

- The incorporation of hedgerows on farmlands contributes to reduced environmental degradation of cultivated fields (Kiepe, 1995 and Fujisaka, 1993) through prevention of soil erosion and improved soil structure and drainage (Walter *et al.*, 2003) and helps with water conservation due to tree roots going deeper into the soil than most crop plants (Kiepe, 1995; Alegre and Rao, 1996). This protects adjacent cultivated lands, allowing them to be more productive. (Group 25, 2009)
- If hedgerows are both sufficiently dense and tall they can provide wind protection which assists in preventing loose top soil from being blown away thus preventing the need for more inputs to maintain crop yields (Alegre and Rao, 1996). (Group 25, 2009)
- Predatory insects, birds and mammals inhabiting hedgerows can consume many common crop pests (Altieri and Nicholls, 1999; Best, 1983) and can scare away migratory bird species (Ribic and Sample, 2001) thereby reducing the pressure placed on crops. (Group 25, 2009)
- Hedgerows with blooming native plant species encourage the presence of native pollinator species, which are necessary for fruit and vegetable production (Goulson, 2002). Additionally, bee hives can be established in hedgerows. (Group 25, 2009)
- Hedgerows can also provide a source of revenue to farmers by including fruit trees, wild flowers, berry bushes and a number of other plant species. (Group 25, 2009)

Benefits to Climate

- Hedgerows are able to sequester and store carbon through large biomass accumulation, both above and below ground (Falloon *et al.*, 2004). The ability of hedgerows to sequester carbon is dependent upon their structure, tree species, biomass production, environmental influences, soil characteristics and management of the system such as pruning frequency (Albrecht and Kandji, 2003). (Group 25, 2009)

- The ability of hedgerows to minimize soil erosion (Walter *et al.*, 2003) is fundamental to its ability to sequester and store carbon (Albrecht and Kandji, 2003). Reducing tillage through establishment of hedgerows increases the soil's ability to store carbon (Follain *et al.*, 2007). (Group 25, 2009)
- When frequently cultivated land is converted to hedgerows and tree strips, the level of carbon sequestration increases while the release of N_2O decreases. N_2O has a global warming potential 280 times that of CO_2. (Falloon *et al.*, 2004). (Group 25, 2009)
- Hedgerow can take 50-100 years to reach a carbon equilibrium. This means for optimal carbon sequestration the hedgerows must be a permanent component of an agricultural system (Falloon *et al.*, 2004). (Group 25, 2009)

Drawbacks to Hedgerows

- Hedgerows can encourage pest population growth including insects, small mammals and birds (Rieux et al., 1999; Arnold, 1983) as well as beneficial species thus requiring management for overall benefit (Paoletti et al., 1992). (Group 25, 2009)
- Crops can be harmed by diseases that are present in hedgerow vegetation given their close proximity (Koech and Whitbread, 2004). (Group 25, 2009)
- Hedgerows take arable land out of primary production (Alegre and Rao, 1996) and harvestable hedgerow plants will likely not have returns as high as if under normal cultivation and could therefore lead to a loss in revenue. (Group 25, 2009)

LIVESTOCK IN MIXED FARMING SYSTEMS- BEES

- Bee pollination is vital for the sustainability and profits of agriculture as it can determine crop yield and quality (Delaplane & Mayer, 2000). Bees pollinate 15-30% of the world's food crops and more than 66% of the world's 1,500 crop species (Kremen, Williams & Thorp, 2002). Bees are considered a keystone species and without them our ecosystem would be at risk of collapsing (Shultz, 2007). (Group 24, 2009)
- 20-30,000 bee species exist but farmers rely on only about 10 species for pollination. There are approximately 4,000 species of native bees in North America. Native honeybees are more effective than honeybees at pollinating due to the diverse foraging behaviours of native bees including during colder or wetter conditions (The Xerces Society, 2009). (Group 24, 2009)
- Bee abundance and species diversity are directly related to the abundance and diversity of flowering plants. Native bees have been declining over the years due to the intensification of farming practices, the use of pesticides, the increasing homogeneity of landscapes, the increased isolation of bees from nesting and feeding resources, and the many diseases that plague bee populations. This decline in native bees has resulted in an increased demand for foreign bee species such as the European honeybee, *Apis mellifera*, which alone contributes between $5 and $14 billion per year in crop value. Foreign bees are not nearly as effective pollinators as native species. (Group 24, 2009)
- Landscapes, like the UBC Farm, which favour habitat heterogeneity within the foraging range of bees, can have a positive effect on bee communities. Farm landscapes with small field sizes growing a variety of crops with patches of non-crop vegetation, such as hedgerows, fallow fields, meadows and semi-natural wood or shrub lands, are best suited for bee populations (Kremen et al, 2007). (Group 24, 2009)

Colony Collapse Disorder (CCD)

- Colony Collapse Disorder (CCD) is an event affecting bee colonies, which results in adult populations being rapidly decimated. CCD is different from other colony collapse events in that no corpses are found in or surrounding the hive, as they would be if they had died from a parasitic attack for example (Cox-Foster *et al*, 2007). (Group 24, 2009)
- In 2006/2007 over 23% of American beekeeping operations were affected, resulting in an estimated loss of over 45% of bees within those operations (Cox-Foster, *et al*, 2007). Currently, the exact cause of CCD is under investigation by scientists. Researchers agree that a combination of factors are likely causing CCD and investigations are focused on

understanding some of the possible pathogenic and viral sources, as well as how pesticide use and nutritional deficiency from commercial bees traveling long distances to pollinate monocrops is contributing to the CCD epidemic. (Group 24, 2009)

Beekeeping in British Columbia and Greater Vancouver

- Beekeeping has been practiced in British Columbia for nearly 150 years (Ministry of Agriculture and Lands, 2003). Honeybee colonies are kept virtually everywhere throughout the province with 2,300 registered beekeepers operating 47,000 colonies. A small number of beekeepers breed bees and queens, which are sold to other beekeepers in areas where it is difficult or costly to winter bees. Apiculturists also move bee hives into orchards or vegetable fields to provide pollination services for those crops. Despite its size, beekeeping in BC is critically important to the annual production of over $100 million of crops (Honey, n.d.). (Group 24, 2009)
- BC's agriculture is limited by its topography and climate which limits the development of BC's apiculture (Honey, n.d.). Beekeeping is highly dependent on the seasonal availability of nectar and pollen. In many areas of BC, the natural vegetation offers limited floral nectar sources but food crops and weeds have improved local beekeeping conditions. Other influencing factors include quality of management, presence of disease and pests and the genetic quality of the bee stock (Ministry of Agriculture and Lands, 2003). (Group 24, 2009)
- Honeybee colonies are regulated by the Provincial Bee Act and all apiaries must be registered with the BC Ministry of Agriculture and Lands (BCMAL). BCMAL is in charge of responding to complaints, inspecting apiaries and controlling bee diseases (Bradley, 2005). (Group 24, 2009)
- Although beekeeping was prohibited within the Vancouver City limits until 2005 by a 1970's Health by-law, it was estimated that there were 36-46 beekeepers in the City, 26 of which were officially registered with the BCMAL (Bradley, 2005). Current regulation dictates that backyard beekeepers are limited to 4 hives which must be well managed to prevent swarming, aggressive behaviour and relocation (Chan, 2005). (Group 24, 2009)

Beekeeping at the UBC Farm

- The UBC Farm is currently home to seven colonies of European honeybees (*Apis malifera*). The number of bees varies throughout the year with the lowest numbers during the winter and up to 50-60,000 bees during the summer. UBC Farm workers do not believe that the hives have been affected by CCD, but in 2006 all the colonies died off. This may have been due to poor management of the bee colonies (A. Garr, personal communication, 2009). (Group 24, 2009)
- According to Amy Frye (personal communication, 2009), the UBC Farm marketing coordinator, there is great customer demand for honey. In 2006 the UBC Farm sold 96 jars for $594 of revenue at $6 per jar. In 2007 there was no honey due to colony die off and in 2008 the UBC Farm sold 75- 500g jars of honey at $10 each generating $750 of profit. (Group 24, 2009)
- Currently, only 7 colonies can be sustained at the UBC Farm as beekeeping is directly dependant on the crops that provided nectar which are currently limited to field crops (eg: squash) and wild crops (eg: blackberries, dandelions). In order to house more bees, the UBC Farm would need to plant more crops from which the bees are able to feed. (Group 24, 2009)

BIOFUELS AND ENERGY CROPS

- The first-generation of biofuels utilized seeds and grains like canola for fuel and diverted land and resources away from food production and subsequently raised food prices. Second-generation biofuels rely on agricultural waste products such as stalks of wheat, corn or wood for fuel production. (Group 23, 2009)
- In the context of the UBC Farm, the canola and miscanthus plots serve as educational demonstration sites for the production of biofuels and they represent the potential for UBC Farm to become more carbon friendly. (Group 23, 2009)

Canola Crops

- Canola was developed in the 1970s by Canadian plant scientists who were looking for a crop that would yield a healthy and edible oil (MCGA, 2008). Canola is used as a cooking oil, livestock feed, a rotational crop, and more recently as a biofuel (Shahidi, 1990). (Group 23, 2009)
- Canola is a member of the genus Brassica, and as a member of the *crucifer* family. The yellow flower produces seed pods that are five centimeters in length containing seeds which are crushed to extract canola oil. (MCGA, 2008). It is a cool-season crop and is mostly produced in Alberta, Saskatchewan, Manitoba, and British Columbia (Shahidi, 2008). (Group 23, 2009)
- Ideally, canola should be grown on fertile, well-drained soils that have minimal weeds (Shahidi, 1990). Wet soil should be avoided, since canola cannot survive in saturated soil conditions for long periods of time (Shahidi, 1990). The crop is tolerant to saline conditions and a soil pH as low as 5.5 (Oplinger, Hardman, Gritton, Doll, & Kelling,1989). Canola can be developed as either spring or winter annual. Production of canola requires 100-200 kg of nitrogen/hectare, and 10-20 kg of sulfur/hectare (Hoveland, Odom, Haaland, & Alison, 1981). (Group 23, 2009)
- At the UBC Farm canola may face a lack of sufficient nitrogen. While available nitrogen levels are continuing to increase at the Farm through compost and winter cover cropping practices, the levels are not yet optimal. Nitrogen deficiency in canola limits chlorophyll development (Berlund, McKay, Knodel, 2007) and ultimately leads to a decreased flowering period and seed production. (Group 23, 2009)

Canola as Biodiesel

- Canola is the primary source of biodiesel, which is the fastest growing alternative fuel in Europe. Biodiesel is produced using a mechanism called trans-esterification (Energy System Research Unit, n.d.). The trans-esterification of canola is a relatively easy and inexpensive process and the UBC Farm could produce a portion of its own biodiesel to run its farming equipment. (Group 23, 2009)
- Biodiesel can be used as a substitute for conventional diesel or as an additive. In both pure and blended forms, biodiesel has been shown to reduce the emissions of air toxins such as carbon dioxide, particulate matter, carbon monoxide, black smoke from vehicles as well as hydrocarbons. When comparing regular diesel with pure biodiesel, pure biodiesel produces a 73% decrease in the lifecycle of CO_2, a 51% reduction in methane emissions, a 67% decrease in unburned hydrocarbons, a 48% decrease in carbon monoxide, a 47% reduction in particulate matter and a 100% reduction in sulfur oxide emissions (Western Economic Diversification Canada, 2004). (Group 23, 2009)

Miscanthus

- *Miscanthus x giganteus* is a sterile hybrid of *M. sinensis* and *M. sacchariflorus*, and is commonly known as "giant Chinese silver grass" (Living Countryside, 2009). It is one of the most productive grasses known as it has the ability to tolerate cool temperatures and maintain photosynthetic activity even in colder months (Yates, 2008). It is a perennial plant which can grow more than 3.5 meters in height and its dry weight can reach 25 tonnes/hectare in one growing season. (Group 23, 2009)
- Miscanthus crops have optimum growth in areas with mild temperatures and high water activity. The most favourable soil for the crop is sandy or silty loam with high water-holding capacity and organic matter content (Christian & Haase, 2001) but Miscanthus has shown reasonable yield in soils ranging from sandy to having high organic matter (DEFRA, 2007). The soil pH should be maintained around pH 5.5 to 7.5 (DEFRA, 2007) and nutrients such as nitrogen and phosphorus are required but only in low levels (Lewandowski, Scurlock, Lindvall, & Christou, 2003). Fertilizers can be applied to miscanthus plots but are usually for soils with a low nutrient content (Lewandowski et al., 2003). (Group 23, 2009)
- Miscanthus requires a lot of water and may face problems at the UBC Farm due to the inability of the soil to hold water. Irrigation of the crop may be necessary (OMAFRA, 2007). (Group 23, 2009)
- Miscanthus species use a C4 photosynthetic pathway. The numbers C4 and C3 indicate the number of carbon atoms in the molecule used in photosynthesis (Yates, 2008). C4 plants are

the most efficient in converting sunlight energy to biomass energy (Heaton et al., 2004). It is a GHG-neutral crop because the amount of carbon dioxide absorbed by the plant during growth is the same as the amount released when used as a biofuel (Living Countryside, 2009) and could potentially move the farm towards carbon neutrality. (Group 23, 2009)

- Miscanthus' rapid growth and highly favourable energy balance of low input and high yield characteristics have led to its popularity as a potential biofuel in Europe since the 1980's (Heaton et al., 2004). Miscanthus yields ethanol but the cellulosic ethanol technology that is required to extract the ethanol from miscanthus is still expensive and not yet available at an industrial level. The Farm can still potentially use the miscanthus as a fuel for heating their buildings using a process called pyrolysis that combusts biomass into fuel. (Group 23, 2009)

AGRICULTURAL PLASTICS

- The UBC farm uses agricultural plastics for three different purposes. (Group 22, 2009)
- Drip Tape is a thin-walled, water-emitting hose used to irrigate crops (Lamm & Ayars, 2007) and is normally composed of polyethylene (Peacock, 2000). The UBC farm uses a flow resistant drip tape which slows water flow to a slow drip. This tape is used on 200 plus varieties of row crops. Drip tape is designed to use less water (Jensen & Malter, 1995), less energy and less labor (Humphrey & Mussen, 1995) than above ground watering systems. The disadvantages of a drip irrigation system are the initial cost and the disposal. Other issues associated with drip tape use include clogging, poor uniformity of water delivery, risk of animals chewing on the tape, and rupture during mechanical weeding processes (Humphrey & Mussen, 1995). (Group 22, 2009)
- Plastic mulch is a product commonly used in agricultural operations to suppress weeds and conserve water. When drip irrigation is installed under plastic mulch, higher crop yields can be achieved (Jensen & Malter, 1995). The chemical composition and pigmentation of the plastic film are critical factors in determining the mulch's durability, strength, resistance to aging, and its ability to retain heat within the soil (Jensen & Malter, 1995). Plastic mulch also prevents weed growth and rapid heating of crops while selectively improving lighting (Stevens *et al.*, 1991). The black films can be used during cold weather to provide increased heating for seed germination (Stevens *et al.*, 1991) and the clear films reflect some of the sunlight rays and cool the soil to prevent scorching the plants. (Group 22, 2009)
- Greenhouse films are used in order to achieve warmer temperatures within greenhouses by trapping the heat from the light rays that enter through the film. The lifetime of the polyethylene used is determined by many factors (Hamid, 2000). (Group 22, 2009)

Wildlife Interactions at UBC Farm

- Coyotes chew on the ends of drip tape which often causes damage that prevents the plastics from being reused (Carter, personal communication, 2009). The topic was researched but little information was found regarding this behaviour. (Group 22, 2009)

Disposal of Agricultural Plastics

- The typical methods for disposing of agricultural plastics are listed below:
- **Dicing** involves burying the used plastic in the soil as the disc harrow turns and loosens the soil (Stevens, *et al.,* 1991). The method is not recommended for the black film that is used at the UBC farm due to the risk of plastic particles building up in the soil.
- **Burning** of plastic films is laborious, with a risk of emitting toxic fumes, and violates the environment protection laws in many countries (Stevens *et al.*, 1991). Burning plastics at low temperatures in open fields adds pollutants to the atmosphere and poses a risk to human health (Clarke & Fletcher, 2002; Levitan & Barros, 2003). (Group 22, 2009)
- **Dumping** is the least intensive option; however, many landfills no longer accept plastic mulch wastes (Stevens *et al.*, 1991). Currently, the UBC Farms has resorted to storing plastic wastes until an affordable, local, and sustainable alternative option to dumping arises. (Group 22, 2009)

Existing Recycling Infrastructure for UBC Farm

- The company that provides recycling service to UBC collects plastics labelled 1-7 (Beaudrie personal communication, 2009). From correspondence with various plastic recyclers and manufacturers it was determined that most agricultural plastics are numbered between 2 and 5 and can therefore be recycled at several local facilities (Larry Munoz, personal communication, 2009). However, agricultural plastics are not widely accepted at recycling facilities due to a number of logistical reasons including the plastics are often not cleanable (Beaudrie, personal communication, 2009), their processing can be quiet costly for the recycling plant (Anderson, personal communication, 2009) and many of the plastics are mixed plastics making the recycling process almost impossible (Clarke, 2001). (Group 22, 2009)

