Ways to Waste:
The Garbology of Post-consumer Refuse in the UBC Okanagan Cafeteria

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Abstract

Earth and its resources are limited and eventually we will exhaust many sources that are vital to human survival if we continue to live as we do. Through a Directed Readings course, and carried out as a SEEDS project (Social, Ecological, Economic and Development Studies), the primary objective of our study is to identify sustainable means for reducing post-consumer waste in the cafeteria at the University of British Columbia, Okanagan campus. The groundwork for this of this project is based on the exploration of a wide range of literature on garbology, archaeology and food sustainability.

By observing post-consumer refuse disposal patterns, we will quantify and classify the food waste disposed throughout the day. Data collected for the peak hours of cafeteria use during breakfast, lunch and dinner indicate that lunch meals which include fries, pasta and bread are most wasteful. Non-food items such as napkins and plastic cups constitute the greatest portion of the garbage. On completion of our compilation of data and analysis, we will be able to make recommendations to the UBCO cafeteria on how to contribute to sustainability, by decreasing the amount of unwanted food and other items in the trash bins.

1.0 Purpose and Objective

Earth's ecosystem and society's globalizing economy are progressively becoming more competitive. The degree to which human impact has reached covers a great deal of the planet. Along with this, there are hardly any facets within our daily lives that do not depend upon land and the resources that it provides. Currently, the value our society places on our resources are expressed solely in consumerism, instead of what is needed. This idea is strongly related to food, society's food consumption patterns and the waste it produces. We will show that post-consumer waste can be drastically decreased at the UBCO campus' cafeteria. As a social institution, the University of British Columbia's Okanagan campus has the duty to lead an optimistic model in decreasing post-consumer food waste and increasing campus sustainability.

In conducting a comprehensive review on post-consumer waste expenditure at UBCO, we felt it was necessary to conduct a garbology study and assessment. Garbology is simply an audit of the solid waste materials that are found in trash samples. Our objective was to obtain an average consensus of the trash that is being placed in receptacles that are designated by the UBCO cafeteria. The purpose of this study is to analyze and assess the University of British Columbia's Okanagan campus's cafeteria and issues pertaining to post-consumer waste. By completing this study, we will be able to make recommendations to the cafeteria in the hopes of increasing sustainability on campus.

2.0 Society and Waste

Our society has become overwhelmed by wastefulness. We take possessions for granted and generate vast quantities of waste. In nature itself, there can be no waste unused. Everything produced is used as a resource by some other living organism. There is a constant cycling of matter. However, society often goes against this cycle (Baynham and Dalton 2005: 3-4). By six months of age, a common Canadian has disposed the same quantity of resources that an average individual living in the developing world would dispose in a lifetime. Throughout the course of a person in Canada's life, they will produce 600 times his or her adult weight in garbage. A 68 kg adult will leave a legacy of 40,825 kg of trash (Statistics Canada 2005: 1). It will cost Canada more than $1.5 billion a year to dispose of this garbage. Currently, 80% of public and industrialized waste in Canada is disposed of using the land-filling process. These landfills sites are responsible for 38% of Canada's total methane emissions. The remainder is disposed through recycling, resource recovery and incineration. Although two thirds of household was can be composted, Canadians generate roughly seven million tons of organic waste each year. (Statistics Canada 2005: 1). These statistics are alarming. To reduce all of these numbers, society as a whole must be aware and together reduce their consumption. One way to do this is through reducing post-consumer waste.

Many factors influence the making of waste. Garbage tends to grow with economic output. As income and consumption of goods rise, more waste gets discarded. Changes in society, such as the trend toward fewer people per household, also have an impact on waste production. Census data show that in 1981 households consisting of one or two people represented 49% of all households; by 2001, they accounted for 58%. All

households, regardless of size or composition, consume certain basic goods such as furniture, appliances, newspapers, food and other products. When there are fewer members in each household to share these goods, per capita consumption and waste generation surprisingly tend to go up (Statistics Canada 2005: 1).

This paper will discuss the current post-consumer waste problem in the cafeteria at the University of British Columbia Okanagan. Society observes consumption as something supportive of the country, the economy and themselves. It is complicated, if not impossible; to achieve a sustainable revolution in the ways and the means by which people go about their lives. The UBCO cafeteria cannot resolve the post-consumer waste dilemma the world confronts single-handedly. However, it can encourage transformation and change as well as act as an ideal for other universities, cafeterias and restaurants to strive towards. The UBCO cafeteria needs to put into practice a curriculum that integrates longevity and flexibility; a program that can be easily implemented into the daily lives of students, faculty and administration. It is imperative to understand that changes may not be observed instantly. But, if the whole UBCO community is committed to reducing post-consumer waste, along with continued work on these difficulties in the future, there will be a revolution. This change will be essential in forming a sustainable society. This paper will give the solutions that are needed for a sustainable cafeteria and campus.