Alternatives to Traditional Agricultural Plastics

- Synthetic degradable plastic polymers ideally deteriorate into CO_2, water, minerals, and biomass and do not negatively impact the environment or release any toxic by-products. Unfortunately, if the soil and abiotic properties are not ideal, which can often be the case, the deterioration of these plastics may not proceed properly, resulting in contamination of the soil and pollution of the environment. Products with slow degradation rates are more likely to be toxic and accumulate in the soil (Kyrikou & Briassoulis, 2007). (Group 22, 2009)
- Plant starch-based plastics are another type of biodegradable polymer. These are single-use products which may necessitate increased consumption of the product. Additionally, there are increased energy requirements in growing the raw plant materials to produce the product (The Environment and Plastic Industry Council, 2009) as well as in the manufacturing process resulting in the consumption of far more fossil fuels than are used in the production of traditional plastics (Arévalo-Niño, Sandoval, Galan, Imam, Gordon & Greene, 1996). Although biodegradable materials offer many environmental benefits, uncertainty remains regarding their sustainability. (Group 22, 2009)
- Many of the companies that provide alternative plastics are located overseas which is undesirable due to the transportation emissions (Carter, personal communication, 2009). (Group 22, 2009)

Waste Reduction, Recycling and Other Uses

- **Recycling**- Nearly one-third of the energy used in the manufacturing of polyethylene is invested in the recycling process. When this reprocessing energy is added to the energy expended in transportation, cleaning of waste, and additive-use to create a serviceable product, the overall ecological benefits of recycling is frequently lost. Additionally, agricultural plastics are often a combination of several different types of polymers, making them difficult to recycle (Scott, 1999). (Group 22, 2009)
- Until recently, agricultural plastics from the Lower Mainland and Okanagan regions could be sent for processing and recycling to the Polymere Group in Abbotsford, BC. Unfortunately, due to the drop in the plastics market, these facilities were forced to close down, as the market could not support the lower grade plastics used in agriculture (Anderson, personal communication, 2009). (Group 22, 2009)
- **Burning**- Burning agricultural plastics as an energy source may be a viable disposal method. The energy expenditure of plastic wastes is comparable to that of fossil fuel, and the thermal energy produced by polyethylene incineration is similar to that used in the manufacturing process, making it an efficient energy source (Scott, 2000). Additionally, hydrocarbon polymers produce only carbon dioxide and water and are consequently considered clean fuels. In a trial conducted by the Central Termica Litroral de Almeria, greenhouse film was tested as a fuel-substitute in coal-fired power plants. It was found that greenhouse film is a possible substitute for coal as it maintains comparable thermal efficiency without the emission of harmful wastes into the environment (Paolo La Manita, 2002). (Group 22, 2009)
- One challenge to the incineration process is that agricultural plastic is usually contaminated by the soil and plant debris. A process developed in the US, however, can encapsulate the dirt and debris within pellets called Plastofuel, which are easily stored, shipped, and used for fuel. The burning of these pellets releases similar amounts of sulphur- and nitrogen-dioxide compounds into the atmosphere as burning coal (Garthe and Miller, 2004). (Group 22, 2009)
- High temperature combustion of plastics pellets to heat greenhouses may provide an alternative use for agricultural plastic waste. Further testing is required before these systems can be used (Garthe and Miller, 2004). (Group 22, 2009)

- **Biological Recycling**- This process involves the degradation of biodegradable plastics with the primary product being biomass. The resulting biomass can be used as a seed-bed for new crops. Biomass formation is beneficial for the environment as the carbon is retained, rather than being released into the environment (Scott, 2000). (Group 22, 2009)

FIELDWORK EXPERIENCE

All groups did hands on fieldwork. The following are comments about the experience:

- "Working on the farm has given us a better understanding of the significance of our chosen topic. Not only were we able to apply skills learned in class as well as through research, but through our experience we gained knowledge about each group member's strengths and weaknesses, which has further strengthened our bond as a team." (Group 21, 2009)
- "Having UBC Farm workers work closely with us benefited our whole group."(Group 21, 2009).
- "Overall, we highly encourage next year's AGSC 450 students to experience and participate in the same or similar hands-on project to ultimately promote the UBC Farm as a carbon neutral model, helping us move one step closer to a sustainable and ecologically-friendly community." (Group 25, 2009)
- "Field work (should) be directly correlated with the topic of focus for the project. Our work at the Farm would have been more influential if we had a greater understanding of the importance of our work and how it affects the farm landscape. We feel that Community Service Learning is a very useful pedagogical tool when it is designed with concrete goals in mind." (Group 24, 2009)
- "There is a distinct difference between reading about something and actually witnessing it in real life. Our group had the opportunity to see plastic drip tape that was gnawed on and damaged by coyotes that inhabit the adjacent wooded ecosystem. Seeing this unfortunate damage allowed our group to feel sympathy for the farm workers and the coyotes whose fringe habitat puts them in direct contact with human life. We have read a lot over our years, and it is very helpful to live out what we have learned down at the farm even if it is just for a few hours. The main themes of AGSC all relate to the livelihood of the farm. Without this experience, it would be difficult to imagine where some of our classroom learning would apply when we are living in an urban environment." (Group 22, 2009)

KEY RECOMMENDATIONS- SCENARIO 3A:

TO UBC FARM:

On-Farm Wood Stands-

- Use the tree stands for revenue generating crops include fruiting mushrooms in spring and fall; berries (such as elder berries, salmon berries, salal berries and huckleberries) in summer; and bows and evergreen decorations (such as cedar, fir and salal for floral arrangements) during the winter. All of these suggested species are popular and marketable crops, which have the potential to be sold at the UBC Farmer's Market. (Group 21, 2009)
- Partner with an agroecology or forestry course focusing on soil management to manage the tree stand soils for optimal carbon sequestration. Students would collect samples and perform the lab work in order to investigate and propose methods that maximizes the carbon sequestration capacity of the wood stand from the soil aspect. (Group 21, 2009)
- Coordinate an interdisciplinary approach to further define the ecological and economic value of the tree stands. Faculties such as the faculty of Science, Forestry, and Commerce should be involved in developing a management strategy. (Group 21, 2009)

Farm Landscape Diversity- The following is a list of ways to promote biological diversity on the UBC Farm with an emphasis on hedgerows.

- Conserve the native forest habitat for increased biodiversity and to provide refuge for local wildlife from the current development of adjacent lands. (Group 25, 2009)
- Continue managing the established hedgerows to improve their ability to act as carbon sinks. Emphasize the importance of the UBC Farm as a carbon sink to younger students, other

undergraduates and the UBC Board of Governors. Hedgerows demonstrate how agricultural practices can reduce carbon dioxide emissions thereby conveying agriculture's role in sustainability and climate change. (Group 25, 2009)

- Establish a fully connected hedgerow system to integrate the Farm with the surrounding landscape and avoid habitat segmentation. Prune the hedgerows to increase habitat niches, to allow sunlight penetration to the under story and to prevent overgrowth of larger plant species. (Group 25, 2009)
- Establish diverse plant communities within the hedgerows with a variety of hedgerow types including tree, shrub, and herbaceous species to provide sufficiently diverse habitat for the wildlife at the UBC Farm. Eliminate alien invasive species from agricultural land and the surrounding natural environment. (Group 25, 2009)

Livestock and Mixed Farming Systems- The following is a list of strategies to increase native bee populations at the UBC Farm (The Xerces Society, 2007) (Group 24, 2009):

- Use local native plants. Native plants are four times more attractive to native pollinators than exotic plants.
- Chose several colors of flowers and shapes. Blue, purple, violet, white and yellow are particularly attractive to bees. Different bees varieties feed on different shaped flowers.
- Plant flowers in clumps. Flowers clustered together attract more pollinators compared to individual plants scattered throughout.
- Include a diverse array of plants flowering all season. By having several plant species flowering at the same time and throughout the year, it will support a greater range of bee species that pollinate at different times of the seasons.
- Provide appropriate nesting sites. Include patches of bare ground with soils of different textures; holes of different sizes drilled into boards, fences or dead trees; stranding dead trees and fallen branches; and fields where tillage and flood irrigation are avoided (Kremen et al, 2007).
- Choose to grow more crops and plants that can provide food for bees. Recommended plants include sweet clover, Cecilia, alfalfa, and borage (personal communication, 2009). A list of crops that require or benefit from bee pollination and can provide food for bees can be provided.
- Control mowing. Limit mowing to only patches of weeds and during dormant periods such as in the fall or winter. Like grazing, mowing can alter species composition and may destroy smaller topographical features which provide structural diversity to the habitat and are potential nesting sites for bees. In general, mowing should not be conducted when flowers are in bloom.

Biofuels and Energy Crops-

- Continue to establish biofuel demonstration plots for both canola and miscanthus.
- Incorporate biofuel education into the UBC Farm field trips that are offered for elementary and secondary school classes and create connections with UBC courses that could use the demonstration plots for education or research. (Group 23, 2009)
- Pursue a system for producing, processing and utilizing canola within the boundaries of the UBC campus. Potentially the UBC Farm could work with the Department of Chemical and Biological Engineering for the purpose of the trans-esterification of canola or with the Faculty of Forestry to explore cellulosic ethanol technology. (Group 23, 2009)

Agricultural Plastics-

- Research types of agricultural plastic to find more suitable varieties with increased lifespan and durability. There may also be methods of plastic management that can help maintain its functional condition, such as altering the placement of drip tape or storage methods. (Group 23, 2009)
- Maintain plastics in working order to avoid recycling and reuse plastics when possible. Waste reduction is important as recycling of plastics can be difficult. (Group 23, 2009)
- Recycle plastics. For any plastics that cannot re-used, there are methods of recycling available. To improve the likelihood of the plastic being recycled, keep the plastic clean and dry and separate plastics by type. Appoint a liaison for the farm and a local recycling depot

such as BTR Recycling to better know when agricultural plastics are being accepted. (Group 23, 2009)
- Use biodegradable plastic substitutes for mulch or bags to decrease waste. (Group 23, 2009)
- Work with the local government to find sustainable methods of plastic management and recycling. (Group 23, 2009)

BACKGROUND- SCENARIO 3B:

The Centre for Sustainable Food Systems (CSFS) at UBC Farm and the 100-Mile Diet Society have embarked upon the "Changing the Food System to Change the Climate" project. This collaborative, two-year project highlights how sustainable agricultural techniques can reduce the negative impact of the food system on climate change and the environment.

SPECIFIC OBJECTIVES- SCENARIO 3B:

Students were asked to research and design public education materials addressing climate-friendly food choices, which were to be distributed to the UBC Farm's 20,000 visitors during the 2009 UBC Farm markets. The materials developed include carbon smart food labels and carbon smart food guides in a ready-to-distribute form and ideas for supplementary online publication.

CENTRAL FINDINGS- SCENARIO 3B:

LITERATURE REVIEW:

Each group did a literature review to support their recommendations for the Carbon Smart Food Guide, website and label. The following summarizes the most important findings:

Greenhouse Gas Emissions (GHGs)

- GHGs are capable of trapping heat in Earth's atmosphere and increasing the Earth's temperature (David Suzuki Foundation, 2009). Consequences include: a rise in global surface temperature, severe weather conditions, and rising water levels (EIA, 2008). A large portion of GHGs come from the burning of fossil fuel. (Group 14, 2009)
- Between 1970 and 2004, there was a 70% increase in greenhouse gas (GHG) emissions, 80% increase in carbon dioxide emissions, and 120% increase in direct emissions from transport to the atmosphere. These numbers are expected to rise even more over the next few decades (IPCC, 2007). (Group 15, 2009)
- Total CO_2 emissions have increased by 40% since pre-industrial times, and human-caused emissions have nearly doubled since 1970 (IPCC, 2007). CO_2 accounts for three quarters of anthropogenic emissions and is used as the base for comparison for the global warming potential of other gases (IPCC, 2007). (Group 12, 2009)
- Human contribution of CO_2 is roughly 95% of the total and most CO_2 comes from the use of fossil fuel. 20 lbs of CO_2 is produced for every gallon of fossil fuel burned (LIL, 2009). (Group 14, 2009)
- Methane and nitrous oxide also contribute to the increase of GHGs concentration and are especially released from food production (David Suzuki Foundation, 2009). Methane comes from landfills, coal mines, oil/natural gas operation and agriculture. Nitrous oxide is emitted through nitrogen fertilizers, from industrial and waste management process and burning of fossil fuel (EIA, 2008). It was found that methane has 21 times the global warming potential and nitrous oxide has 310 times the global warming potential of CO_2 (CCS, 2009; BBC, 2008). (Group 14, 2009)
- It is reported that an individual's consumption pattern contributes equally to GHG emissions as his or her transportation choices (Eshel & Martin, 2006). (Group 15, 2009)

Contributions to Greenhouse Gas Emission by the Food System

- The agricultural sector has the fourth highest GHG production and is estimated to account for 8% to 13.5% of total GHG emissions (Environment Canada, 2007; FAO, 2009; van Aardenne, 2000). When considering the entire food system, the estimate could be as high as 20-30% (Pimentel & Pimentel, 1996; Eshel and Martin, 2006; Garnett, 2008). (Group 11 & 12, 2009)

- Food related emissions rose by 27% between 1970 and 1990. This growth can be tied to urbanisation, crop intensification, technological changes and worldwide economic growth, among many other factors (IPCC, 2007; FAO 2006). (Group 12, 2009)
- In the food system, GHGs are released from agriculture from livestock production, crops production, food processing, transportation, and even refrigeration storage (Steinfield et al., 2006). 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 (Steinfield et al., 2006). (Group 13, 2009)
- Only 50% of GHG emissions related to our food systems are from on-farm production – the other half come from transportation, processing, packaging and waste (Heller & Keoleian, 2000). Foods now travel on average 25% further than thirty years ago using more energy-intensive methods of transportation such as airfreight and trucking (FAO, 2006). (Group 12, 2009)
- Eshel and Martin (2006) demonstrated that personal food choices contribute to GHG emissions on the same order of magnitude as individuals' transportation choices. (Group 12, 2009)
- International food transportation by air, land and sea now accounts for 11% of total GHG emission. This sector is a large source of global CO_2 emissions (LIL, 2009) with the average North American meal traveling 2,500km before it reaches consumers and containing ingredients from five other countries (Get Local, 2009) (Group 11, 2009). The major vehicles used for transporting food are: train, truck, plane and ships, with trucks producing the most GHGs (Weber & Matthews, 2008). (Group 14, 2009)
- According to the United Nations livestock production generates 18% more GHG than transportation (FAO, 2006) and the global livestock sector is growing more rapidly compared to other agricultural sub-sectors. (Group 14, 2009)
- Livestock and rice cultivation are the main contributors to the release of methane gas in the agricultural sector (Government of Alberta, 2004). Bacteria in the intestine of livestock digest nutrients into methane gas which is released into the environment (Government of Alberta, 2004). Rice cultivation is done in flooded fields where methane producing bacteria thrive in waterlogged soil (US EPA, 2006). (Group 14, 2009)
- Nitrous oxide is produced naturally in soils through microbial processes and released to the atmosphere. These emissions are increased by a variety of agricultural practices including: the use of synthetic and organic fertilizers, production of nitrogen-fixing crops, cultivation of high organic content soils, and the application of livestock manure to croplands and pasture (Government of Alberta, 2004). (Group 14, 2009)
- Consumption of processed foods accounts for 16% of the total energy used in the food system (Heller & Keoleian, 2002). 25% of all calories produced for human consumption are thrown away, and less than 3% of food waste is composted and used as fertilizer (Heller & Keoleian, 2002). Landfilled waste contributes huge amounts of carbon dioxide and methane. (Group 12, 2009)
- Neff, Chan and Clegg Smith (2008) followed climate change-related articles in 16 large American newspapers and found that only 2.4% named the food system as a contributor to GHG emissions. Of these, only one-fifth discussed food systems in any detail. This study shows that there is unmet need for public education. (Group 12, 2009)

DEFINING CARBON SMART

Based on the literature review each group developed a definition of "Carbon Smart" to inform their recommendations for a Carbon Smart Food Guide.

- "For the purposes of (the public) education materials, we have defined a 'carbon friendly diet' as "a healthy diet that focuses on reducing carbon emissions. This includes the processes by which the food is produced, transported, processed, consumed and disposed." (Group 12, 2009)

- "'Carbon smart' is defined as making choices that reduce the amount of GHG emissions, which, in turn, contribute to a lower environmental impact. With regards to the food system, being carbon smart means making personal food choices that contribute to less GHG emissions." (Group 11, 2009)
- "Carbon-smart food is "food that contributes to the minimization of GHG emissions when taking into account its methods of production, processing and distribution from field to table." (Group 15, 2009)
- "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." (Group 13, 2009)
- "To be carbon smart means to be able to recognize how our choices may contribute to enhance or reduce current environmental problems. The goal of being carbon smart is to make educated lifestyle choices in order to lessen GHG emissions." (Group 14, 2009)

Discussion of Literature Review of Carbon Smart Food Guide Categories

The following lists the groups' findings and summarizes their conculsions about the identified food categories for the Carbon Smart food guide, Label and Website.

Eating Lower on the Food Chain.

- A food chain involves primary producers, herbivores, carnivores, omnivores, and decomposers with each level consuming the previous for fuel. As energy is being passed through each stage of the food chain, there is less of it available at every stage because energy is used for purposes such as breathing and digesting. This concept is explained by the ecological pyramid, which shows that only 10% or less of energy is transferred from one food chain level to the next (Arcytech, 2000). A food system with more carnivores/omnivores requires much larger plant based feed because of energy losses throughout the chain (Li *et al.*, 2006). In our system, two-thirds of all produced grains are now used to feed livestock, not humans (FAO, 2006). (Group 12, 2009)
- *Conclusion:* Humans are omnivores and therefore have a choice between eating animals and eating plants. By choosing to eat foods that are lower in the food chain, we obtain energy more directly and efficiently, and at the same time reduce GHG emission. (Group 12, 2009)

Red Meat

- The world's livestock generates more GHG emissions than our worldwide transportation industry (Pollan, 2008). The production of a pound of beef requires an equivalent of 16 pounds of grain (Gershon, 2006). Therefore, production and consumption of meat and animal products accelerate environmental damage. (Group 15, 2009)
- **Emissions:** Among the animal-based products, red meat including cows, sheep and goats and dairy are the highest contributors to GHGs. Reducing consumption of these products would have a greater impact on reducing GHG than reducing one's food miles and buying local (Webber & Matthews, 2008). (Group 11, 2009)
- In "*Livestock's Long Shadow: Environmental Issues and Options"* the FAO reported that livestock is responsible for 18% of GHG emissions which is a bigger share than that of transport (Steinfield et al., 2006). Another report stated that it contributes 4.6 to 7.1 billion tons of GHG per year or 15-24% of total GHG emissions (Reijnders & Soret, 2006). (Group 11, 2009)
- Livestock contributes to 9% of carbon dioxide emissions, 37% of methane emissions and 65% of nitrous oxide emissions (Steinfield et al., 2006). (Group 11, 2009)
- Red meat is 150% more carbon intensive than chicken or fish (Weber, 2008). Having one meatless day a week can have the same climate impact as solely buying local foods (Weber & Mathews, 2008). (Group 12, 2009)
- Livestock consumes more food than it yields. On average, it takes 10 grams of plant protein such as soybean to generate 1 gram of animal protein such as beef (Reijnders & Soret, 2006).

It is known that 80% of the world's soybean crop and more than 50% of all corn is fed to the global livestock population (Koneswaran & Nierenberg, 2008). (Group 11, 2009)

- The manure and gas from cattle are the most significant source of GHG emissions from livestock by-products. Cows produce 9% of human-induced carbon dioxide, 37% of all human-induced methane, and 64% of ammonia, which is tied to acid rain (Environment Canada, 2006). They also generate 65% of human-induced nitrous oxide emissions (Environment Canada, 2006). Run-off from improperly managed manure at factory farms can leach into the water supply, causing extreme loss of oxygen in rivers and streams which is detrimental to fish and other species populations (Oliver, 2008). (Group 12, 2009)
  - o *Conclusion:* Decreased emissions are associated with decreasing large scale raising of animals, and instead raising small numbers on diverse farms and consuming meat less frequently. (Group 13, 2009)
- **Feeding Method:** Most cattle today are grain-fed because grain-fed cattle grow faster and are more cost-effective resulting in less expensive meat (Walsh, 2005). A cow's digestive system is not meant to digest grain, and eating grain causes them to release an excess of gaseous compounds such as methane and carbon dioxide, two potent GHG (Walsh, 2005). (Group 12, 2009)
- Industrially grown grain limits biodiversity, depletes soils and often involves the use of pesticides. Artificial nitrogen fertilizer is produced through an energy-consuming process that uses great quantities of natural gas and produces huge amounts of CO_2 and N_2O. Tractors, slicers, and harvesters use diesel for energy and contribute to GHG emissions. Transporting feed to livestock incurs large energy costs and further increases GHG emissions (FAO, 2006). (Group 12, 2009)
- Alternatively, grass-feeding cattle can lead to increased deforestation which affects biodiversity and can leads to erosion and flooding (Stock & Rochen, 1998). (Group 12, 2009)
  - o *Conclusion:* If meat consumption is necessary, local, organic and grass-fed cattle may be a better choice as it emits 40% less GHG and consume 85% less energy than conventionally produced beef (Koneswaran & Nierenberg, 2008). (Group 11, 2009)
- **Land Use:** On a global basis, the 56 billion land animals being reared for human consumption occupy 30% of the earth's entire land surface (FAO, 2008; Steinfield et al., 2006). (Group 11, 2009)
- Livestock destroys biologically sensitive terrain. 70% of the former Amazon forest has been cleared for livestock grazing which leads to emission of 2.4 billion metric tons of CO_2 annually as a result of deforestation (Steinfield et al., 2006). Livestock also causes land degradation problems which are difficult to reverse. Pastures and rangeland soil loss in the United States is around 6 tons/ha/y whereas sustainable rate of soil loss is 1 ton/ha/y. The current rate of soil loss due to livestock is unsustainable considering that it takes about 500 years to regenerate 1 inch of soil (Pimentel & Pimentel, 2003). (Group 11, 2009)
  - o *Conclusion:* To have less negative impact on the environment, we could choose to eat meat from grass-fed cattle, eat less red meat overall, or just stop eating meat. (Group 12, 2009)
- **Poultry and Eggs:** These products produce 150% less GHG emissions than red meat (Weber & Matthews, 2008). (Group 11, 2009)
  - o *Conclusion:* If one must consume animal products, the best choice is to choose poultry and eggs products more often than red meat. (Group 11, 2009)
- **Seafood:** Choosing local fish means it is fresher, seasonal and does not have to be transported long distances. Method of transport must also be considered. (Group 11, 2009)
- Fish farms are another major contributor to carbon emissions and are damaging to the natural environment. The emissions come from farm operations, the fish themselves and from the large amount of fish feed that is used (Tyedmers et al., 2005). Fish feed contributes 90% of the farmed salmon's carbon footprint (Tyedmers et al., 2005). (Group 11, 2000)
- Smaller fish species such as sardines, herring and other low trophic seafood such as clam and mussel are considered to be low carbon due to their fishing and farming methods. They generally do not require as great of an input from fossil fuels (Circle of Responsibility, 2007) (Group 11, 2009). Additionally, they require less feed to grow and mature and they tend to

reproduce more quickly than large fish. Another bonus is there is less chance of mercury accumulation in small fish (Nestle, 2002) (Group 13, 2009).

- Many fish poulations are over fished and threatened. Over the last centuries, commercial fisheries have depleted the fish population with 52% of fish being fully exploited, 16% being over exploited and 7% being depleted (Seachoice, 2009). (Group 11, 2009)
    - *Conclusion:* Eat less seafood. If you must consume seafood, eat further down the food chain including shellfish and non-carnivorous fish.

Vegetarian Diets

- **Emissions**: Plant-based foods contribute relatively little to GHG production when compared to animal-based foods such as red meat, dairy, eggs, seafood and poultry. It takes 10 times more fossil fuel to create 1 gram of animal protein when compared to 1 gram of plant protein such as beans and grains (Pimental et al., 2004). A person consuming a typical animal-based diet (70% plant based, 30% animal based) generates about 1.5 metric tonnes of CO_2 more per person per year than on an equivalent 100% plant based diet. This is equivalent to switching from a SUV to a compact car (Eshel & Martin, 2006). (Group 11, 2009)
- **Energy Consumption**: Plants require less energy input in production. A unit calorie of beef production requires 33% more energy than plant production (Nierenberg, 2005). (Group 15, 2009)
- **Water**: Vegetarian diets use 300 gallons of water per day versus meat based diets which use 4,200 gallons daily for an animal-based diet (Worldwatch Institute, 2004). Overall, a vegetarian or a vegetable-centered diet is more ecologically friendly than an omnivore's diet (Wallace, 2008). (Group 15, 2009)
    - *Conclusion:* Consumers should increase the number of vegetarian meals consumed on a regular basis for increased human and environmental health benefits. (Group 13, 2009)

Processed Foods

- Processed foods include food that is pre-packaged, frozen, canned or modified into products. (Group 11, 2009)
- The greater the amount of modification, the greater the contribution to GHG emissions. The production phase of food contributes 83% of the US household CO_2 emissions from food (Weber & Matthews, 2008). (Group 11, 2009)
- Increasing processing generally increases transportation miles as processing steps are often performed in separate locations (Weber & Matthews, 2008). (Group 11, 2009)
    - *Consclusion:* Reduce consumption of processed food products to reduce their carbon foot print. (Group 11, 2009)

Carbon Smart Lifestyle

- Buying food with the intent of minimizing waste has a positive impact on reducing GHGs. (Group 11, 2009)
- Composting and recycling have a positive impact on carbon emissions (Composting Counsel of Canada, 2009). (Group 11, 2009)
- Choosing to walk, bike or use public transport reduces carbon emissions (Pascal & Walter, 2006). (Group 11, 2009)

Transportation, Food Miles & Local Foods

- The average North American meal "travels 2400 km to get from field to plate and contains ingredients from 5 countries in addition to our own" (David Suzuki Foundation, 2009; FarmFolk/CityFolk, 2008).
- There is some disagreement over the food system GHG emissions generated by transportation with one report stating that transportation accounts for 11% of food generated GHG emissions (Weber & Matthews, 2008) and another study showing that "transporting what we eat accounts for 80% of the U.S. food system's GHG emissions" (Eilperin, 2008). (Group 11, 2009)
- The "average American's eating habits account for 2.8 tons of carbon dioxide emissions each year, compared with the 2.2 tons of carbon dioxide the same person generates by driving" (Tyedmers et al., 2005). (Group 11, 2009)

- **Transport Method**: The method of transportation of food and food incredients differ in the amount of carbon emissions they emit. (Group 11, 2009)
- The most energy efficient mode of transportation is by water (consumes 423 KJ/tonne-km), then rail (consumes 677 KJ/tonne-km), then road (consumes 2890 KJ/tonne-km) and finally be aircraft (consumes 15,839 KJ/tonne-km) (Lang & Heasman, 2004). (Group 11, 2009)
- Per kilometer, airfreight contributes 6-fold more CO_2 emissions than road, 30-fold more than rail, and 40-fold more than water (Lang & Heasman, 2004) (Group 12, 2009). Even though only 1% of food is transported by air it accounts for 11% of all food transport carbon emissions (Garnett, 2008). Aircrafts emit directly into the atmosphere and therefore cause greater damage (Zhou & Griffiths, 2008). (Group 11, 2009)
- In trucking 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. In plane transport, 1 kg of CO_2 will be emitted for every 2.2 km traveled (liters of fuel unknown) (Time for change, 2007). (Group 13, 2009)
- **Local:** A quarter of the transported goods are foods (Get Local, 2008) (Group 15, 2009). Locally grown fruits, vegetables and grains alleviate the reliance on long distance transport and the need for refrigeration and therefore contribute less to climate change (Weber & Matthews, 2008) (Group 11, 2009).
- The Canadian Food Inspection Agency considers a food "local" if the item's origin is within 50 kilometres of where it's sold (FarmFolk/CityFolk, 2008). The 100-Mile Diet Society uses a 100 mile radius, which is more realistic for the city of Vancouver (100 Mile Diet Society, n.d.). (Group 12, 2009)
- Studies have shown that the average household could reduce GHG emissions by a quarter of a tonne if they replaced enough imported foods with those locally grown (FarmFolk/CityFolk, 2008). Each Canadian produces about 5 tonnes of greenhouse gas emissions per year so this switch would only reduce personal carbon emission by 5% (Seeds, 2006). (Group 12, 2009)
- In North America over the last 20 years there has been a tripling of agricultural imports and exports (Get Local, 2008). Purchasing an apple from New Zealand contributes to 87% higher GHG emissions than buying a locally grown apple (Get Local, 2008). (Group 15, 2009)
  - *Conclusion:* Choosing locally produced foods can cut down on transportation emissions. Food flown by air (i.e. perishables produced in other countries) should never be chosen.
- **Supporting Local Farming:** This can help decrease emissions because local farms are more likely to be environmentally responsible as they are usually smaller and have more incentive to be environmentally responsible than large scale farms, because they will personally suffer the consequences of any harm they do to the environment (Harrington, 2008). (Group 12, 2009)
- Local foods also support local farmers, producers and the economy (Get Local, 2008) (Group 11, 2009) and create more job opportunities (Group 15, 2009).
  - *Conclusion:* Eating locally produced foods supports the local economy and helps build food sovereignty in the region.
- **Nutritional Benefits:** Nutrients are lost when foods travel a long distance (Tychie and Lee, 2007) (Group 15, 2009) meaning more nutrients are retained by local foods compared to conventional foods that can be in transit for days or weeks (Silva, 2007). (Group 13, 2009)
- **Packaging:** Local foods require minimal processing and packaging. Conversely, most imported foods need to be processed immediately following their harvest to prepare for long distance transportation. This involves the use of materials in packaging, chemicals in preservation, as well as energy in refrigeration, all of which lead to more carbon emissions. Packaging is a major source of pollution in our environment (Robertson, 2006). (Group 13, 2009)
- **In-Season Foods:** Local doesn't always mean carbon-friendly. People expect food to be available year-round and have several options for purchasing out-of-season foods. (Group 12, 2009)
  - Transported from other countries
  - Grown in local greenhouses
  - Stored in local cold storage

- Buying local is not necessarily the most carbon-friendly choice because greenhouses and cold storage are energy-intensive practices. Imported foods can be less carbon-costly. For example, in-season UK apples are less GHG-intensive than imports but, when apples are not in season, apples shipped from the southern hemisphere emit less carbon than the UK apples maintained in cold storage (Garnett, 2008). Another study found that importing Spanish tomatoes to the UK resulted in fewer GHG emissions than those locally grown in greenhouses (Garnett, 2008). (Group 12, 2009)
- In-season foods require less processing, packaging, storage and fewer preservatives, all of which require fossil fuels and contribute to carbon emissions. (Group 12, 2009)
  - *Conclusion:* Eating seasonally reduces GHG emissions.

Organic Foods

- **Goal of Organic**: Organic agriculture is based on reducing or eliminating reliance on external inputs such as fertilizer, pesticide and irrigation and keeping waste outputs to a minimum (Group 12, 2009). Certified Organic (CO) plants are grown without the use of synthetic pesticides and fertilizers, and animals are raised without the use of antibiotics and growth hormones (Jones, 2001) (Group 15, 2009).
- 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). (Group 13, 2009)
- A change from conventional chemical-based agriculture to organic agriculture reduces energy requirements by 25-50% (FAO, 2009). (Group 12, 2009)
  - *Conclusion:* Organic food production produces less GHG emissions than conventional methods of production.
- **Carbon Sequestration:** Increased soil organic matter has huge carbon sequestration potential (FAO, 2009). It is estimated if 10,000 medium-sized U.S. farms converted to organic production, they would sequester the equivalent carbon to removing 1,174,400 cars from the road, or reducing car miles by 14.62 billion miles (Sayre, 2003). (Group 12, 2009)
- In organic agriculture, crop rotation is one of the main tools to control soil fertility. A good cropping system allows for a rebuilding phase to restore soil fertility and build organic matter (Bellarby, 2008). A huge amount of carbon is sequestered from the atmosphere when soil is allowed to restore in this manner (FAO, 2009). (Group 12, 2009)
- Reduced tillage (the disruption of the ground to ready the soil for seeding) increases carbon sequestration and requires less herbicides and fertilizers (FAO, 2009) .(Group 12, 2009)
  - *Conclusion:* Organic farming techniques are capable of sequestering more carbon than conventional techniques.
- **Reduced Input & Waste:** Organic agriculture requires up to 32% less fossil fuel energy input, reduced chemical fertilizer inputs and reuses farm waste products (Pimental et al, 2005). (Group 15, 2009)
- 10% of all GHG emissions come from the agriculture sector and 24% of agricultural GHG emissions came from fertilizer use (Agriculture and Agri-Food Canada, 2009). Production and application of synthetic fertilizers in conventional farming methods especially contribute to the release Nitrous Oxide (NO) which has 310 times the global warming potential as CO_2 (Agriculture and Agri-Food Canada, 2009). (Group 13, 2009)
- In organic agriculture, soil fertility is achieved through using composted crop wastes and animal manures (Altieri, Ponti, and Nicholls, 2005). This minimizes both external inputs and waste outputs of the system. Recycling manure vastly reduces emission of methane, nitrous oxide and ammonia, which occur when manure is discarded (Badgley et al, 2007). (Group 12, 2009)
- Conventional agriculture relies heavily on monoculture. This reduces soil fertility and can encourage a build up of pests, diseases and weeds in the soil (Bellarby, 2008). In turn, this requires pesticides and synthetic nitrogen fertilizers to maintain high yields (Meleca, 2008). Pesticides are used at great environmental cost, adding 300 - 600 million tonnes CO_2 per year or between 0.6 - 1.2% of the world's total GHGs (Bellarby, 2008). Many organic farmers are

using integrated pest management (IPM) to replace the role of pesticides in conventional agriculture. (Group 12, 2009)

- As the diversity of a system decreases, the risk that a pest or disease will spread throughout an agricultural plant or animal base increases (Meleca, 2008). Diversity in a field significantly reduces the farmer's need for fertilizers and pesticides. (Group 12, 2009)
- Selecting varieties and breeds fit for local conditions minimizes input needs, and can improve yields in both conventional and organic systems. (Group 12, 2009)
- **Nutritional Benefits:** Organic food produce is denser in concentration for most micronutrients, including vitamins A, C, E and the B group, and minerals such as zinc and calcium and fibre (Pollan, 2008). Therefore, consuming smaller quantities of food is enough to meet the optimal nutrition requirement (Pimental et al, 2005). (Group 15, 2009)
- **Drawbacks:** "In terms of the amount of potential human food, the conventional system exceeds the organic system by 41%" (Stagl, 2002). Organic farming has a higher dollar cost of production due to the lower yields (Aldrich, 1977) which leads to higher costs to consumers. 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) (Group 13, 2009). These arguments do not consider the long term sustainability of environmental resources such as topsoil fertility and GHG emissions contributing to climate change.
- 'Big organic' farms that use the same large-scale farming techniques as conventional farms and ship their products over long distances do not necessarily have the same benefits as small scale organic agriculture (Time, 2007). Traveling long distances implies the food products will require further packaging and refrigeration (Silva, 2007). (Group 13, 2009)
    - *Conclusion:* Generally, consumers should choose organic when possible keeping in mind that some organic farms are more carbon smart than others. (Group 13, 2009)
    - *Conclusion:* Organic food is considered to be carbon smart because it does not require artificial fertilizers, growth promoting drugs or routine antibiotics. It does not require energy intensive machinery and technology to produce, it maintains biological soil activity and it ensures sustainability and minimizes GHG emissions. (Group 11, 2009)