3.0 Literature Review

To form a comprehensive knowledge base for this project, it was necessary to review a variety of literature pertaining to garbology, post-consumer waste disposal patterns and trends and food service sustainability. Also, scholarly resources that focused

on the collection of data that involved food consumption were reviewed. An important contribution to the study of Garbology, as well as its practices and theories, is the book, Rubbish!- the Archaeology of Garbage by William Rathje and Cullen Murphy. This book is a comprehensive examination of the University of Arizona's Garbage Project. For over twenty years, this project has been an extensive task for the Anthropology department at the University of Arizona. This book described the short, yet broad, history of garbology. Contextual material, such as theory and methods, were also discussed to show and help researchers better understand the benefits as well as the implications of studying garbage. By providing history, theory, methods and case studies, this book was an essential basis for developing our own garbology study.

In order to better understand post-consumer waste in universities, research was important concerning programs that involved food sustainability, food consumption, waste disposal patterns, environmental development and composting of pre-and post-consumer waste. Many universities throughout the United States and Canada have implemented post-consumer waste programs. For example, Kentucky State University observed the food waste habits of 743 sixth grade children who bought lunches from their middle school. Their food was then photographed before they ate and after they ate. The researchers were then able to observe what was being thrown away and from there, make recommendations to the school cafeteria (Marlette, Templeton, Panemangalore: 2005). By comparing other universities post-consumer waste research with UBCO, we were able to understand the full spectrum of food waste in universities as a whole.

Composting programs, both pre- and post-consumer waste, were also an important literature source. Case studies have shown that hogs and other farm animals

can consume food waste. Case studies, such as the one produced by Hamline University in 2003, looked at the ability and its practice of livestock being fed through post-consumer food waste scraps. This provided insight into means of disposal for post-consumer waste (Hameline: 2003).

4.0 The Study of Garbology

Archeology is defined as "the scientific study of material remains, such as fossil relics, artifacts, and monuments, of past human life and activities (Baguchinsky 1999: 1)." The most common thought of archeology is often in terms of human history. However, the fundamental ideas and theories of archeology can also pertain to more diverse studies to gain knowledge of the present. Just as archaeologists are able hypothesize about a civilization that lived several thousand years ago by looking at the remains of that culture, they can also make these theories about today with contemporary society. By observing the material culture of a modern, existing population and by studying the physical and preservative substance and items utilized, archeologists are able to establish suppositions about a particular population (Baguchinsky 1999: 1).

Garbology is a significant field of study because it allows for the examination of a multitude of issues. During a garbology study in Tucson, a survey found that all Hispanic women in the area did not use bottled baby food. However, it was discovered through the analysis of these women's garbage that they used just as much prepared baby food as other households within the region. Thus, through studying garbage we can analyze the belief system surrounding food consumption (Rathje, Murphy 2001). Garbology also allows researchers to observe socio-cultural change through refuse. For

example, the number of condom wrappers had remained stable between 1976 and 1984 but had increased to 45% between 1985/1987(Rathje, Murphy 2001: 64-65). This allows garbology to be an important tool in looking at socio-cultural change and development.

The concept of garbology was introduced to the archeological community by Professor William Rathje of the University of Arizona. Garbology is, essentially, the study of garbage. In particular, it is the vigilant inspection and analysis of waste products produced by a population, in order to learn about that population's activities and behavior in topics such as waste disposal and food consumption. In garbology, daily bits of trash quickly become significant and fascinating objects from which many conclusions about their supply and source can be derived (Baguchinsky 1999: 1).

4.0 Waste Policies and Environmental Programs at other Institutions

Many institutions comparable to UBCO have employed environmental programs to aid in controlling environmental issues such as post-consumer waste refuse prevention and management. Establishments like Ithaca College in NY, USA and Trent University in Canada have implemented programs to deal and promote sustainability on their campuses. It is apparent that UBCO is behind in applying such a plan. The University of British Columbia, Okanagan Campus, should look towards these schools that have attained accomplishment with their environmental programs, and try to adjust their ideas to the university and the community to develop defenses against environmental problems, such as food waste management.

Ithaca College, an upstate New York school has 6,190 undergraduate students. In September 1991, the college began the Resource and Environmental Management

Program (REMP). This program promotes and aids individual departmental strategies against unnecessary waste. The REMP also provides guidance, policies, and timelines to help establish and achieve goals. Among these goals was the implementation of an "Integrated Solid Waste Management Plan". In 1992, one year after the official start-up of REMP, the College redirected more than 20% of its waste through recycling. In the following year, the college commenced a pre and post-consumer compost program (Hirsh *et al* 2003: 24). By 1995, 20 tons of food waste was being diverted from the landfill. Some of this compost was being used as soil around the campus grounds. Today 2500 pounds of pre and post-consumer food scraps per day is composted. The REMP was performing with immense accomplishment and consequently the college officially implemented a more inclusive environmental plan. On April 26, 2001, the college passed a Comprehensive Environmental Plan. The plans function was to, "make Ithaca College a positive example and play a significant role in the advancement of environmental responsibility on the campus and in the local and greater community" (Hirsh *et al* 2003: 24-25).

The plan itself consists of six parts including: "commitment to environmental education; an environmentally responsible purchasing policy; efficient use and conservation of energy; minimizing solid waste production; minimizing hazardous waste and toxic materials on campus; and environmentally responsible campus design and planning principles" (Hirsh *et al* 2003: 24). After the first review by the REMP, it was discovered that the college was having great success with the plan. It had met the majority of the goals that it originally established. Because of this, in a 2002-2003 review, new plans were established, including:

> "promotion of the establishment of a green design and building; continuing education and have better liaisons with the members of the facilities planning committee; have presentation to the community to update them on progress; and continue to develop and improve the schools environmental responsibility" (Hirsh *et al* 2003: 25).