Reduce Waste

- Food waste leads to emission of methane gas from decomposition of food (Love Food Hate Waste, 2009). By reducing food waste, GHG emissions can be decreased by up to 15 million tonnes of carbon dioxide equivalents per year (6 Wrap, 2009). (Group 11, 2009)
- **Landfills:** Organic waste in landfills is eventually decomposed by bacteria found naturally in the waste and surrounding soil. Bacterial decomposition contributes heavily to landfill gas which includes a mixture of many different gases, mostly methane and carbon dioxide (Crawford & Smith, 1985). In 2000, worldwide landfills of municipal solid waste generated over 730 million metric tons of CO_2 equivalents which is equal to 12% of total global methane emissions (Oliver, 2007). This number is expected to escalate by 9% from 2005 to 2020 due to an increasing rate of organic waste deposits (United States Environmental Protection Agency, 2006). (Group 12, 2009)
- **Food Waste:** About half of the produce throughout the world ends up being discarded along the food supply chain. Additionally, one in four food purchases end up in the trash (David Suzuki Foundation, 2009). (Group 12, 2009)
- Discarded food generates CO_2 in unnecessary vehicle trips to purchase the food, processing of the food and in its decomposition (David Suzuki Foundation, 2009). (Group 14, 2009)
    - *Conclusion:* To avoid this cause of food waste, we recommend shopping with a list to avoid impulse buying and bringing Tupperware to pack up leftovers at restaurants. (Group 12, 2009)
- **Shopping bags:** In the United States, 100 billion plastic shopping bags are produced each year. Plastic bag production is an energy-intensive process requiring a large amount of fossil fuel. Paper bags are not a suitable replacement for plastic as they take four times more energy to produce and ten times more energy to recycle than a plastic bag (Ableman et al., 2008). (Group 12, 2009)
    - *Conclusion:* Use a reusable cloth bag to carry home groceries. (Group 12, 2009)

- **Recycling and composting:** Landfill waste generates 1.5 lb of GHG emissions compared to 0.5 lb for recycled waste (Harrington, 2008). Composting also produces some GHG emissions due to bacterial activity, but still represents GHG emission savings especially when used as a replacement for synthetic fertilizers. (Group 12, 2009)
    - *Conclusion*: Recycle and compost whenever possible.
- **Processed Foods**: Food processing is a way to "add value" to foods to make products more appealing to consumers (Nestle, 2002). The lengthening of the food supply chain consumes energy and contributes to greenhouse gas emissions in many ways; refrigeration, packaging, thermal processing, food additives, machinery, and transportation are all dependent on fossil fuels (Church, 2005). (Group 12, 2009)
- **Transportation and food processing**: In food processing, raw materials are often gathered from many different sources and shipped in many different stages of production (Church, 2005). (Group 12, 2009)
- **Refrigeration**: Refrigeration has become more necessary as the food supply chain lengthens and includes more transportation and storage stages. Many foods require temperature-control at every stage in the supply chain. The energy required to operate this equipment is enormous and some of the gases used as refrigerants have global warming potentials that are thousands of times greater than CO_2 (Garnett, 2008). (Group 12, 2009)
- **Packaging**: Materials such as delivery boxes, metal cans, printed-paper labels, plastic trays, cellophane, glass jars, plastic and metal lids are heavily relied on to protectively package and preserve food (Church, 2005). Packaging is often not or cannot be recycled (The Strategy Unit, 2008). (Group 12, 2009)
    - *Conclusion*: Choosing minimally processed foods and buying in bulk can help to reduce the carbon emissions associated with the transportation, refrigeration, and packaging involved in the production of many foods (Group 12, 2009). When choosing packaged products, it is best to choose products packaged using recycled materials (Rodale Institute, 2003). (Group 14, 2009)

Personal Transportation

- Canada's largest source of GHG gas is transportation (Environment Canada, 2005; Natural Resources Canada, n.d.). In 2006, Transport Canada (2007a) estimated 18.5 million personal vehicles were on the roads in Canada which collectively drove approximately 300 billion kilometres. The GHG emissions from these personal vehicles have grown by 10% since 1990, despite a significant increase in fuel efficiency, which indicates that people are driving more often (Transport Canada, 2007a; Transport Canada, 2007b). (Group 12, 2009)
- In Vancouver grocery stores are very accessible by foot (Metro Vancouver, 2007). For those living in areas where walking or biking is not possible, public transportation is a preferable mode of transportation. When using a personal vehicle, it is important to make fewer trips, keep tires inflated and drive below 100 km/hour on the highway to help reduce emissions (Environment Canada, 2005). (Group 12, 2009)
    - *Conclusion:* To reduce emissions, walk, bike or use public transportation to get to the grocery store.

Drink water from the tap

- 1.5 million tons of plastic are produced each year for bottled water which requires large amounts of fossil fuel energy for manufacturing and transportation (WWF, 2001). (Group 14, 2009)
    - *Conclusion:* To decrease the amount of waste and CO_2 emissions, we recommend consumers to drink water from the tap instead of purchasing bottled water from the supermarket. (Group 14, 2009)

KEY RECOMMENDATIONS- SCENARIO 3B:

Each group designed a Carbon Smart Food Guide, website and label. These were presented to the UBC Center for Sustainable Food Systems (CSFS) at UBC Farm who in turn shared these findings with the 100-Mile Diet Society. Below is a list of guiding principles that supported the creation of these recommended as well as some of the main ideas found in these educational materials.

All groups recommended that the style and content themes of the Carbon Smart Food Guide, label and website be consistent to promote consumer recognition of the education materials.

CARBON SMART FOOD GUIDE

Objective

- To educate the general public on how to identify low-impact, carbon smart foods. (Group 11, 2009)
- The guide should aim to clear up and ease the confusion involving climate friendly food choices. (Group 11, 2009)
- The audience includes people who are already interested in carbon-smart foods, but would like more information and people who might not know about carbon-smart food, but who after reading the food guide would be better educated and hopefully motivated to make carbon smart food choices. (Group 15, 2009)

Style

- Information on the guide should be concise, easy to read and simple. (Group 11, 2009)
- The guide should be colorful and attractive. (Group 11, 2009)
- The guide should be interactive to help with knowledge retention. (Group 11, 2009)
- The aesthetics of the food guide could incorporate pictures of foods that can be locally bought and produced in Vancouver to help give people an idea of availability and may motivate them to make local choices. (Group 15, 2000)

Content

- The guide should contain more than just basic information. (Group 12, 2009)
- The guide should include lifestyle tips that help consumers reduce their own GHG emissions. (Group 11, 2009)
- Key phrases should be highlighted- eg "Save the planet, eat a Carbon Smart diet" and "Six Steps to a Carbon Friendly Diet" to spark interest. (Group 12, 2009)
- The messages should match the website so consumers that choose to further explore the topic will be familiar with the format. (Group 12, 2009)

Specific Designs

- Design 1: The carbon smart food guide that consists of two 8" circle parts (one double-sided and one single-sided) divided into six categories including: Fruits, Vegetable and Grain; Legumes, Nuts and Seeds; Seafood; Poultry and Eggs; Red Meat and Dairy; Processed Foods. The circles are perforated in the centre and bound by a metal pin. The nature of the circle design demands a special offset printing and has to be die-cut to shape. The stock of the paper has to be quite heavy for the wheel to operate effectively. Vancouver Sharp Imaging (sharpimaging.com) quoted $10,460.00 for 5000 copies of our food guide on 100lb MOHAWK OPTIONS SMOOTH COVER (100% Post consumer, Processed Chlorine Free FSC Certified Green Seal Certified Made with wind-generated electricity FSC Certification which ensures responsible use of forest resources). This works out to be $2.09 per food guide. (Group 11, 2009)
- Design 2: A tri-folded, 8.5 x 11" pamphlet for ease of production, distribution and use. To limit our own carbon footprint, this pamphlet can be printed on recycled paper and will be fully recyclable (Group 12, 2009). The brochure can be easily handed out anywhere and can be taken home and kept as an easily accessible reference. It could be a good tool to spark attention without overloading the reader with too much information. The cost of printing 5000 full color, tri-fold brochures at Staples was $4000, with folding included for an additional $100 and FedEx Kinkos was $3248, at $0.65 per sheet (Group 15, 2009).
- In general, Vancouver companies estimated that printing with recycled paper can cost up to 10% more than regular paper (Group 14, 2009).

CARBON SMART FOOD LABEL

Objective

- The main objective of the food label is to indicate to consumers that certain food choices produce low GHG emissions and contribute to a lower environmental impact when compared with other food choices (Group 11, 2009).

Style

- Simple with sufficient information (Group 11, 2009).

Specific Designs

- Design 1: The label includes the words 'carbon smart' written across the top with a reduced-CO_2 symbol right underneath it. The environment is included in the label in the form of a leaf that rests against the edge of the label. The overall, green color scheme pops against the white background (Group 11, 2009).
- Design 2: The sign is approximately 4"x 6" and should be posted on or near sale items. Signs will be laminated and farm staff will use washable markers to check off the criteria that apply to the product (Group 12, 2009).
- Design 3: The label is approximately half the size of a standard letter paper, 7.5 inches by 4.5inches, and would be large enough to be seen from a distance. The colour scheme includes two basic colours, red and green, to invoke patriotism, localism and nature/plant life. The message of P.L.O.W. is conveyed and a check list of qualities that will satisfy the Carbon Smart Food definition - plants, local, organic and whole – which are vital components in reducing GHG emissions (Group 15, 2009).

WEBSITE

- The Webpage should be connected to both the UBC Farm website and the 100 Mile Diet Society site. Potentially the site could be housed on one of these websites.

Objective

- The Carbon Smart website provides detailed information on the definition of carbon smart, the impact of carbon smart food on the environment, and several tips on how to be carbon smart (Group 11, 2009).

Style

- Casual English language should be used on the website so consumers can easily understand its content (Group 11, 2009).
- The online publication would essentially be an electronic version of the carbon smart food guide. It should be divided into sections that can be navigated by clicking on the corresponding tabs. (Group 14, 2009)
- The website should elaborate on the brochure by providing more in-depth information about carbon emissions for interested individuals (Group 12, 2009). The information on the website should be collected from credible sources- scientific journals and other credible websites (Group 11, 2009).

Content

- *Homepage- C*ontains the logo and the definition of carbon smart foods (Group 11, 2009).
- *Search Engine*- enables people to search for related information (Group 12, 2009).
- *Food and Climate Change* page- contains explanations on why consumers should choose carbon smart food in terms of its GHG contribution to the environment (Group 11, 2009).
- *Carbon Calculator*- allows visitors to calculate their carbon emissions (Group 12, 2009).
- *Evaluating Carbon Smart Foods page*- consumers can choose between the categories to find detailed information about certain foods. Additionally, the pages contain current research findings of that particular category and simple tips to be carbon smart in choosing food (Group 11, 2009).
- *Local and Seasonal Foods page*- contains information on how to eat locally and seasonally. This page should contain the "Foodshed Map" from 100 Miles Diet Society which illustrates the availability of local food around Greater Vancouver Areas (Group 11, 2009). Food availability

charts can illustrate which foods are fresh and abundant during a particular month (Group 15, 2009).

- *Organic Foods page*- explains the importance of organic farming and provides various methods on how to increase consumption of organic foods. (Group 11, 2009).
- *Processed Food page*- explains why processed foods are harmful to the environment due to high GHG emissions and various ways to avoid such items are provided (Group 11, 2009).
- *Carbon Smart Lifestyle*- explains how lifestyle can support the reduction of GHG emissions (Group 11, 2009).
- *Carbon Smart Recipes*- pages contain recipes for each season of the year based on locally grown foods. (Group 11, 2009).
- *Interactive game*- to stimulate the interest of consumers and browsers, called "Guess the Greenhouse Gas Emissions!" The design of this interactive game is vivid and colorful. The background is a farm, featuring various fruits, vegetables, and livestock. When players click on one of the items, the GHG emissions of the local version of the food and the conventional or imported version will appear. Upon comparing and contrasting local versus imported foods, we hope that consumers will be more conscious of the dramatic differences in GHG emissions (Group 15, 2009).
- *Discussion forum*- gives browsers a place to discuss their experiences, share carbon saving tips, creative recipes, and nutrition concerns with other individuals who share the similar vision of creating a low carbon community (Group 15, 2009).
- *Useful Links*- to the local farmers markets within BC (Group 15, 2009), the UBC Farm, the 100-Mile Diet and the David Suzuki website (Group 12, 2009).
- *About Us*-. Bief introduction to the UBC Farm and 100 Mile Diet along with their websites should be available (Group 11, 2009).

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SCENARIO 4: PRACTICING URBAN AGRICULTURE RIGHT HERE: INTEGRATING THE LFS GARDEN WITH THE FACULTY OF LAND & FOOD SYSTEMS COMMUNITY

Community Partners: LFS Orchard Garden
AGSC 450 Groups: Scenario 4A-16, 17, 18: Scenario 4B- 19, 20, Fence 2

BACKGROUND:

The Land and Food Systems (LFS) Orchard Garden is roughly 400 square meter urban demonstration garden dotted with surviving apple trees from the UBC Campus Orchard located on the South side of the MacMillan Building. The vision of the student-driven initiative is to provide food to the LFS community via Agora Café and the AgUS, to create opportunities for experiential learning and to further enhance campus' contribution to small scale/urban sustainable food production and regional food security.

OBJECTIVES:

Since its conception, the overall vision for this garden has expanded to become a micro-scale demonstration garden of a localized food system. In scenarios 4A and 4B students were asked to work on making the LFS Orchard Garden better serve as a site to connect community to land and food systems.

History of the Garden:

All groups researched the history of the LFS Orchard Garden. A summary of their findings follow:

- In the early history of UBC the garden space was part of a larger orchard and some of its original fruit trees remain (Group Fence 2, 2009).
- In 2006/2007 temporary buildings were removed from part of the area where the garden now stands. A mixture of compost and sand was used to replace the soil in that area. (Group 18, 2009)
- In 2007, the Landscape Architecture program (LARC) began the LFS Garden as a demonstration site for urban and organic agriculture. The project was designed to address the three tiers of sustainability: economical, social, and environmental. The layout was planned by LARC and an agroecology student, Lin Steedman. Through donations from Friends of the Farm and the UBC Farm a variety of herbs and vegetables have been planted in the south garden including tomatoes, zucchini, cucumbers, squash, lettuce, basil and cover crops (Group 20, 2009). The soil was reported as sandy and slightly acidic with a pH of 5.8. Steedman subsequently added phosphorus and potassium to improve soil quality (Group 16, 2009).
- In 2007, an AGSC 350 group expanded the LFS Garden (south) to the west side of the MacMillan Building (Group 20, 2009) with the goal of supporting local and sustainable agriculture and providing a teaching and learning space for LFS courses. The garden was developed through the combined efforts of the 2008 AGSC 450 Scenario 5, directed studies projects, and dedicated faculty, staff and volunteers. It was given the name "LFS Orchard Garden" in honour of the pre-existing heritage apple orchard. (Group 19, 2009)
- In 2008, AGSC 450 students conducted research on compost, crop rotations, funding, urban agriculture, as well as connections and integration with the UBC Farm's Centre for Sustainable Food Systems and Agora Café. Efforts were made to secure volunteers and staff to run the garden for the 2008 season which led to the hiring of Jian Hui Cheng as garden manager in June 2008 (Group 20, 2009).
- In 2008, Hui Cheng (Personal communication, 2009) planted broccoli, squash, kale, flowers, garlic, carrots, beets, bush beans, cover crops and a variety of herbs, with variable success-potatoes and kale crops were the most successful. Produce from the garden was sold to Agora, AgUS, Sprouts, LFS Community Dinner, and independently. Total sales from the garden amounted to nearly $800.00. Additionally, mulched paths were added and over-wintering garlic was planted. (Group- 19 & Fence 2, 2009)
- In 2008, A "Garden Committee" formed through the collaboration of students, faculty, and staff, who have interests in maintaining the garden. (Group 20, 2009)
- In 2009, AGSC 450 Scenario 4 worked to design and build a fence and an on-site composting system as well as working to enhance student-learning opportunities in and around the garden. (Group Fence 2, 2009)

Specific Objectives- Scenario 4A:

The groups were instructed to conduct a review of resources, to determine the successes and challenges of the 2008 year, to develop a renewed business proposal and propose community connections and educational opportunities for the LFS Orchard Garden for the 2009 production year (UBCFSP 2009).

Key Findings- Scenario 4A:

Agricultural Management

Soil

- The native soil in the LFS Orchard Garden is considered a Bose soil. The soil is naturally acidic and the stony, coarse structure with low clay content results in low cation exchange capacity (CEC) and poor water holding capacity (B.C., MoE, 1981). Generally, Bose soils are not ideal for agricultural use and require active management to increase suitability for crop growth. Retaining soil moisture and building soil stability is an issue for management in the LFS Orchard Garden as it has been at the UBC Farm, which shares the same soil profile. This soil profile is consistent throughout Vancouver, allowing soil management in the LFS Orchard Garden to be extrapolated to community and backyard gardens throughout the city. (Group 18, 2009)
- In February 2008 and March 2009 soil samples were taken by AGSC 450 students and analyzed by Pacific Soil Analysis Inc. These soil tests have included separate samples for native and non-native areas of the garden.
- Results of the February, 2008 soil test (Group 18, 2009):
  - Organic Matter (OM) content was approximately 10%, which is considered sufficient.
  - The native soil had a carbon/nitrogen (C/N) ratio of 17.7. C/N values less than 20 probably mineralize nitrogen on decomposition, making it available for uptake by plants. (Bomke, 2009)
  - The non-native showed a higher C/N ratio indicating nitrogen deficient. Inadequate nitrogen was confirmed by testing the potato tissue cultures from the modest yield of potatoes which showed signs of a deficiency.
  - Magnesium (Mg) was also low and Potassium (K) was considered adequate in the non-native but low in the native soil.
- To address the low levels of Mg and K the whole garden was fertilized with Langbinite, a sul-pho-mag granular fertilizer (N-P_2O_5-K_2O-MgO). To increase available of mineralized N, a winter cover crop of Hairy Vetch and Fall Rye were planted to be incorporated into the soil this spring. (Group 18, 2009)
- Results of the March, 2009 soil test (Group 18, 2009)
  - pH decreased slightly but remains within an acceptable range (5.4-6.6)
  - The C/N ratio is increasing and total N levels have not improved. Note-it is difficult to assess available N at this time of year as soil microbes have yet to mineralize N that is present in the soil and the Hairy Vetch will not be incorporated until May.
  - Boron (an essential plant nutrient) is low at 0.3 ppm.
  - Mg and K are low and require some amendments.

Irrigation

- The irrigation system of LFS garden is inadequate as there is no permanent water supply to the garden. A mobile overhead sprinkler is the primary source of irrigation (Group 18, 2009).
- The following is a list of potential irrigation systems explored (Group 18, 2009):
  - Drip irrigation system consists of thin hoses laid next to plants and water slowly trickles from pores in the hoses (Cramer et. al, 2006). Each plant has different water requirements at different irrigation frequencies. Ideally, drip irrigation could be used to cater to summer crops such as broccoli without affecting adjacent areas. However, when crop rotation practices are employed, the permanence of drip irrigation may pose a problem (Hui-Chieng, personal communication, 2009).
  - Multi-sprinkler systems use increased water-pressure which is not available at MacMillan Building according to Jurgen Pehlke, MacMillan's Operations Manager (Pehlke, 2009).
  - A trench water line could be installed from the nearest permanent source of water located at an out-of-service outdoor tap on the south-side of MacMillan Building (Pehlke, personal communication, 2009). The line would terminate at a faucet near the garden from which water can be distributed to other points in the garden. This system eliminates the need for hoses and would be a permanent and reliable water source. Pehlke has requested that UBC Plant Operations work to fix the south-side tap.
  - Recycled rain water system consists of an underground water reservoir which would be constructed at the upper end of the garden using gravity to deliver the water (Hui-Chieng personal communication, 2009). Water would be stored during the rainy season and used throughout the growing season to irrigate the garden. This is an energy efficient and sustainable system.

Pests

- The LFS Orchard Garden does not have a strategy for pest management. Based on soil samples from 2008, wireworms are present in the garden with higher population levels around the edges of the garden. Observations from the nearby LFS Garden (south) indicate that aphids may also become a pest of concern. (Group 18, 2009)
- Integrated Pest Management (IPM) is a preventative practice to stop pests from becoming a problem in the garden. Planned crop rotations can create habitats for both beneficial species and pests. By carefully monitoring crops, pest populations can be kept at acceptable levels (NAIS, 2001). IPM strategies developed for and used by the LFS Orchard Garden can serve as a "living laboratory" for UBC students and home gardeners in the community to demonstrate strategies for monitoring and managing pests. (Group 18, 2009)
- Monitoring and maintaining detailed, accurate, and current records of the garden is essential to a good pest management plan. These records should include current pest problems, management strategies and their results (Flint & Gouveia, 2001). (Group 18, 2009)

Waste

- A compost system is ideal for sustainably managing waste from the garden and MacMillan Building. Compost benefits the soil by fostering the slow and steady release of nutrients, providing a wide range of micro-nutrients, and increasing the soil's water-retention capacity (Composting Council of Canada, 2006). Compostable food and waste from Agora, the AgUS, staff and students could also contribute the compost and help complete the MacMillan food system. The compost furthers the LFS Orchard Garden's potential as a "living laboratory" and an educational tool for LFS students and community members. (Group 18, 2009)

Production/Harvesting

- In the 2008 growing season, crop selection and varieties for the LFS Orchard Garden were chosen for their suitability for a late season (September to November) harvest and ability to over-winter (Hui-Cheng, personal communication, 2009) (Group 18, 2009). The majority of the crops were successful. The garlic and kale held well over winter.
- The winter squash (Delicata and Early Butternut) and beets did not produce well. It is recommended that winter squash be started and transplanted by May (Forstbauer, personal communication, 2009). The poor yield of beets may have been due to the non-native soil which gave poor yields of other crops. In the upcoming season there will be a final planting of crops in the non-native soil to determine if it has any growing potential. The over-wintering crops also had difficulty growing due to snow. It is recommended that broccoli be attempted in 2009 to add to harvestable produce in the spring (Hui-Cheng, personal communication, 2009). (Group 18, 2009)
- In 2009 growing season potatoes are being seeded for an early summer harvest. This will hopefully yield large enough quantities to sell potatoes at the UBC Farm's Saturday Markets in the summer as the UBC Farm has been unable to grow potatoes due to the high levels of wireworms in their soil. (Group 18, 2009)
- A production plan goal is to improve crop yield through better space management. The original production plan included rotating crops that had been planted in 2008, with small changes to varieties within crop families (Hui-Cheng, personal Communication, 2009). The Agora Café now has a summer student position which will allow the opportunity to plant more mid-season crop varieties for Agora's use through food preservation and storage. (Group 18, 2009)
- A comprehensive production guide was developed with input from the Agora Café, the AgUS, and Sprouts and previous production manuals. The manual includes crop type, planting season, harvesting season and recommendations, and preservation techniques. (Group 18, 2009)
- A blank Production Data Sheet was created to record planting dates, harvesting data, and other information. (Group 18, 2009)

Distribution

- Agora, the UBC Farm, Sprouts and the AgUS are the purchasers of LFS Garden crops. Potatoes were sold at the UBC Farm's Saturday market and kale and broccoli were sold and/or used for cooking at Sprouts, Agora Cafe, and by the AgUS. In November 2008, LFS Garden kale, carrots and beets were featured at the annual LFS Community Dinner. (Group 18, 2009)

- The distribution system is informal due to the small scale of the garden (Hui-Cheng, personal communication, 2009) (Group 18, 2009).

GARDEN MANAGEMENT

- The LFS Orchard Garden Committee is comprised of LFS community partners who support and oversee the management of the garden (Group 17, 2009).
- Challenges to the garden management plan include communication and organization amongst stakeholders and garden workers and a potentially high turnover rate of garden managers due to the nature of university student scheduling (Group 17, 2009).
- Development of a website for the LFS Orchard Garden would be a major asset in the organization and fluid functioning of the garden. The City Farmer website can be used as a prototype for the LFS Orchard Garden website. The site will serve as an outreach tool to engage the university community and help increase awareness of the space. The site can contain information regarding garden management and volunteer job descriptions, applications for paid or volunteer opportunities, garden management information, planting and harvesting schedules, a time-line that contains grant deadlines and hiring times, garden history and vision statement, events, contacts, "How to" information and links to other sites like the UBC Farm (Group 17, 2009).
- The garden has functioned with only one paid worker up to this point but more paid positions are necessary to help the garden reach its full potential. A structured management team and garden committee is essential to the future of the garden as these organizations oversee maintenance and provide legitimacy to the garden. (Group 17, 2009)
- A garden management plan was developed and includes a management plan timeline, details of who is responsible for production, harvesting, distribution activities, community outreach, and general maintenance (Group 17, 2009).
- Currently, there is no active Sustainability Coordinator for the LFS program. A new Sustainability Coordinator could participate in the Garden Committee (Swada, personal communication, 2009). (Group 17, 2009)

RESOURCES AND BUDGET

Current Resources

- **Physical Resources**: a wheelbarrow, two shovels, a vineyard hoe, a diamond shovel hoe, a slim draw hoe, two Rubbermaid totes, a garden hose, two overhead sprinklers, a brass 4-way hose splitter, a rake, and a carrot fork (Hui Cheng, personal communication, 2009). (Group 17, 2009)
- **Human Resources:** LFS Orchard Garden committee members and stakeholders, UBC faculty and staff and AGSC 450 groups. (Group 17, 2009)

Needed Resources

- **Physical Resources:** another wheelbarrow, hoes, more garden hoses, and more Rubbermaid totes (Hui Cheng, personal communication, 2009). (Group 17, 2009)
- Garden tools should be purchased new, as donated tools are often poor quality and break easily (Bomford, personal communication, 2009). (Group 17, 2009)
- **Human Resources:** Two Garden Coordinators, Volunteer Labour (Hui-Cheng, personal communication, 2009). (Group 17, 2009)
- A Garden Coordinator is needed to provide steady year-round management of the garden and a hiring system needs to be developed to ensure the entire year is covered.
- A second Garden Coordinator would help alleviate the burden of managing the gardens and would allow the two coordinators to focus on different aspects of the garden.
- Volunteer labor is needed. Another Garden Coordinator would provide much of the labor needed for maintaining the garden but additional labor is needed to accommodate the

growth and expansion of the garden. Volunteer labor is ideal as there are no costs to the garden and it provides an opportunity to educate new gardeners.

Budget

- A budget was developed based on the associated costs of the garden. This budget was used to apply for potential grants. Potential profits made from the garden could not be incorporated into the budget because garden production and sales were too unpredictable. (Group 17, 2009)
- The UBC Farm relies on grants and donations to cover wages for staff and any teaching, research or community services. Income from market sales does not cover all costs. (Group 17, 2009)
- Funding is required to obtain resources for materials, including plants, tools, and soil testing and will help pay for the garden coordinator position as well as student work/study programs. Methods to secure funds for the garden included searching for applicable external and internal grants, and working through the application process. (Group 17, 2009)
- Mark Bomford, the UBC Farm Coordinator, recommends that the LFS Orchard Garden and the UBC Farm apply together for internal and external funding to decrease competition. Bomford committed to identifying funding opportunities as they arise and assisting in preparations for proposals students may find (personal communication, 2009). (Group 17, 2009)
- Potential funding opportunities include (Group 17, 2009):
  - Grad Class Council Gift (GCCG) through the AMS.
  - The Innovative Project Fund (IPF)- can provide between $3,000-$5,000 for up to 3 years. New applications must be submitted each year with a 12 month progress report of how the funds were spent in order to renew funding.
  - The new summer work/study program could be available for students this year (Sawada, personal communication). To qualify the students must be enrolled in 6 credits over the summer or paying full time fees as a graduate student. UBCCS will pay $9.00 an hour and the faculty is responsible for providing enough to make the wage at least $12.00/hr. The student is allowed to work a maximum of 10 hours per week and can earn up to $3,000 for the summer (UBC Career Services).
  - A new SEEDS funding program is starting in the near future with $15,000 available for projects relating to sustainability (Sawada, personal communication).

EDUCATION AND COMMUNITY OUTREACH

- "Gardening serves a wide range of needs and benefits on many levels, including psychological, emotional, social, and spiritual" (Kidd et al., 2002). (Group 16, 2009)
- The California Healthy Cities and Communities (CHCC) initiative demonstrated how a community garden program could facilitate knowledge and community improvements ranging from knowledge and skill enhancement to behavioral and systems change. For instance, the city of West Hollywood "complemented its school gardening program with nutrition and physical activity education" (Twiss et al., 2003). This resulted in an "increase (in) weekly physical activity sessions from 4.9 to 5.2 times per week and (an) increase (in) consumption of fruits and vegetables from 3.44 to 3.78 servings per day (;) among 338 students participating in gardening and educational workshops" (Twiss et al., 2003). (Group 16, 2009)

Potential Education Initiatives

- There are plans to incorporate the LFS Orchard Garden more heavily in the LFS curriculum especially in the AGSC 250 Community Food Security Assessment Project (Rojas, Personal Communications, 2009). (Group 16, 2009)
- Courses that have the potential to incorporate the LFS Orchard Garden as part of the curriculum are identified in a list and have been handed over to the LFS Garden Coordinator. (Group 16, 2009)
- Various secondary schools and educational programs near the Point Grey area may be interested in being involved with the LFS Garden. One example is Windermere Secondary

School which already has its own very successful school garden but views this as a learning opportunity. (Group 16, 2009)

- The Intergenerational Landed Learning Project (ILLP) is an educational program for children aged 8-10 to learn about farming and food-production with teachers and retired local farmers. This program could be used as a model or extended to the LFS Orchard Garden. There is excess demand for the ILLP indicating the potential for the program to be extended to the LFS Orchard Garden. Some challenges to establishing connections and outreach opportunities between the ILLP and the LFS Orchard Garden include the need for further development of the garden before educational activities can take place and the difficulty in securing funding for the educational program (Friedman, personal communication). (Group 16, 2009)
- A LFS Orchard Garden website can expand the garden's network to a wider Vancouver community via the internet. (Group 16, 2009)

Signage

- Clear, visible signs identifying the garden, its vision statement, and the crops grown are needed for community education and to build a sense of stewardship towards the garden (Riseman, personal communication, 2009). (Group 16, 2009)

KEY RECOMMENDATIONS- SCENARIO 4A:

TO THE LFS ORCHARD GARDEN COORDINATOR(S):

Production and Harvest plan:

- Expand upon the production guide.
- Observe and record the growth of the plants in the current soil based on our soil analysis report. (Group 16, 2009)
- Focus on maximizing yields of current crops, rather than increasing crop variety. As the garden expands, more crops such as fruits, flowers, and fungi can be added into rotation. (Group 16, 2009)
- Continue the relationship with Agora Café, the AgUS, Sprouts, and the UBC Farm. Effective communication and cooperation will ensure continual and reliable supply of produce to its users and maximize food production in the space. (Group 16, 2009)
- Determine what crops the garden can grow to fill niches not occupied by the UBC farm. (Group 17, 2009)

Distribution plan:

- Consider growing specifically for the needs of Agora, AgUS, Sprouts and the UBC Farm. (Group 16 & 17, 2009)
- Strengthen buyer-seller relationship with Agora Cafe by building communication with Agora Coordinator (Group 17, 2009) and establish a distribution plan for Agora and AgUS (Group 16, 2009).

Garden Management Plan:

- Ideal Management Scenario- Garden Manager/Coordinator with job duration March-October and an hourly wage of 15$/hour. This position would be supported by an Orchard Garden Directed Studies Student who could switch in each of the three semester terms as would be determined by directed studies students and advising professor. (Group 17, 2009)
- Ideal future Management Scenario as the garden expands - Garden Manager/Coordinator as above. The Outreach Manager would support the coordinator and have a job duration of March- October and an undetermined hourly wage. This position would be responsible for education outreach coordinator, community involvement, website/blog maintenance (including photo and event updates), and communication. (Group 17, 2009)

Agricultural Management plan:

- Soil amendment recommendations:
  - Apply another application of Langbinite to the whole garden- doubling the application for the native soil due to its low proportion of potassium (K) and

magnesium(Mg). Calculate the quantity of the application and record this information in the soil management log. (Group 18, 2009)
  - Apply 0.12kg Boron to the whole garden in two separate applications, after the potatoes have been planted. Calculate the quantity of the application and record this information in the soil management log. (Group 18, 2009)
  - Apply a fish emulsion to the rows of potatoes before they are `hilled up` to make up for the current nitrogen deficiency. This is not a sustainable input. Future managers should work to increase N content so that external inputs are not needed on a yearly basis (Bomke, 2009). (Group 18, 2009)
  - The Boron, Langbinite and fish emulsion amendments are to be acquired from the UBC Farm manager, Tim Carter, at no cost.
- Maintain the soil organic mater content at about 10%. (Group 18, 2009)
- Monitor the soil at the LFS Orchard Garden site. Carry out appropriate tests annually or on a regular basis to be able to adjust the soil for its agricultural purposes and to acquire long-term data that can compare chemical indicators of productivity with management practices. Soil sampling must be done according to standard protocol for consistency (Group 18, 2009).
- Maintain the "Soil Management Log" including all soil tests, amendments and pertinent management information. This log should be used as a record by the current and all future LFS Orchard Garden managers. (Group 18, 2009)
- Maintain the "Integrated Pest Management Log" sheet. This sheet will record what species of pests are present in the garden, important information about their history and behavior and the pest management strategies. (Group 18, 2009)
- Monitor the wireworm population size through soil tests and visual observations of the soil after practices such as tilling or turning up the soil (BC MoF, 2007). (Group 18, 2009)
- Use recycled rainwater to irrigate the garden. A small underground water reservoir could be constructed at the upper end of the garden (Chieng, 2009) using the gravity from the garden's natural slope to deliver the water. Water can be stored during the rainy season and used throughout the growing season to irrigate the garden. (Group 18, 2009)
- Coordinate with the Climate@UBC Project, spearheaded by professors Andy Black and Andreas Christan, to install microclimate sensors into the LFS Orchard Garden which would stream to a monitor in Agora. This will provide students with a source of interactive learning; data from this program could be used to assess indicators like soil temperature, moisture, wind, precipitation and radiation (Black & Christan, 2008). It would be desirable to track this information along with any amendments and management practices carried out so that proxies could be developed to improve the effectiveness of management practices. (Group 18,2009)

Resources:
- Establish a website for communication with the public, for enhanced communication of garden management, and for data and information storage.
- Establish a volunteering program to ensure a study source of labour. The future website can be used to gain public interest in the garden. (Group 17, 2009)

Waste management:
- Maintain the three bin composting system. Careful management of the implemented compost system should yield an organic matter source with the correct ratios of carbon to nitrogen. (Group 18, 2009)

Budget:
- Obtain additional financing for the garden, continue garden maintenance. (Group 16, 2009)
- Hire a summer work/study program student to help with garden work over the summer. (Group 17, 2009)

RECOMMENDATIONS FOR THE GARDEN COMMITTEE:

- Increase communication among the members to ensure the maintenance of the garden. This may include meeting more frequently (3-4 meetings/semester) and helping develop an LFS Garden website as an additional means of communication. (Group 17, 2009)

- Develop a communal and detailed vision statement for the garden with a clear layout of levels of management within the committee and an organizational chart with contact information. (Group 17, 2009)
- Ensure all LFS faculty programs, including FNH representatives, are represented in the committee. (Group 17, 2009)

TO THE FACULTY OF LAND AND FOOD SYSTEMS

Educational opportunities

- Use the LFS Orchard Garden as an educational tool in Faculty of Land and Food Systems courses (Group 17, 2008; Group 16, 2009). Use the garden for directed studies research projects and hands on learning opportunities in Agricultural Science (AGSC), Agroecology (AGRO), Food, Nutrition and Health (FNH), Soil Science (SOIL), and Food Resource Economics (FRE) courses. (Group 16, 2009)
- Use the garden in collaborative studies with other faculties such as Education, Engineering, Arts, Biology, Forestry, and Environmental Studies. (Group 16, 2009)

TO THE AGRICULTURAL SCIENCE UNDERGRADUATE SOCIETY (AGUS)

Community outreach:

- Continue collaboration with the LFS Orchard Garden through events such as the Wednesday Night BBQs, an annual Fall Harvest Festival, and garden Work Parties to help maintain and promote the garden through community involvement and education. (Group 16, 2009)
- Consider using the garden as a venue for Imagine UBC to welcome first year LFS students to the faculty. (Group 16, 2009)

SPECIFIC OBJECTIVES- SCENARIO 4B:

Groups were instructed to consult with community partners in the design of an enclosure (fence) for the LFS Orchard Garden.