Trent University is comprised 6171 students located in Ontario, Canada. The university was forced to enact an Environmental Plan by the Ontario Environmental Protection Act. The Act required the university to decrease the quantity of waste going to the landfill by at least 50%. The act inspired the University to expand its individual environmental strategy. The policy focused to decrease energy and water use, waste generation, environmental assessment and improving education (Hirsh *et al* 2003: 26). The university embarked on a plan to lessen the weight of landfill waste by 75% per person by the year 2000. This goal resulted in the development of a solid and food waste management policy. The program encouraged that all students and faculty of the university be accountable for reducing their individual contribution to waste through proper reuse, reduce, and recycle practices (Hirsh *et al* 2003: 26).

Particular programs that Trent University has integrated in order to reduce its food waste upsurge comprise of collecting food waste for composting, which are then donated to local farms. The university imposed firm recycling policies including the recycling of Styrofoam waste. These enforcements have helped Trent University lower their amount of solid and food waste being transported to landfills (Hirsh *et al* 2003: 27).

It is obvious that schools within Canada as well as in other countries are making bold efforts to implement food waste policies in order to minimize the consequences that their universities and communities are having on the environment. With overall

commitment from UBCO and the cafeteria, the university could also be a leader in sustainable food practices.

5.0 Methods

Two methods were used in examining post-consumer waste in the UBCO cafeteria. Between January 26th and February 28th 2008, statistical data was collected from observations of refuse thrown away by students, professors and other customers at the cafeteria. These observations were completed at all times during the day, but more specifically when consumption of food was greatest, around breakfast, lunch and dinner. These sessions typically lasted one hour, in which the researcher observed people's refuse of trash from one of the three trash bins found within the cafeteria. Data was then collected and compiled into data sheets and sorted into larger groupings according to the Canadian Food Guide. Data collection was based on the Canadian Food Guide because of the guide's ability to format stereotypical food eating habits of Canadians. Further, this data was sorted to examine what particular foods were thrown out most often.

The data sheets illustrate the quantities of food based on the measurements of small, medium and large amounts. Small equated to anything less than the size of a golf ball, medium equated to anything less than the size of a tennis ball and large equated to anything larger than the size of a tennis ball. These types of measurements were crucial to qualify and organize data. It should be noted that the decision not to weigh the garbage was based on the amount of time allotted for the study, as well as our ability to quantify the items by examining their size. In order to protect the individual trash consumer's anonymity, no personal characteristics of the persons producing the waste was recorded.

Once the statistical data was compiled, the size, amount and the frequency of these foods, were averaged and graphed to illustrate the variety of waste being produced and its frequency. The data sheets used were modeled after the data collection sheets used by the Arizona garbage project. Although not using the same coding system used for the Garbage project, the formatting of the typologies we used were similar (Rathje, Murphy 2001:22).

To reinforce the findings from the observation data collection, on March 28th, a garbology sample, in which we sorted through three trash bags, was conducted. During the sorting practice the sorter wore protective gloves and a mask. Garbage was carefully removed from the garbage bag, examined, photographed and recorded onto the data collection sheet. Figure 1 illustrates the protective measures taken by the researchers in this study. Because hot weather will cause bacteria to grow faster, this method could be hazardous to the researcher, it was important to conduct the study on a cool day (Rathje, Murphy 2001). The garbage was also "fresh" to ensure minimal hazardous inhalation. Afterward this data was graphed, averaged and compared to the observations sheets. Using the two methods, observation and sorting through the trash, allowed for quick and proficient collection and analyze, but also to ensure and reinforce our findings.

Figure # 1

6.0 Results and Findings

Found in one bag:

Human Hair
2 full pieces of Pizza
20 napkins
Quarter Cup of Soup
Half a hamburger
A Full Sub Sandwich
Half a bacon and tomato sandwich
3 tomato slices
3 cups of French Fries
9 Waxy Pepsi Cups
7 Styrofoam Containers
Half a Cup of Pasta
Half a bagel
6 Dixie cups of ketchup
3 Plastic Forks
3 Styrofoam bowls
1 Apple core
3 Banana Peels
3 Pizza Boxes
1 Sushi Container

Appendix A refers to the data collected and the averaged results of the data throughout the study. The data sheets chart the averages of the food waste and other garbage thrown away. This sheet was used in the observation process as well as the trash sorting process. It should be noted that the sorting of trash took place around 2pm which was not a time measured in the observation setting. Thus the findings slightly differed compared to the observation studies. To the left is a compiled list of what was discovered in one trash bag. Carbohydrates and napkins were the two more prevalent disposed items. This is conducive to the data recorded during our observational research.

At breakfast a large quantity of eggs, bacon, potatoes and bread were noted to be wasted. *Figure 2* illustrates the division of waste found during breakfast. Carbohydrate food waste in particular, potato waste was most predominating, followed by fruit and vegetable waste.