CENTRAL FINDINGS-SCENARIO 4B:

DESIGN PROCESS:

Eric Villagomez from the Landscape Architecture Department was the project head. He provided an overview of the diverse aspects of design theory, specifications and execution. Each of 3 groups developed a design of an enclosure that incorporated input from stakeholders including LFS faculty members, Campus and Community Planning, and UBC Plant Operations. The groups presented the individual plans to various groups of stakeholders, including the Scenario 4A AGSC 450 groups, to further include their input regarding the practical, social and ecological aspects of the space. Finally, the plans were integrated to include the best ideas from each of the 3 groups into one plan (Group 19, 2009). On the last day of class the groups helped flag the site where the fence would be installed (Group- Fence 2, 2009).

DESIGN CONSIDERATIONS:

The following are a list of design considerations identified by the groups and research to support their findings.

Ecological Functions

- The fence should benefit its surroundings in as many ways as possible, and conversely have as little negative impact as possible. (Group 20, 2009)
- **Pest control**- Enhancing diversity of an agro-ecosystem increases sustainability by creating balance. Integrating plants into the fence creates habitat and potential niches for various

communities. This forces pest species to compete with beneficial organisms and potentially detrimental communities are prevented from multiplying to economically damaging levels. The fruit and berries of these plants could also help sustain the local bird population which may control insect pests (Gliessman 2007). Other plants produce root exudates which may inhibit garden pests such as marigolds which when planted densely may significantly reduce plant parasitic nematode populations (Ploeg 1999). (Group 19, 2009)

- **Pollination**- The apple trellis and other flowering plants will help attract bees and syrphid flies as pollinators of the garden (Hanna, 2002). (Group 20, 2009)
- **Reduction of Pollution**- The enclosure can function as a hedgerow. This would reduce pollution entering the garden and lessen environmental factors such as wind. (Group 19, 2009)
- **Erosion/Run-off**- Water and nutrient scavenging plants such as perennial grasses planted around the perimeter of the garden could limit erosion and runoff which is important as the garden is located on a slope. (Group 19, 2009)
- A trellis system can protect the garden against wind and offer a place for climbing plants to grow. Incorporating bark mulch underneath the trellis will also attract beneficial beetles to the garden (Hanna, 2002). (Group 20, 2009)
- **Carbon Sink-** Planting the perimeter of the garden can increase the ability of the garden to act as a carbon sink depending on the plant species and management practices. (Group 19, 2009)

Educational Functions

- There is room for development of the garden to fulfill many educational roles as both an informal and formal learning space. The fence has the ability to be used as a teaching tool for many subjects including Soil, Plant, Wine, Nutrition, Food Production and Community Building. For example, trellising apple trees would provide students with the opportunity to get hands on experience with the cultivation, care, harvest and food preservation. The garden's proximity to the MacMillan building increases its value as a teaching tool. The growing space also has ties to the UBC Farm and can serve to connect LFS students to the UBC Farm. The fence can be a visual demonstration of the LFS faculty values and commitment to land, food and community. (Group 19, 2009)

Logistical Concerns

The following is a list of factors taken into account when designing the fence.

- Upkeep of plants- When choosing plants their maintenance must be considered. (Group 19, 2009)
- Aesthetics and year round appearance of the fence- Many flowering plants lose their leaves in the fall and winter which is when the space will be seen most. (Group 19, 2009)
- Shading concerns- The fence and plants growing on it can create too much shade in the garden and inhibit growth. (Group 19, 2009)

Infrastructure in the Garden

- The mulched paths are semi-permanent so entrances were designed around them (Hui Cheng personal communication). (Group 19, 2009)
- Compost bins were designed in consultation with AGSC 450 Scenario 4A Group 18. The three-bin-compost system was designed to the Metro Vancouver compost bin construction manual (2002) specifications. Garden Manager, Jian Hui Cheng helped direct the location of the bins which provides Agora access to dump compost while also providing garden workers access to the compost (Personal Communication, 2009). (Group 19, 2009)
- Covered benches can provide a social aspect to the garden. (Group 19, 2009)
- Cold frames will add another microclimate good for starting seeds and extending the growing season of the garden. Placing the cold frames close to the compost piles may be beneficial as the compost produces heat. (Group 19, 2009)

Connecting to LFS Community

The fence is to participate in the food production that already occurs in the garden. The following is a list of plant varieties that groups have planned for the space and that could be useful to the Agora Café or the AgUS.

- Blueberries- for Agora in salads, baked goods, or frozen in smoothies. (Group 19, 2009)

- Herbs- for Agora soups, quiches and lunches and the AgUS Wednesday night barbeques. (Group 19 & 20, 2009)
- Apples- Agora and AgUS- baking and to be sold individually at Agora where fresh fruit is often sold at an affordable price. (Group 20, 2009)
- Grapes- Agora and AgUS meals (Group 20, 2009). Grape trellises can be used for the FNH Wine Science Laboratory as a visual learning aid (Group 20, 2009).

Barriers

- Many crops ripen in the summer when students are not on campus. Therefore finding sufficient volunteers to harvest and preserve the crops is very difficult (Group 19, 2009).
- This challenge will be partially mitigated by the recent hiring of an Agora summer student who can help organize the harvesting of the gardens and fence crops (Group 19, 2009).

FINAL DESIGN:

Eric Villagomez used SketchUP to create the final amalgamation of the fence (Group 19, 2009). The following are descriptions of various aspects of the final fence design as described by the groups.

- The fence gains in height steadily as it moves down the slope with the highest wall blocking out the parking lot creating a sense of intimacy in the space (Group 19, 2009).
- Split cedar and branches will be used for a rustic look (Group 19, 2009).
- Posts and wire fences will be used to support fruit production and birdhouses will be placed atop fence poles. (Group Fence 2, 2009)
- A trellis structure was chosen to border the main entrances at the northeast and southeast corners of the garden. (Group 20, 2009)
- The east side of the garden will feature an alternating bench and planter design. This was chosen because the majority of students tend to congregate here. The row of planters and benches will also be detached and pushed out slightly from the garden allowing people to sit on either side of the bench while preventing plants from being trampled. People will be able to enter from either the northeast or southeast corner of the garden. A layer of bark mulch will be spread between the benches/planters and the garden to provide a finished look and to define the space as a walking area. Similar to the eastern edge, the trellis system along the west of the garden will also be detached allowing both corners to be entry points to the garden. (Group 20, 2009)
- Other seating areas will use corner spaces and have overhead structures supporting plants. (Group Fence 2, 2009)
- The apple tree trellis was chosen for the south side of the garden as the foliage of the espalier style is less dense than that of the grape trellis chosen for the north side, which will allow the sun to shine into the garden. (Group 20, 2009)
- The three bin compost unit has been included in the design and will be placed on the western side of the main entrance for accessibility reasons. (Group 20, 2009)

KEY RECOMMENDATIONS- SCENARIO 4B:

TO THE LFS GARDEN COORDINATOR(S):

- Plant the post, wire edges, overhead arbour, and planted boxes. The recommendations that follow should be well researched:
  - Low Blueberries- in planters on south edge (Group 19, 2009)
  - Grapevines- on trellis on the north edge (Group 20, 2009)
  - Dwarf apple trees- Post and wire edges on northwest edge (Group Fence 2 & 20, 2009)
  - Kiwifruit- Overhead arbour on Northeast edge (Group Fence 2 & 20, 2009)
  - Raspberries or pollinator gardens - for the planters on southeast edge (Group Fence 2, 2009)
  - Climbing Squash (Group 19 & 20, 2009)
  - Heather (Group 19 & 20, 2009)
  - Clematis vines (Group 19, 2009)

  - Herbs (Group 19, 2009)
- Use of signs to identify individual crops as well as to explain concepts such as composting and mulching. Signs could also be used to help people identify the types of birds and bees that are working in the garden and what their roles are. (Group Fence 2, 2009)

TO THE FACULTY OF LAND AND FOOD SYSTEMS:

- Classes should use production edges as educational tools. Seminars can be designed to explain the specifics of production including planting, pruning, harvesting and preserving of products. (Group Fence 2, 2009)

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SCENARIO 5: INVESTIGATING THE SUSTAINABILITY OF SPROUTS

Community Partners: Sprouts Natural Food Co-op
AGSC 450 Groups: 26, 27

BACKGROUND INFORMATION:

Sprouts Natural Food Co-op is a volunteer run food buying co-op and café located in the basement of the Student Union Building (SUB) at UBC. Sprouts aims to serve ethical, responsible and sustainable foods at affordable prices to the campus community.

OBJECTIVES:

Students were instructed to conduct a sustainability assessment of Sprouts in terms of its social, economic and environmental impacts on the UBC community. The assessment was to include an inventory of its food sources (including place of production), food options, criteria used to select items, budget, waste management practices, etc. (UBCFSP VI, 2009). The results of the project included a food procurement analysis of the "Strategic Voting Stew" and a social sustainability assessment.

CENTRAL FINDINGS:

CURRENT PRACTICES AT SPROUTS

- Sprouts serves about 50 bowls of soups a day. Any soup not sold is taken home by the volunteers, minimizing waste production at Sprouts (Taylor, 2009). (Group 26, 2009)
- **Suppliers-** According to the Sprouts Store Coordinator, Jeremy Taylor (personal communication, 2009), Sprouts orders from three suppliers: Discovery Organics in Vancouver, Pro Organics in Burnaby, and Horizon Distributors in Burnaby. (Group 26, 2009)
- Depending on the season, Sprouts receives up to 20% of their grocery store saleable vegetables from the UBC Farm and they sporadically receive produce from the LFS Orchard Garden. (Group 26, 2009)
- Sprouts aims to use and sell the most local foods possible. 15-20% of their produce comes from outside of BC mainly due to cost. (Group 26, 2009)
- Specifics on Items: lentils and beans come from North America; black beans are not used since they are exclusively cultivated in China; spices are obtained from Dan-D Market, in Vancouver, or in bulk; most juices are obtained from BC; organic tea comes from Oregon- some is fair trade; fair trade coffee is from Mexico; the milk is Avalon and is sold in glass bottles with a refund given for the return of the bottles. (Group 26, 2009)
- **Transportation-** Trucks are the main source of transportation with each food provider delivering once a week. (Group 26, 2009)
- **Storage-** Sprouts has access to a large fridge with a small freezer that they share with the catering crew. Since space is not guaranteed, they do not rely on freezing anything. (Group 26, 2009)
- Baked goods usually last for a week and are stored in reusable Tupperware containers. Soups are stored in metal trays that are wrapped in plastic and stored in the AMS fridge (Newson, 2009). (Group 26, 2009)
- **Processing & Packaging-** Cooking and baking occurs three times a week. No chemicals or other processing techniques are used in the café. It is estimated that 768 feet of plastic wrap is used by Sprouts every semester to cover the soups trays. (Group 26, 2009)
- **Waste Propagation-** Sprouts does not offer to-go containers. No plastic cutlery is provided. Most dishes come from thrift stores or donated by the UBC pottery club. Paper towels are provided. (Group 26, 2009)
- **Waste Disposal-** Inside the café, there are garbage, composting, and recycling bins.
- Cardboard boxes are compacted, wrapped, and taken off campus by UBC Waste Management (UBC Waste Management, 2009). (Group 26, 2009)

- Old produce that cannot be sold is used in cooking and baking, and in the rare case that the produce spoils, it will be composted at the UBC In-Vessel Composting Facility on South Campus (UBC Waste Management, 2009). The compost is used for university landscapes. (Group 26, 2009)
- **Cleaning-** Most of the kitchen utensils are cleaned by the sanitizer shared with AMS, while a few items including knives are washed by hand (Newson, 2009). (Group 26, 2009)
- **Economic Sustainability-** In general, sales at Sprouts generate enough profit to cover the limited expenses of the establishment. There are no overhead costs (no rent, no labor costs). (Group 26, 2009)
- The grocery store component of Sprouts provides 25% of their profit from 20% mark up of most goods; the café makes up 50% of the profit; and the catering component of Sprouts sporadically makes up 25% of their profit. (Group 26, 2009)

THE SPROUTS 'STRATEGIC VOTING STEW'

- Sprouts makes a variety of soups and does not repeat recipes. The ingredients for soups are generally purchased from the same suppliers. Therefore, the following look at Sprouts' 'Strategic Voting Stew' from October 2008 will give a good idea of the ecological sustainability of the soups produced at Sprouts. (Group 26, 2009)
- All ingredients were purchased from Discovery Organics and came from exclusively organic farms with the exception of UBC farm, which is not certified. Discovery Organics is a retail wholesaler with the focus of supplying organic products grown in small, local farms. The farms that work with Discovery Organics are all carefully chosen based on their commitment to produce the best food products possible in the most sustainable way. (Group 26, 2009)
- The following is a list of the distances that each of the soup's ingredient traveled from farm to Sprouts (food miles). The overall food miles required to make this soup are very low.

Strategic Voting Stew – October 2008 (Group 26, 2009)

Butternut Squash	Cliffe Farms, Armstrong, BC	455 km
Yukon Gold Potatoes	Across the Creek Farm, Pemberton, BC	161 km
Parsnips	Similkameen River Farm, Cawston, BC	351 km
Beets	Myers Farm, Aldergrove, BC	34 km
Carrots	Destiny Lane, Cawston, BC	351 km
Turnips	Bhumi Farm, Ashcroft, BC	337 km
Eggplant	UBC Farm	2 km
Spices	Various origins	
Distances to Sprouts		
Discovery Organics		16.4 km

SOCIAL SUSTAINABILITY ASSESSMENT OF SPROUTS

Group 27 did a social sustainability assessment of Sprouts to better understand the strengths and weaknesses of the social and structural aspects of the organization are. The following are the results of their findings:

Definition of Social Sustainability

The group defined social sustainability as having 4 parameters to be evaluated including (Group 27, 2009):

- **The Size** – of the organization and its members affects the interactions within the organization and with the community.
- **The Society –** of customers and volunteers consists of a community of diverse people with a shared vision. It should provide a sense of belonging, support, and enthusiasm to it's members, and encourage positive social interactions**.**

- **The Stability –** of the organization is indicated by its ability to withstand competition from other businesses, to maintain the commitment of its volunteers, and to establish a consistent customer base.
- **The Satisfaction** – of workers and customers is important to ensure sufficient human resources and to guarantee their loyalty.

Volunteer Survey
12 of the 28 volunteers were surveyed over the course of a week regarding their volunteer experience at Sprouts. The results of the survey follow (Group 27, 2009):

- 10 volunteers expressed concerns when asked whether they were interested in joining the executive team next year.
- 83% of respondents were concerned about the amount of time required of them to volunteer at Sprouts. 50% of respondents worked at Sprouts for '5+' hours a week.
- A total of 85% ranked Sprouts as a high priority among their other commitments.
- 75% of the respondents believe Sprouts needs more volunteer training and 42% felt executive volunteers need more training.
- The survey suggests that the initial volunteer motivation of respondents was for 'socialization' and to support the community and to help others. This motivation seemed to shift for respondees during the course of volunteering to a desire to see and help Sprouts prosper and a feeling of commitment to the organization.
- The majority of respondents thought their volunteer job was challenging and interesting and felt that their work had made a unique and valuable difference to the people in the community.
- New and less committed volunteers show less enthusiasm towards volunteering reportedly stemming from difficulty in finding support and a desire to be treated with more patience and compassion from their senior workers. Senior volunteers who devoted an average of 5+ hours show higher satisfaction overall.

Customer Survey
36 Sprouts customers from various faculties were asked to participate in a survey regarding their experience at Sprouts. Responses were collected on a voluntary basis over the span of 7 days. The results are as follows (Group 27, 2009):

- 89% of survey participants generally spend less than $5 dollars per visit.
- 90% of respondents are most satisfied with the reasonable/fair prices of the foods.
- Respondents come to Sprouts for other reasons as well. Data indicates 78% of the participants like Sprouts' harmonious atmosphere and pleasant ambience.
- 83% of respondents reported ordering soup and 81% reported ordering baked goods.
- 75% of participants rated local food as one of the top reasons they visit Sprouts.
- Many of the participants responded that they are completely satisfied with Sprouts for its overall quality in service and food, and all but one survey participants indicated that they would recommend Sprouts to others.
- 61 % of the customers indicated that they were least satisfied with Sprouts' confined space. 44% of the customers addressed that they would appreciate a wider variety of food products. 22% of the customers find the waiting time for the foods longer than expected.
- 22% of respondents indicated that service quality can be improved if their "inquiries were routed to the appropriate person" and workers "respond in a professional manner".

Size

- The size of a volunteer-based organisation is defined not only by the number of its members, but also its resources to meet the demands of its customers and its initiatives. Survey results demonstrate a potential divide between what customers want and what Sprouts can provide with regards to size. According to customer surveys, the main reasons for dissatisfaction are limited seating, lack of variety in the menu and insufficient soup to meet consumer demand. However, Sprouts President Gunst states that Sprouts is currently operating at full capacity, making more profit than necessary and neither needs nor can support expansion due to limited physical space and volunteer resources. Additionally, Sprouts is certified to produce limited hot items. The production of items such as sandwiches would require additional certification of premises and training of volunteers which Sprouts cannot currently administer (Gunst, personal communication, 2009). Consumer disappointment could hinder the satisfaction parameter of social sustainability. (Group 27, 2009)

- Despite customer desire for Sprouts to grow larger, Sprouts has grown significantly over the past year which has affected the society parameter of social sustainability. Increasing the size of an establishment can affect the other aspects of social sustainability. When food co-ops, such as the East End Food Co-op located in Vancouver, flourish there is a tendency to increase in size requiring greater professionalism and organizational tactics such as middle management (Chaland, 2001). In most instances, these changes are resisted by members, affecting the society, satisfaction and stability parameters of social sustainability (Group 27, 2009).

Society

- One of the missions of Sprouts is to create a society with diverse members and a sense of belonging which would foster community within the university. Gunst states that there has been a decline in familiarity between volunteers and customers as the popularity of Sprouts has increased (personal communication, 2009). This observation is supported by results of the volunteer survey as 40% reported that Sprouts is having challenges 'coping with the changing demographic of volunteers' as turnover has increased. This decline in positive social networking and loss of community endangers the satisfaction parameter of both volunteers and customers. (Group 27, 2009).

Stability

- Sprouts provides a unique service on campus and is thus relatively unaffected by other food outlets or competitors. (Group 27, 2009)
- Unlike other food co-ops, the community members of Sprouts are constantly changing as students graduate and leave the community. The stability of Sprouts might be threatened as there is a lack of consistency in its volunteer base. (Group 27, 2009)
- For a successful volunteer program, it is necessary to conduct marketing campaigns to reach potential volunteers (USDA, 2009). Although volunteer positions and job descriptions are advertised on the Sprouts website, this reaches a small demographic. Sprouts' lacks a formal marketing and wider spread recruitment program. (Group 27, 2009)
- Currently, Sprouts is considered a club, and does not pay rent. Sprouts status as a club is questionable as it is acting as a food provider and is in direct competition with the Alma Mater Society's food businesses. If club status is taken away from Sprouts it will have to increase in size to generate enough profits to pay rent and thus it would be necessary to address its current barriers to *size* in order to be sustainable. (Group 27, 2009)

Satisfaction

- Survey findings indicate that both customer and volunteer satisfaction is generally being achieved. (Group 27, 2009)

RECOMMENDATIONS

TO SPROUTS NATURAL FOOD CO-OP AND CAFÉ:

Social Sustainability

- **Reassessment of Goals and Organization practices-** In order for Sprouts to become more socially sustainable it is recommended that an assessment of Sprout's goals and values be done and the results compared to current practices. The recommended methodology for such an evaluation could consist of the following:
    - Large team meeting of executives and other stakeholders to review the formal and informal values and goals of Sprouts and to rank these goals in order of importance.
    - Next consider if the ranked goals and values are aligned with the current practices of the establishment. How are they aligned and what are the gaps? Where the gaps lie- with your most important values and goals or lower ones?

  - Finally, evaluate what can be done to address the gaps. What can be done (added or eliminated) to adjust current practices to better reflect goals and values?
- "Ultimately, organizations that are volunteer run must keep in mind that while the enthusiasm of one leader can push these organizations forward, it is the dedication of many that will keep them running in the long term. These organizations need to be kept at a scale that is conducive to this, a size that keeps the workers involved and gives them a sense of ownership over the organizations, and one that can foster a social community, as we have seen that "meeting others/socialization" was a strong motivator for Sprouts' volunteers." (Group 27, 2009)
- Agora Café is currently in the process of scaling back in an attempt at improved social sustainability for their management (Vanessa Perrodou, personal communication, 2009). Benefits include (Group 27, 2009):
  - Smaller work and time commitment could entice more volunteers to join the organization and its executive coordinator positions.
  - Managers will experience less stress and sense of overwhelm.
  - Managerial positions may appear less intimidating to potential candidates and would be easier to balance with a full course load.
- Each Sprouts coordinator/executive should take an assistant who could share the workload of the position and be trained for the full position the following year. An expected barrier to this recommendation is finding students to commit to their position for 2 years (Group 27, 2009). It may be beneficial to follow the Agora Café model.
- Consider a volunteer mentorship program between experienced and new volunteers. This would help train new volunteers and make them feel more welcomed at Sprouts.
- Create a formal recruitment plan with a timeline and list of specific avenues for recruiting volunteers. Recruitment promotion should be geared towards the common motivations for the volunteers (contribution to community, sustainability, etc.). The task of recruiting future volunteers and management should be included in the job description of the executives and coordinators (Group 27, 2009). Plan could include: Advertising in the AMS Student Planner, advertising within Sprouts, advertising with posters throughout the SUB and other faculties across campus, such as the Sauder School of Business.
- Market Sprouts to recruit a more varied customer and volunteer base. Marketing would help Sprouts reach its goal of promoting sustainable and fair-trade food to more UBC students as well. (Group 27, 2009)

Environmental Sustainability

- Use environmentally friendly cleaning supplies, like lemon juice, vinegar, baking soda. (Group 26, 2009)
- Purchase more environmentally friendly kitchen supplies with the AMS Food and Beverage Department. This may include: lids for soup trays instead of using plastic wrap; environmentally-friendly kitchen utensils such as biodegradable wooden cutting boards and wooden spoons; and energy-saving kitchen appliances. (Group 26, 2009)
- Work with current suppliers, such as Discovery Organics to determine the feasibility of reducing the food miles for butternut squash, turnips, parsnips, and carrots by finding growers who are located in closer proximity to campus.
- Consider working with UBC Farm to expand procurement of soup ingredients from eggplant to include more commonly used ingredients such as squash.

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SCENARIO 6: CONDUCTING A SUSTAINABILITY ASSESSMENT OF UBC FOOD SERVICES FOOD PRODUCTS

Community Partners: UBC Food Services
AGSC 450 Groups: 28, 29, 30

BACKGROUND:

At the University of British Columbia (UBC) food providers are incorporating more sustainable practices into their operations, ranging from adopting local food procurement initiatives, ethical procurement policies, composting, to healthier menu options. UBC Food Services (UBCFS) has implemented initiatives, such as offering organic shade grown fair trade coffee at all non-franchise campus outlets, a variety of organic local apples at residences such as *Place Vanier*, sustainable seafood options, healthier food choices, composting units at all food outlets, biodegradable ware, green discounts for bringing your own mug, 100% cage-free shell eggs at all outlets, and a growing selection of local seasonal food features at a number of their outlets, with an increasing amount derived from the UBC Farm.

OBJECTIVES:

Groups were instructed to determine the level of sustainability of main staple food ingredients especially dry and extended shelf life ingredients, to recommend alternatives and to develop a strategy to enable UBCFS to further strive to be a sustainable food service operation.

CENTRAL FINDINGS:

All groups conducted a literature review. The following are a list of their findings.

What other Universities are doing

- **Simon Fraser University (SFU)**'s student, staff and alumni run the organization Sustainable SFU (SSFU) which has initiated a local food project to increase fresh and local food on campus, to educate students, and to support food production and distribution projects on campus. They have established the "Harvest Box" program which delivers fresh, affordable and quality produce to campus each month. SFU works with Chartwells dining service to promote a sustainable food system (Sustainable Purchasing, 2009) by purchasing local and ocean friendly foods. Chartwells' mandate states (2009) that they deal primarily with suppliers who use recyclable containers for delivery and compostable material for packaging. (Group 29, 2009)
- **University Of Victoria (UVic)** incorporates sustainability education in over 200 courses in a number of disciplines. UVic's Student Society facilitates a number of green initiatives on campus including workshops on organic gardening (UVic Sustainability, n.d.). The University of Victoria Sustainability Project (UVSP) is a student organization launched in 2005 to encourage sustainable living. They published the *UVSP's Guide to Slow Living for Students* (UVSP, n.d.). The Food University Network partners with *Share Organics* to offer a pocket market in which organic, local and seasonal food is sold on campus. UVic established a list of actions for 2009-2014; one of these actions investigates a "low impact" menu that serves organic, local and seasonal dishes (Webb, Personal Communications, 2009). (Group 29, 2009)
- **University of California Santa Cruz (UCSC)** is one of the leading universities in conducting sustainable agriculture research and the Farm-to-College movement which connects the farm located on campus with other local, organic farms to bring local organic products to the campus dining halls and restaurants (Group 29, 2009). There are a number of organizations, educational student programs and events at UCSC that focus on food systems, such as the program in community and agroecology (PICA), Kresge Food Cooperative and the Food systems working group. These organizations and programs connect the campus

farm with dining halls and provide a chance for students and the community to learn about sustainable food systems (CASFS, 2007). (Group 29, 2009)

SPECIFIC FINDINGS:

Each group analysed a different staple commodity. The following is a list of their findings.

RICE

Literature Review

- Rice is the staple food of almost 3 billion people in Asia (IRRI, 2004). In the United States, about one in five Americans consume at least half a serving of rice daily (Iowa State University, 2005). (Group 29, 2009)
- 90% of world's rice production occurs in Asia and 3.2% in Latin America. Rice farms cover about 150 million hectares of agricultural land (IRRI, 2004). (Group 29, 2009)
- Conventional rice cultivation relies heavily on pesticides and fertilizers which reduce biodiversity within rice fields by affecting microbial life and disrupting the natural food chain, increasing nutrients and toxins in groundwater, and generating more greenhouse gases than any other major agricultural crop (WWF, 2005). Prolonged use of fertilizers degrades soil quality, contributes to the alkaline chemical build up in the paddy and increase the amount of fertilizer required to achieve the same level of productivity (WWF, 2005). (Group 29, 2009)
- Rice paddies are one of the major agricultural contributors to global methane emissions with an estimated 10-15% of total global methane emissions (Neue, 1993). Rice cultivation takes place in wetlands and flooded paddies which are very water-intensive. Carbon can not be held in the anaerobic conditions of wet rice field and is instead converted to methane by soil microbes and released into the atmosphere (Neue, 1993). The burning of rice husks between harvests generates CO_2 while the high use of nitrogen-based fertilizers increase nitric oxide emissions from rice fields (WWF, 2005; Khalil, 2006). (Group 29, 2009)

Current Procurement Practices at UBC Food Services

- On the UBC Point Grey campus alone, UBC Food services purchased about 6.5 tons of rice in 2008. In the past three years, UBCFS purchased seventeen rice products that fall under twelve brand names which originate from various countries: Uncle Bens (USA), Riso Arbori International (Italy), Lundberg (USA), Texana (various countries), Vita (Vietnam), Royal Van (Thailand), Gldnchf (unknown), Xo Thai (Thailand), Mughal (unknown), Jackpot (USA), GFS (unknown) and Nishiki (USA) (Poupart, personal communication, 2009). Among the rice products purchased by UBCFS, Lundberg's rice products originating in California are produced the closest to Vancouver with a distance of about 1,750 km. Rice products that originate furthest from Vancouver are grown in Thailand with a distance approximately 11,820 km (Time and Date, 2009). (Group 29, 2009)
- Currently UBCFS does not have any specific guidelines regarding the procurement of food. In the near future they aim to improve the sustainability of food procurement by increasing the purchase of local food ingredients, increasing the purchase of produce from UBC farm and strengthening the bond with current local producers. UBCFS selects its food provider based on quality and price. UBCFS looks for suppliers and producers that are more local, organic, and sustainable, but the bottom line is food cost (Yip, personal communication, 2009). (Group 29, 2009)

Environmental Sustainability Policy: Rice Producers

The rice production and processing practices of Uncle Bens and Lundberg were researched as these were the only companies that explicitly state their commitment to sustainability on their websites. (Group 29, 2009)

- **Uncle Bens**® states its environmental commitment to waste nothing and to become energy self-sufficient. The 200,000 pounds of rice hulls created everyday are used to heat water to cook rice and are therefore used as energy rather than being sent to landfill. In addition, the ash resulted from burning the rice hulls is sold to the steel industry to be used as insulator thus achieving the goal of waste nothing (Uncle Ben's, 2008). (Group 29, 2009)

- **Lundberg** states its commitment to sustainability throughout the entire process of growing rice. Their goal is to maintain rich earth, clean air and pure water. To ensure soil enrichment, Lundberg combines the traditional method of crop rotation and fallowing fields with new techniques such as laser levelling rice fields. To control weeds and pests, they use water management as the main tool and only use herbicides that are carefully chosen when needed. To reduce waste and gas emission, rice straws are not sent to landfill or burned but are chopped into small pieces and ploughed back into the soil for decomposition. At the stage of storage, specialized atmospheric control is used rather than applying chemicals to get rid of grain pests (Lundberg, n.d.). (Group 29, 2009)

International Production Practices and Ecological Impacts

- **India** is one of the leading countries that have endeavoured to reform agriculture to meet the needs of climate change, sustained productivity and environmental conservation. The resource-conserving concept of Conservation Agriculture (CA) has been adopted with the primary focus of raising crops without disrupting nature, enhancing natural biological processes, and reducing the use of mechanical processes and external inputs (Abrol, 2006; FAO, 2008). CA methods can be adopted in a wide range of rain fed and irrigated environments and has been used in many countries including Brazil, North America, New Zealand, and Australia (Indian Agriculture, 2008). CA yields are sustained at levels comparable to intensive farming. Other environmental benefits of CA include enhancing biodiversity, reducing CO_2 emissions, and improving water, soil and air quality (Abrol, 2006). Disadvantages of CA may include high initial costs for equipment, and high farmer management skills (Abrol, 2006) (Group 29, 2009).
- **California** government and industry participation in sustainability programs and production methods have facilitated sustainable rice production in California. The adverse effect of burning rice straw on air quality is a key issue in sustainable rice production. In 1991, California passed a law called The Rice Straw Burning Phase-down which restricts rice growers from burning more than 25 % of their fields. Rice farmers may also participate in The Sacramento Valley Smoke Management Program and commit to burning only a small quantity of straw for the objective of disease-control. These limitations resulted in new management strategies such as recycling, soil incorporation and off-field uses (California Rice, 2008). (Group 29, 2009)
- **Japan**'s government is keen on making Japan a more sustainable and environmentally friendly country. Tomioka Town founded the research group "Recycle in an Organic Spirit", in which local farmers, local consumers and farm produce processing companies all worked together to use composts to grow food. They compost food waste, tree bark and other biomasses in order to grow organic rice. They aim to generate enough compost to fertilize 35% of their current organic rice fields (Japan For Sustainability, 2006). Kikkoman Group supports this initiative by supplying biomass fertilizer from their recycling factories and by purchasing rice from Tomioka Town (Kikkoman, n.d.). (Group 29, 2009)
- In 2004, the International Rice Research Institute (IRRI) developed the IRRI's Environmental Agenda with the strategic goal to ensure that rice production is sustainable, has minimal negative environmental impact, and can cope with climate change. To meet their vision, they developed targets to be achieved by 2015 with focus on land management, biodiversity, water availability and climate change (IRRI, 2004). (Group 29, 2009)
- Other sustainability practices suggest that rice can be cultivated without paddies and may be grown in drier conditions without compromising yield (WWF, 2005). Additionally, Chinese studies reveal that methane can be significantly reduced while boosting crop yield by draining the paddies midway through the season to interrupt methane production (NASA, 2002). (Group 29, 2009)
- **Local Initiatives**
- Rice production at the UBC Farm was proposed but found to be infeasible due to incorrect growing conditions, prohibitive costs and lack of man power. (Group 29, 2009)
- The Terra Nova Schoolyard Project (TNSP) in West Richmond aims to be a learning tool to connect elementary students to their food. Terra Nova Gardens is attempting to grow rice in the northern part of the gardens. Richmond's climate is similar to parts of China and Japan and highly suitable for cultivation of the Oryza Sativa Indica rice. Brackish water from the

inter-tidal zone will be used next season to flood the rice paddy (Lai Personal Communications, 2009). (Group 29, 2009)

CANNED TUNA

Literature Review

- Fish is the best source of omega-3 fatty acids, which are important in decreasing blood clot formations, heart disease, attributing to proper development of the brain and eye for infants, and for proper functioning of the brain in adults (Gropper, Smith & Groff, 2009; Horrocks & Yeo, 1999). For these reasons many nutritionists push for an increase in consumption of healthy fish. (Group 28, 2009)
- Globally, fish consumption is rising but ocean catches have been leveling off. Aquaculture production is increasing significantly to meet consumer demands (Sargent, 1997). Fish farms crowd fish in unnaturally high densities that result in production of toxic wastes, diseases and parasites that damage the surrounding environment and negatively affect wild populations (Weiss, 2002). (Group 28, 2009)
- Over-fishing is a huge problem and it is estimated that the global oceans have already lost more than 90% of large predatory fish including codfish, skates, blue-fin tuna and rockfish (Myers and Worm, 2005). Canada's Atlantic cod is a clear example of over-fishing with a 95% drop of biomass in the 1990s and a subsequent failure to recover (Frank et al., 2005). (Group 28, 2009)

Current Practices at UBC

- Both UBCFS and the AMS use significantly more tuna than salmon. UBCFS use Tuna packaged in a pouch form, whereas AMSFB outlets use canned tuna. Both UBCFS and AMSFB use salmon packaged in a can, and both obtain their products from the company, Ocean's Fisheries Ltd situated locally in Richmond, B.C. (Toogood & Yip, personal communications, 2009). (Group 28, 2009)
- Neptune Food Service is the food supplier for UBCFS and the AMS. Neptune has been the leader in food distribution in B.C. for over 25 years, and it is strongly committed maintaining that leadership position for the future (Neptune, 2009). According to our estimation, the travel distance between UBCFS and the Neptune warehouse is about 31 km and shipments are sent to UBCFS two times per week. (Group 28, 2009)

International Production Practices and Ecological Impacts

- Ocean's Fisheries Ltd. only uses fish caught from wild stocks. Skipjack and yellow-fin are among the most commonly caught tunas and are caught in the Indian Ocean and South East Asia. The pink and sockeye salmon used are caught in the waters of Alaska and British Columbia (Safrika personal communication, 2009) (Group 28, 2009). Ocean's Fisheries harvest fish by using purse seiners- boats that use large nets to encircle schools of fish- and gillnets- nets attached to small boats, strung close to shore and continually tended (BC Salmon, 2005). Net sizes of gillnets and seines are strictly regulated by length, depth and mesh size as are the areas where vessels can fish and the number of times they can fish (Safrika, personal communication, 2009). Oceans Fisheries' tuna products are Dolphin Friendly using tuna supplied by vessels that use dolphin-safe forms of fishing. They are certified by Earth Island Institute's Mammal Project (Oceans's, 2007). (Group 28, 2009)
- It is difficult to gauge how sustainable current fishing practices are because it is difficult to estimate wild fish populations. We know that world catches of some fish are increasing and others are leveling off but it is unclear if these findings are due to overfishing or if some populations are increasing in the wild. (Group 28, 2009)
- Tuna and salmon are both carnivorous fish. Sustainable eating practices recommend eating low on the food chain, such as the omnivorous tilapia fish (Haliweil & Nierenberg, 2008). Tilapia is a tropical, warm-water fish that grow best at 24˚C (Rakocy, 1989) thus requiring energetically demanding heated aquaculture systems. The advantages of Tilapia include no risk of the fish escaping and becoming a problem for native species and it is a fast growing fish that can have several broods per year (Canadian Aquaculture Industry Alliance, 2008).