When looking at lunch waste the greatest amount of waste produced were carbohydrates as well. *Figure 3* demonstrates that 59% of food waste found during the lunch hour was found to be a carbohydrate in nature. During dinner, it was noted that 68% of food waste produced was a carbohydrate followed by 20% of the food waste

produced found to be fruits and vegetables. Moreover, throughout all times of food consumption it was noted that meat and dairy products were the least likely to be wasted.

Overall 60% of food waste produced in the UBC-O cafeteria was carbohydrates. The amount of carbohydrate food waste runs parallel to additional food waste studies. In 1995 it was noted by the U.S. Department of Agriculture that 30% of grains were wasted during foodservice and consumer waste **(**Kantor, Lipton, Manchester, and Victor Oliveira 1997:7). It should be noted that a study compiled by Kentucky State University found pizza waste comprised 10% of the waste produced by school aged children in the region (Marlette, Templeton and Myna Panemangalore 2005) Perhaps our difference in data can be associated with the age of the study participants – young children enjoying pizza to a greater degree than university age students. Or perhaps the sizes of the pizza slices found within this study were smaller than the pizza slice produced with the UBC-O cafeteria.

Many explanations could account for the amount of carbohydrate food waste to other types of food waste. In one study, Rathje found that the first principle of food waste is that the more repetitive a diet, the more things are eaten day after day, results in less food waste per day (Rathje 2001:62). In accordance with our data findings, this idea is supported. Food, like pizza and fries, which are not classically everyday food consumption items are the items most wasted. Rathje also noted that specialty breads such as buns, rolls and baked goods were found to be wasted between 30-60% in most households in his study. Perhaps due to the specialty nature of pizza and fries, they are discarded the most.

Additionally, the slices of pizza sold are quite large and this could account for the large amounts of pizza being thrown out. Reasons such as portion size and taste of

the food items once cooled could also account for a portion of the waste disposed. The density of the food items themselves also should be taken into consideration. For example, fries are more filling than an orange in terms of density. When looking at fruits and vegetable categories, the highest frequency of waste was small amounts of tomatoes, lettuce and oranges.

Along with postconsumer food waste, there was also a high amount of napkins and plastic cutlery deposited. In one particular observation, we witnessed the refuse of twenty four Styrofoam food contains in a one hour setting. On average twenty napkins were disposed of per hour. Thus, the amount of food waste tools disposed is another area where sustainability options are worthy of some consideration.

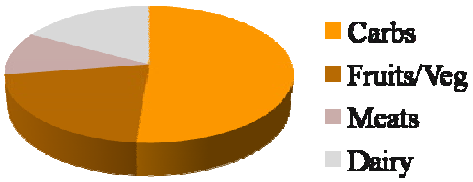

Figure 2

Figure 3

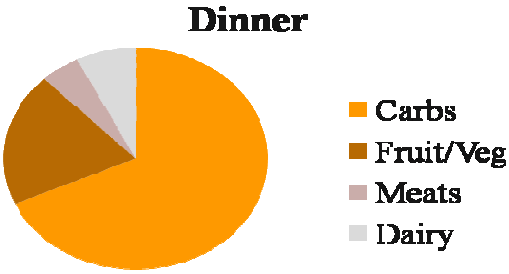

Figure 4

7.0 Recommendations: Post-consumer Waste and Sustainability on Campus

The University of British Columbia, Okanagan campus's cafeteria sees most of the University's population throughout the week. Therefore, there is a lot of waste. There are many ways that the UBCO cafeteria can reduce its garbage refuse. But this will require effort from not only the cafeteria, but the students and faculty as well.

A potential substitute to transferring food waste to landfills is implementing a post-consumer food waste composting program. Composting is a method that uses organic wastes that are degraded by microorganisms at elevated temperatures. Compost temperatures range between 50 to 55 degrees Celsius. The increased temperatures result from heat produced by microorganisms during the degradation of the organic material in the waste (Hirsh *et al* 2003: 17). Many other colleges and universities, such as the University of Michigan and Penn State University, have already implemented these programs with much success. The advantages of this program would facilitate the environment by reducing the quantity of waste taken to the landfill. It would also help the atmosphere of UBCO by offering practical, completed, compost. Although much food waste can be used in this way, many cannot, for instance meat and meat products, dairy foods, fats, oils, and grease are unable to be used because they do not readily break down. They may also cause undesirable odors and increased chance of disease carrying organisms (Hirsh *et al* 2003: 16). Therefore, appropriate signage is important.

A key satisfying aspect of this plan is decreasing the quantity of waste refuse and the cost decline of disposal. In North America, food waste is responsible for approximately 25% of all household waste (Hirsh *et al* 2003: 18). With this number, as an institution, it is clear that UBCO can save a lot of money and space. Landfill usage

will be significantly decreased and the organisms that are involved with decaying food will also be abolished.

Plates and bowls used for take-out are biodegradable. To increase campus sustainability, 100% recycled unbleached and biodegradable napkins are used. One hundred percent recycled wax paper cups for cold drinks and paper cups for hot drinks are used. Wood stirrers for hot drinks are already used. All of the products named above are completely compostable, if the university continues to use these products it could be a major factor in increasing sustainability. For the products that are not disposable, reusable china and stainless steel service-ware are and should continue to be utilized and promoted. If a customer wants take out, only then should they be provided with plastic forks and knives.

Among this, biodegradable and compostable cups could be given out to employees to reduce the use of disposable cold-drink cups. Hot mugs and plastic and reusable drinking cups could be sold in the university book store and cafeteria for hot and cold drinks as well as reusable food containers. Students and staff can then receive 5-25 cent discounts for bringing personal mugs or cups for beverages. Instead or along with to go cups, hand out glasses could be given out that can be washed, since water for dishwashing is relatively low.

Utilization of food residues for animal feeds represents a high level of recycling as well as significance as a means of increasing the feeds self-sufficiency rate. A farm could recycle food waste by cooking it and feeding it to hogs. As part of daily operations, foodservice employees or even students could separate food waste from the other garbage

and place it into barrels to be picked up or delivered to a farm. This will be described in further detail later.

By managing the food waste generated in the cafeteria at Sorin Hall, Hamline University estimated that it has saved 14% in trash hauling and disposal costs (Hirsh *et al* 2003: 19). In addition to cost savings, Hamline University has experienced other benefits because the food waste generated in the cafeteria at Sorin Hall is managed separately from its garbage stream (Hirsh *et al* 2003: 22). For Hamline University, this program improved workers safety due to the elimination of lifting heavy garbage bags into the trash dumpster. It has enhanced labor efficiency since there were fewer trips to the garbage dumpster. There were other benefits such as increased sanitation of the cafeteria area due to the elimination of liquid waste from the garbage stream. There was also better inventory management because food waste was separated and more visible to foodservice employees (Hirsh *et al* 2003: 22). All of these suggestions would help to create and develop an environmental program which would provide the community with goals aimed at reducing waste and improving the quality of the university environment.

Another important suggestion for reducing post-consumer waste in the UBCO cafeteria is to reduce portion sizes. From our findings, large amounts of pasta, fries, bread and pizza were found in high amounts. Instead of giving a large portion of fries with meals that include burgers and chicken fingers, the customers should choose and/or add a small, medium or large size of fries. Pizza was also found as a large waste problem. The slices of pizza that are given out at the university are quite large and this could be the reason why half of it was thrown out. Instead of such large slices, the cafeteria could give out smaller slices and reduce the price of the pizza in half as well. Along with post-

consumer food waste, there was also a high amount of napkins and plastic cutlery. Even though these products are biodegradable, they still contribute to a high amount of garbage while on campus. Napkins could be handed out by the cashiers or the employees who serve the meals. Plastic cutlery could be handed out, only if requested by the customer, or with a takeout meal. As well, sandwiches could be served in half or full sizes.

Although the cafeteria makes an effort to supply healthy choices such as salads and other fruits and vegetables that require little or no packaging, there is also a large market for junk food such as potato chips and candy that are located in visible and handy locations. Not only are these foods an unhealthy choice, they contribute to the waste problem on the university campus. Instead of focusing on selling junk food, the cafeteria could promote healthy choices that would also lead to a decrease in post-consumer waste of packaging materials.

The University of British Columbia's Okanagan campus could benefit greatly from programs like this because implementing it would be easy. Along with this, it could save UBCO's dining services money because the cafeteria would not have to pay as much to have so much waste removed. With students getting used to placing their compostable wastes in the proper receptacles, they will, expectantly, get used to composting and recycling. From this plan they will then, hopefully, take these practices into their own homes.

If we look at the post-consumer waste problem as a structure, we can better construct ways to manage the food waste problem. The contribution of the structure includes food and purchased products and materials. The yield is the waste generated from these inputs. By minimizing the universities contributions it can minimize its yield.

This can be accomplished by first creating stricter post-consumer food waste policies. By encouraging reuse, reduce and recycle the cafeteria can directly minimize their post-consumer waste build-up.

7.1 Diverting Food Waste to Feed for Farm Animals

One important option to consider for decreasing food waste and increasing sustainability for the university and Kelowna as a whole is to convert pre and post-consumer waste into animal feed. Diverting food scraps to animal feed could help UBCO's cafeteria by decreasing dumping costs, supporting the local community through waste reduction, enhancing the cafeterias public image and sustaining local farmers, dairies and livestock producers.

The two main ways to divert food to animal feed are to direct feed to animals and converting residuals to a grain supplement, which is then fed to animals. Food scraps consist of everything from plate scrapings (post-consumer) to food processing waste (pre-consumer) (Stillwater School District 1995: 33). Important aspects in deciding whether this diversion option will work for the university depends on the quality of the food residuals and the existence of animal feed operations in the Kelowna area that are appropriate for the type of food scraps generated. Animal feed can be a viable option if a significant quantity of food residuals is generated on a regular basis and storage space is available to keep the material fresh until it can be transported (Stillwater School District 1995: 33-36). It must be stressed that care must be taken to avoid the spread of diseases such as swine fever, Exotic Newcastle disease, and Bovine Spongiform Encephalitis (BSE), also known as "Mad Cow Disease". To prevent this, if given a constant supply,

farmers and ranchers can enhance their livestock's diet with the correct kind of food scraps (Ogino *et al.* 2007:1). The UBCO cafeteria must find a farmer willing to take the food scraps.