More research must be conducted to define the ecological footprint of raising tilapia in our climates. (Group 28, 2009)

- Canned or pouched fish is the most popular way to extend the life of fish. The shelf life of canned fish is generally 2 to 5 years. The processing steps are as follows: After the fish are caught they are quickly frozen to preserve freshness. The fish are separated according to weight and size and the viscera are removed (Ocean 2008). The fish are thawed in large thawing tanks that contain hot water (Bumble Bee Foods, 2009). From this point, the fish is loaded onto racks for pre-cooking (Polar Seafood Processing, 2009). Once the fish is cooled, loining takes place to separate the edible parts of the meat from the skin and bones. Fish is a low acid food and, when improperly processed, there is an increased chance for botulism poisoning (CFASTP, 2005). The heat is applied in many ways during the process including pre-cooking stages and the addition of hot medium salt water. Cans and retort pouches are hermetically sealed under vacuum condition with a double seam to prevent bacteria entry. After packaging the tuna into cans or pouches, retorting cooking further ensures safety by eliminating all pathogens and spoilage bacteria. Next, the product is commercially sterilized to kill all viable microorganisms and inactivating their spores (Durance, 2007). After thermal processing, cans and pouches are cooled under pressure and dried prior to labeling and packing. After each processing, the plant generates a large amount of fish waste which is sent to a reduction facility where it is made into fertilizer or animal feed (Safrika, personal communications, 2009). (Group 28, 2009)
- A retort pouch consists of layers of 12.5-μm polyester, 12.5-μm aluminum foil and 80-μm cast polypropylene (Bindu & Gopal, 2008). The preparatory work before the fish is pouched is the same as the canning process (National Fisheries Institute, 2009). The main differences that the process is carried out in Asia where the pouch material is also made (Safrika personal communications, 2009). (Group 28, 2009)
- In terms of sustainability, both freezing and thawing take a considerable amount of electrical or coal energy to maintain freezing and boiling temperatures (Bumble Bee Foods, 2009). (Group 28, 2009)
- Ocean's Fisheries Ltd use cans made by Ball Packaging, a local can manufacture in Richmond which may indicate reductions in energy consumed in transportation of the cans. (Group 28, 2009)
- Ocean's Fisheries Ltd. has completed its carbon footprint analysis. The company did not compare individual products such as salmon vs. tuna but rather the total carbon footprint of their company (Safrika personal communication, 2009). (Group 28, 2009)
- The retort pouch–packed products need significantly less heat than cans to achieve commercial sterility, with cooking time and energy costs reduced by half (Jun et al., 2006). Unlike canned foods, the pouched foods will not be overcooked, ensuring better texture and taste (Jun et al., 2006). Retort pouch packing is more environmentally friendly because it produces less waste and uses less fossil fuel. Lastly, retort pouch eliminates many work-related injuries due to a reduction in packaging material accidents. Food processors are reluctant to remove a functioning can line to replace it with retort packaging due to its high capital costs. (Group 28, 2009)
- Food alternatives to tuna can contain more nutritional value than tuna and can help reduce the environmental impact of eating tuna. Food alternatives such as: tofu, flaxseed, tempeh are excellent food stuffs that can easily replace tuna by providing similar amounts of essential fatty acids and protein (Sorgen, 2003). (Group 28, 2009)

FLOUR

Literature Review

- Flour is a finely ground powdery food prepared from a variety of edible seeds, nuts and vegetables (How products are made, 2009). The common types of flour available in the market are wheat, maize, rice, barley, oats, buckwheat, soy, arrowroot, and potato. Among all the different varieties of flour, wheat flour is the most popular ingredient used in baked goods around the world (Lovell, 1994). (Group 30, 2009)

- Wheat is one of the main agricultural commodities grown on the Canadian prairies with 7 main wheat types with over 200 varieties (Agricultural and Agri-food Canada, 2009). The protein and gluten content of wheat determines the composition and functional properties of the end products. Wheat is classified by the hardness of its kernel (Wheat flour, 2003). In general, the higher the protein and gluten content in the flour, the harder the wheat (British Nutrition Foundation, 2004). (Group 30, 2009)
- The main types of wheat flour are: all purpose flour- made from the finely ground endosperm of the wheat kernel of a mixture of hard and soft wheat. The bran and germ are eliminated during milling (Wheat flour, 2003); whole grain whole wheat flour- derived from the entire wheat kernel that contains the bran, germ and endosperm (Lovell, 1994), and pastry flour- made from soft wheat, which is relatively low in gluten content when compared to all purpose flour (Lovell, 1994). (Group 30, 2009)
- Nutrition information of various flours is as follows: all Purpose Flour- all the vitamins, minerals and fiber present in the bran and germ have been lost due to the processing; whole grain whole wheat flour- contains vitamin Bs, iron, fiber and other nutrients; enriched flour- is all purpose flour that has a portion of un-natural vitamins and minerals added back. The bio-availability of these vitamins may be low because they are synthetic (La Baguette, 2009). Bleached flour contains alloxan, a toxin, which is used in laboratory animals to induce diabetes (Zeus Information Service, 2005). Organic flour is a healthier flour because chemicals are not used in processing. (Group 30, 2009)

Current Practices at UBC

- Flour is used as a thickening agent and/or a coating in cooking and in baked goods for UBC Food Services. 9,660 kg of flour was ordered last year from the producers Robin Hood (1840kg) and Gordon Food System (GFS) (7760kg). For both suppliers, the origin of flour is 100% domestically produced in Saskatchewan. Saskatoon Mill is the processing location, and products are transported by CN Rail via truck (personal communication, 2009). The flour produced and processed is relatively more sustainable when compared to importing flour from other countries. (Group 30, 2009)
- UBC Food Services is willing to switch to more sustainable and greener food choices but the purchasing budget is the major barrier in switching to a more sustainable organic flour supplier. Anita's locally milled organic all-purpose unbleached flour is priced at $44.10, which is three times higher than Robin Hood all-purpose bleached flour. (Group 30, 2009)

National Production Practices and Ecological Impacts

- Conventional agriculture relies on intensive application of synthetic fertilizers, chemicals, and concentrated feeds. This is extremely unsustainable since those commercial products require large amount of natural resources and energy inputs to be produced in the first place (Ziesemer, 2007). Organic production utilizes fewer inputs and less energy-demanding practices. Although it often demands more labor, it generates more employment opportunities and is supported by higher price premiums for the products (Ziesemer, 2007). Since organic production uses less energy inputs, it also contributes to minimizing green house gas emission. (Group 30, 2009)
- Organic production focuses on maintaining and enhancing principles such as biodiversity, sustainability, natural plant fertilization, soil quality, and water conservation. Several specific methods include replacing toxic chemical applications, like pesticides and herbicides with natural pest and weed management practices, using natural fertilizers, implementing crop rotation to improve nutrient recycling and to avoid potential increase of pest population (Kuepper & Gegner, 2004; NCAT, 2004). (Group 30, 2009)
- Conventional flour processing requires the addition of several chemicals. The incentives to produce conventional flour are the reduced time in waiting for the flour to mature and lower production costs (Wheat flour, 2003). Numerous flour producers, such as Robin Hood and GFS, use chemical treatments during production to increase productivity and profits. The following are typical additives in conventional flour: (Group 30, 2009)
  - Enrichment- conventional white flour in North America is enriched with B-vitamins and iron in amounts equal to those amounts in whole grain to replace the vitamins lost in the

removal of the bran and germ from the endosperm during milling (Canadian National Millers Association).
  - o Chemical Bleaching and Maturing Agents- conventional all-purpose flour has bleaching agents, such as benzoyl peroxide, are added to whiten and brighten the flour color. Maturing agents, such as chlorine, are added to flour to increase gluten development (Wheat flour, 2003).
- The major processing difference between conventional flour and organic flour is the natural aging of organic flour. Natural aging is not as cost effective and time saving as the use of chemical bleaching and maturing agents used during conventional flour production (Harrel, 2002). The flour is then kept in silos in the mills, and is susceptible to pest infestation or microbial contamination (Wheat Flour, 2003). Not only are organic flour producers restrained from selling the flour delayed by natural aging, they also risk an overall lower yield (Wheat flour, 2003). Another distinctive aspect of organic flour is the yellowish color contributed by the carotenoid pigments, contrasting with the color in conventional bleached flour (Wheat flour, 2003). (Group 30, 2009)
- Robin Hood and GFS all-purpose flour have a 12 month shelf life. The shelf life of conventional whole wheat flour is 9 months (personal communication, 2009). Organic flour with no chemical additives has a shelf life of 6 months (Yip, 2009). (Group 30, 2009)
- Robin Hood and GFS use polyester and polyethylene laminated paper bags for packing flour in various volumes (Robertson, 2006) and UBC waste management system recycles most of the plastic or paper food packages. (Group 30, 2009)
- Even though a majority of foods grown organically require similar land and natural resources when compared to conventional practices, the conventional production method is considered more energy intensive (Collins & Fairchild, 2007). (Group 30, 2009)

Distribution Destinations for Canadian Flour

- 80% of Canada's wheat production is exported to Europe and parts of Asia. The remaining 20% of grains is for domestic consumption. Prior to exporting, the grains are shipped to either Eastern Canada (40% of the 80% being exported) or to Western Canada (60% of the 80% being exported) for processing (Dr. Vercammen, personal communication, 2009). (Group 30, 2009)

RECOMMENDATIONS

TO UBC FOOD SERVICES:

- Use the UBC Sustainable Purchasing Guide produced by the Sustainability Office & Supply Management as a guide to developing purchasing guidelines for UBCFS. The guide defines sustainable purchasing and details a supplier code of conduct. If UBCFS develops a document that details specific supplier codes of conduct, pressure will be placed on suppliers to move towards more sustainable practices (UBCSOSM, 2008). (Group 29, 2009)
- Request product information from food suppliers including food origin, food mileage, nutritional facts, processing and packaging practices and waste disposal methods in an effort to increase transparency of food products provided to the campus and to encourage food suppliers to adopt more sustainable food operations. (Group 29, 2009)
- Put a recognizable logo on every package of products that are made from organic and local ingredients. Specifically, baked goods can be labeled with the new logo on their respective packaging. UBCFS should consider collaborating with the AMS Lighter Footprint Strategy to share their existing LOV (local, organic, vegan) logo to demonstrate the food product is produced with minimal environmental impacts. (Group 30, 2009)
- Expand local and organic food products in the food retail outlets. (Group 30, 2009)
- **Rice Procurement:** Take production, processing, packaging, transportation and food miles into consideration. Purchase rice exclusively from suppliers that (Group 29, 2009):
  - o Use sustainable methods of rice production- eg: Conservation Agriculture (Lundberg (best) or Uncle Ben's (alternative));
  - o Are located closest to UBC (California based supplier Lundberg);

  - Use energy efficient machinery in rice processing and transport.
- **Tuna Procurement:** Purchase and use food alternatives to tuna whenever possible. Although Vancouver Aquarium advocates for use of sustainable fish in the food services with their Oceanwise program, serving fish is still not a fully sustainable choice compared to decreasing fish consumption overall. This will also serve to expose students to alternative food choices combined with information on the impact of tuna production. (Group 28, 2009)
- Use retort pouch packaged tuna when purchasing tuna.
- **Flour Procurement:** Switch to organic flour wherever possible. Continue to supply 100% domestically grown and processed flour (Robin Hood and GFS).

TO THE UBC SUSTAINABILITY OFFICE:

- Develop guidelines and supportive evidence to encourage food suppliers to adopt more sustainable purchasing practices. (Group 29, 2009)
- Develop indicators or a scoring system to evaluate sustainability of food products. (Group 29, 2009)

ACCOMPLISHMENTS OF THE UBCFSP 2009:

The following is a list of specific accomplishments that emerged from the 2009 students work and were implemented by stakeholders. Please note that the following summary is not a comprehensive list, and instead contains a selection of key project outcomes such as the implementation of initiatives which have contributed to the enhancement of the sustainability of our campus food system.

AMS LIGHTER FOOT PRINT STRATEGY:

- A new Lighter Ecological Footprint LOV item- The vegan granola bar was implemented at the Pendulum Café and the vegan ginger cookie was implemented at Blue Chip Cookies. Some adjustments were made to the original recommendations.
- Marketing and promotion tactics were significantly increased (in the AMS for promoting current eco-friendly dishes- including any LOV (local, organic or vegan) dishes, seasonal foods, and sustainability initiatives. Specifically, AMS now features posters depicting seasonally feature LOV items available at outlets, more LOV product signs, and promotes these initiatives among others through various different media, including school papers and the SUB TV displays.
- The AMS has taken the recommendation that LFS 450 should inform the development of the New SUB, specifically a rooftop garden which will be a LFS 450 scenario in 2010.

UBC FOOD SERVICES:

- New UBC Farm signage in UBCFS cafeteria at Place Vanier has been designed and erected to help customers make the connection between campus food production and the food they are consuming.
- UBCFS is in process of exploring the feasibility of implementing important LFS 450 recommendations including: sourcing unbleached and potentially organic flour, sourcing more environmentally friendly rice, and sourcing organic sugar.

LFS ORCHARD GARDEN:

Garden Enclosure:

- The construction of the LFS Garden enclosure began in April, 2009 with various elements of the fence already in place and was completed during the 2009 summer months.
- The plants recommended by LFS 450 groups will be considered in the spring planting of the garden boarder.

Three-bin Compost system:

- The three-bin compost system was built in adherence with the Greater Vancouver Regional District's recommended design for a three-bin pest resistant compost system. The design was approved by stakeholders including the LFS 450 Scenario 4B groups working on the LFS Orchard Garden enclosure plan. The compost system accounts for pest control, proper ventilation, ease of use, size, and proper materials. Materials were purchased through a grant from the AMS Student Environmental Society obtained in mid March. Installation of the compost took approximately 22 hours (Group 18, 2009).
- Information on effective composting was compiled for use in the Orchard Garden Website, created by group 17 of the UBCFSP. This will serve to help community members and LFS students to learn proper composting practices (Group 18, 2009).
- Jay Baker-French, an LFS Agroecology student, will further develop the compost system to meet the needs of the community as recommended by the LFS 450 groups.

Production and Harvest plan:

- Agora, AgUS, Sprouts and the UBC Farm have been consulted in the crop planning process to help determine what crops should be focused on.

- Potatoes were identified as a crop that UBC Farm is unable to grow due to a heavy wire worm infestation. The LFS Orchard Garden was successful in growing potatoes and was able to sell them at the UBC Farm markets.

Agricultural Management plan:

- An Integrated Pest Management Plan and an improved production and harvesting management plan were developed (Group 17, 2009).
- A garden management plan has been developed to help the garden run efficiently. The plan includes a time-line for major events (Group 17, 2009).

Distribution plan:

- The relationship with Agora Café and the AgUS has been strengthened through increased communication and coordination of produce purchase. Summer crops such as kale and other greens were harvested and preserved for early spring use in the Agora Café.

Resources:

- A more robust volunteer program was put in place, as suggested by the LFS 450 students, to ensure a study source of labour.
- A summer work/study student was hired to maintain the garden over the summer months.

Garden Committee:

- A communal vision statement for the garden was prepared along with a layout of levels of management within the committee.

UBC FARM:

Student Work:

- Students performed specific project tasks at the UBC Farm over the course of the term including: thinning forest stands, managing hedgerows, managing canola, working with the chickens and helping remove plastic drip tape from the fields.

Carbon Smart Food Guide:

- The Carbon Smart Food guide is in progress. It will be produced as a pocket sized quick guide to low carbon eating.
- A Carbon Smart Website is being constructed to accompany the guide. This will be an interactive site informed by the LFS 450 groups.

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