This program can work and has had success. For example, many hog farmers in California partake in the "Garbage Feeding Program" administered in cooperation by the U.S. Department of Agriculture (USDA) and the California Department of Food and Agriculture (CDFA). The farmer must heat-treat all post-consumer food waste and food scraps that have been in any contact with meat. At a minimum, the materials must be heated to 212 degrees Fahrenheit for 30 minutes prior to feeding it to pigs (Ogino *et al.* 2007:1). This heat management prevents potential transmission of diseases such as Trichonella, enteric coliform bacteria, swine fever, and foot and mouth disease. (Ogino *et al.* 2007:1).

Cattle and sheep are more restricted in what they can eat, but many dairy farmers or ranchers could accept certain types of food residuals as a feed supplement. Pre-consumer vegetable material, like produce culls or fruit/vegetable processing byproducts could be useful for a local farm or ranch. Many types of food scraps can be fed directly to farm animals like hogs; however, some are not acceptable for cattle (Binning 2007: 1). According to the California Integrated Waste Management board, "to prevent the transmission of disease, cattle should not be fed anything containing meat products. Also, certain vegetables such as onions or garlic may taint the flavor of milk from dairy cows" (Binning 2007: 1).

Chickens, turkeys, ducks, and geese eat most fresh foods and have a broad diet. They can eat "spaghetti with tomato sauce, steamed brown rice, grapes, fresh greens and

lettuce, chopped cooked potatoes, corncobs, apple cores, whole grain bread, raw tomatoes, and their own hard-boiled eggs, including the shells. Kelp or blood meals are good sources of needed minerals" (Binning 2007: 1). However, any meals that contain egg, meat or blood have to be cooked to prevent the spread of disease. It is also important to note that chickens must be fed fresh, pre-consumer foods, instead of post-consumer or spoiled foods (Westendorf 2000: 570).

Farmers can feed post-consumer and pre-consumer food waste to hogs without any modification of their feeding system if feed composition is appropriate, or the products can be used as ingredients for commercial concentrate feeds. Another successful program in Sapporo city Japan, is the Sapporo Kitchen Garbage Recycle Centre. This program collects 50 tons of garbage from a total of 188 schools, hospitals and companies and processes it into dehydrated feed by fry-cooking. Fry cooking is a new system of dehydrating food waste in which it is cooked in waste vegetable oil under reduced pressure at relatively low temperature (about 110°C) (Ogino *et al.* 2007:1064-5).

UBCO will economically benefit the most from diverting their unwanted food to beneficial uses. This is especially true if haulers offer reduced rates for collection of segregated organic materials. By reducing the number of trash pickups, costs would tend to go down (Binning 2007: 1). Because this program would involve local farmers, it would greatly contribute to the food sustainability to the Okanagan as a whole community, as well as UBCO.

7.2 Recycling and Composting: Growing Environmental Stewardship

Recycling has positively developed over the last 20 years in Canada. At present, it is a common and acknowledged division of waste management services. About 6.6 million tons of non-hazardous waste materials were arranged for recycling by local waste management organizations and companies in 2002. The volume of recycled material consisted of two categories: paper and cardboard, which accounted for 46%, and organic materials, which totaled 18% (Statistics Canada 2005: 1). Industrial, commercial and institutional sources provided just over one-half of the materials prepared for recycling. Households accounted for 39%. Canadian paper mills recycled an estimated 2.8 million tones of waste paper in 2002. Since 1995, about 40% of waste paper has been recycled each year, compared with only 26% in 1990 (Statistics Canada 2005: 1).

However, composting occurred on a much smaller scale. In 2002, centralized composting facilities composted an estimated 1.2 million tones of organic waste. Unfortunately, according to Statistics Canada, the amount diverted through backyard compost or on-site by industry is not known. There were 351 centralized facilities composting organic waste in 2002, compared with 255 in 2000 (Statistics Canada 2005: 1).

From these statistics, it is clear that Canada is on its way to becoming a more sustainable country. However, there is still more to be planned and more to be accomplished before we can call ourselves a sustainable society. By starting at UBCO, the university can be a frontrunner in the race for environmental stewardship to help make Canada a cleaner, healthier country.

8.0 Conclusions: Towards A More Sustainable Future

It has become evident through the research we have completed and data which we have composed, that UBCO presently has a post-consumer food waste dilemma. By observing other institutions, it is clear that there are ways to control and condense the quantity of food being bought in order to reduce the post-consumer food waste.

In regards to post-consumer food waste, there are many options to deal with unnecessary refuse and ways that the university currently disposes food waste. One alternative is to set in motion compost facilities for post-consumer food, as other institutions have done. Pennsylvania State University, for example, has a very successful composting program. Through composting, post consumer food waste can be reduced and put to use around the campus. Composting could easily be implemented into UBCO's daily activities. It would simply require the organization and the participation from the UBCO community. By minimizing the inputs we, in turn, will reduce the outputs. Both of these ideas concerning food and purchasing are fairly simple concepts, which could easily be introduced at the university. We feel that the community would be willing to implement such programs because they require little effort yet yield great results. This compost can then either be sent away or donated to farms in the local area or it can be used at the university's campus for fertilizer.

The UBCO cafeteria should be prepared to put into practice our ideas because there are no significant costs associated with the concepts, basically, it is an innovative way to help the surrounding environment on campus. The quantity of post-consumer waste can be drastically reduced simply by diverting most of the garbage to recycling. As we found in our garbology study, the majority of the waste was composed of recyclable

materials, such as white paper, like napkins and plastics, like cutlery. These materials should not be going to community landfills, even if they are biodegradable. The UBCO cafeteria could be supplied with more recycling receptacles that are strategically placed for convenience, but most importantly, clearly marked. Along with this, educating the community in recycling procedures can significantly reduce post-consumer waste. This, too, is something that the university's cafeteria could implement.

Regrettably, our culture is a consumer culture. Advertising has influenced Canadian society's attitude to buy and buy. Naturally the more we buy, the more we throw away and this is almost, single handedly, responsible for our large amounts of waste. Many of the products we found in the trash during our garbology study were one time use items such as plastic containers, cups and cutlery. People receive too much food like fries, pasta and bread which is discarded into the trash. Other fruits and vegetables like lettuce and tomatoes are also thrown away, when they can be reused as fertilizer or as animal feed.

Evidently, the only way to resolve the problem of waste production is by an overall commitment from the community, but most importantly those who attend and are employed by the university. Perhaps an incentives program, like giving discounts to those who bring their own mugs, cups and food containers could be put into place in order to encourage people to reduce the amount of waste that they are producing. A sustainable society is one that can persevere over generations, one that is visionary, flexible, and intelligent. Society cannot challenge its physical or its social methods of support. The resolution of post-consumer food waste is one step towards producing an improved, sustainable society not only for the campus, but for the community as a whole.

9.0 Proposal for Further Research

Given the limited amount of time for this project, we were able to gather a wealth of information of the concept of garbology, the literature on the subject and insight into the UBCO cafeteria's post-consumer waste problems. However, there is still a need for follow up. The methods used for this study had a number of weaknesses. The time allotted to the project did not permit for investigation of all the trash cans at once. As well a four month scope of research did not allow time for a report of seasonal food consumption habits. Additionally, the hour periods allotted for observation during peak hours did not permit the researchers to observe other times of food consumption such as afternoon and late evening.

Furthermore, one of the draw backs of doing this type of study without surveys or interviews is that it cannot illustrate the reasoning of why people throw out what they do. The study can only recognize what had been thrown out. Moreover, our understanding of the reasons why this waste has been created are based on observation on the waste tossed, opposed to personal realities and explanations of those who had thrown the trash out. Questionnaires or surveys could be handed out to students asking why they waste their foods. Using questionnaires should yield interesting results that could be more holistic in determining how to reduce the post-consumer waste on campus.

A study on the education of student and faculty on their own personal food consumption habits would also allow for the reduction of waste. Questions such as: How do we communicate asking for portion sizes that can be fully consumed to the student population? How do we encourage reusable mugs and other food ware to reduce the amount of food waste tools consumed on campus? In 1987, study by the University of

Oregon, examined the reasons why households discarded food, suggested that consumer education may play an important role in reducing consumer food loss **(**Kantor, Lipton, Manchester, and Victor Oliveira 1997:7). Further investigation of this would allow the student population to become more engaged in the food choices they are making.

On the UBCO campus, the cafeteria is not the only food service center. Among the cafeteria are the Sushi Bar, Extreme Pita, Tim Horton's and Montego's as well as other garbage bins placed around the campus. All of these food services could give more information on the amount of post-consumer waste on the campus as a whole. From these results, a larger, more holistic, program could be implemented to keep down post-consumer waste and garbage in and around the entire UBCO campus. As well, more research is needed in finding farmers in the local area who would be willing to participate in a pilot program to divert food waste to animal feed. As this project is a viable way to reduce post-consumer waste after it is produced.

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Appendix A: Observational Data Collection Sheets

Data Sheets: Breakfast

	Small Amount	Medium Amount	Large Amount	Frequency
Bread	4	3	0	H
Cookies	1	0	0	L
Muffins	1	0	0	L
Pizza	0	0	0	Z
Fries	0	0	0	Z
Rice	0	0	0	Z
Potatoes	5	2.5	0	H
Noodles	0	0	0	Z
Pasta	0	0	0	Z
Chips	0	0	0	Z
Crackers	0	0	0	Z
Pastries	0	0	0	Z
Pie	0	0	0	Z

H= More than 5 average occurrences
M=Between 3-5 average occurrences
L= Less than 3 occurrences

Vegetables/Fruits (Raw)

	Small Amount	Medium Amount	Large Amount	Frequency
omatoes	1	0	0	L
ettuce	1	0	0	L
eans	0	0	0	Z
ucumbers	0	0	0	Z
arrots	1	0	0	L
elery	0	0	0	Z
ixed Veggie alad	0	0	0	Z
ixed Fruit Salad	1	0	0	L
pples	1	0	0	L
ranges	3.5	2	0	M
ears	0	0	0	Z
ananas	1	0	0	L

Vegetables/Fruits Cooked

	Small Amount	Medium Amount	Large Amount	Frequency
Carrots	0	0	0	Z
Peas	0	0	0	Z
Cauliflower	0	0	0	Z
Yams	0	0	0	Z
Broccoli	0	0	0	Z
	0	0	0	Z
	0	0	0	Z

Meats /Other alternative protein

	Small Amount	Medium Amount	Large Amount	Frequency
Pork chops	0	0	0	Z
Hamburger	0	0	0	Z
Steak	0	0	0	Z
Beef jerky	0	0	0	Z
Turkey	0	0	0	Z
Chicken	0	0	0	Z
Tofu	0	0	0	Z
Ham	0	0	0	Z
Eggs	4.6	2	0	H
Bacon	2	0	0	L

Dairy /Dairy Alternatives

	Small Amount	Medium Amount	Large Amount	Frequency
Chocolate Milk	0	0	0	Z
Milk	0	0	0	Z
Cheese	0	0	0	Z
Soy Milk Vanilla	0	0	0	Z
Soy Milk Chocolate	0	0	0	Z
Ice-cream	0	0	0	Z

Other Foods

	Small Amount	Medium Amount	Large Amount	Frequency
Gummy Candies	0	0	0	Z
Gum	0	0	0	Z
Pretzels	0	0	0	Z
Pop	0	0	0	Z
Juice	0	0	0	Z
Hard Candies	0	0	0	Z
Corn-nuts	0	0.	0	Z

Drink Containers Recyclable

	Amount
Plastic Bottles	15
Milk cartons Small	4
Milk cartons Big	8
Glass Bottles	6
Tin Cans	7

Drink Containers Non Recyclable

	Amount
Paper/Wax Mix	7.3
Styrofoam	9.3
Cardboard/Paper	7.3
Plastic Lids	8

Condiments

	Amount
Mustard	0
Salt	5.6
Straws	0
Pepper	3
Ketchup	3
Cutlery	4
Vinegar	0
Sugar	0
Wooden Stir Sticks	0
Napkins	14.3
Gravy containers	0

Other Trash

	Amount
Paper Plates	3
Styrofoam Plates	2
Paper food Containers	9.3
Styrofoam Food Containers	
Chip Bags	0
Candy Wrappers	1
Plastic Wrap	0

Data Sheets: Lunch

	Small Amount	Medium Amount	Large Amount	Frequency
Bread	3	1	1	H
Cookies	1	0	0	L
Muffins	2	1	0	L
Pizza	6	2	0	H
Fries	4	3	1	H
Rice	0	0	0	Z
Potatoes	3	2	0	H
Noodles	2	1	0	M
Pasta	3	1	1	H
Chips	1	0	0	L
Crackers	0	0	0	Z
Pastries	0	0	0	Z
Pie	0	0	0	Z

Vegetables/Fruits (Raw)

	Small Amount	Medium Amount	Large Amount	Frequency
omatoes	3	1	0	M
ettuce	1	0	0	L
eans	0	0	0	Z
ucumbers	1	0	0	L
arrots	1	0	0	L
elery	0	0	0	Z
ixed Veggie alad	2	0	0	L
ixed Fruit alad	1	0	0	L
pples	1	0	0	L
ranges	3.5	2	0	M
ears	0	0	0	Z
ananas	1	0	0	L

Vegetables/Fruits Cooked

	Small Amount	Medium Amount	Large Amount	Frequency
Carrots	1	0	0	L
Peas	0	0	0	Z
Cauliflower	**0**	0	0	Z

Yams	0	0	0	Z
Broccoli	0	0	0	Z
	0	0	0	Z
	0	0	0	Z

Meats /Other alternative protein

	Small Amount	Medium Amount	Large Amount	Frequency
Pork chops	0	0	0	Z
Hamburger	2.5	0	0	L
Steak	0	0	0	Z
Beef jerky	0	0	0	Z
Turkey	0	0	0	Z
Chicken	1.5	0.5	0	L
Tofu	0	0	0	Z
Ham	0	0	0	Z
Eggs	0	0	0	Z
Bacon	0	0	0	Z

Dairy /Dairy Alternatives

	Small Amount	Medium Amount	Large Amount	Frequency
Chocolate Milk	.5	0	0	L
Milk	0	0	0	Z
Cheese	0	0	0	Z
Soy Milk Vanilla	0	0	0	Z
Soy Milk Chocolate	0	0	0	Z
Ice-cream	0	0	0	Z

Other Foods

	Small Amount	Medium Amount	Large Amount	Frequency
Gummy Candies	0	0	0	Z
Gum	0	0	0	Z
Pretzels	0	0	0	Z
Pop	0	0	0	Z
Juice	0	0	0	Z
Hard Candies	0	0	0	Z
Corn-nuts	0	0.	0	Z

Drink Containers Recyclable

	Amount
Plastic Bottles	4
Milk cartons Small	2
Milk cartons Big	8
Glass Bottles	6
Tin Cans	7

Drink Containers Non Recyclable

	Amount
Paper/Wax Mix	7.3
Styrofoam	9.3
Cardboard/Paper	7.3
Plastic Lids	8

Condiments

	Amount
Mustard	2
Salt	5.6
Straws	
Pepper	2
Ketchup	6
Cutlery	9
Vinegar	0
Sugar	0
Wooden Stir Sticks	3.5
Napkins	23
Gravy containers	0

Other Trash

	Amount
Paper Plates	3
Styrofoam Plates	2
Paper food Containers	9.3
Styrofoam Food Containers	5
Chip Bags	0
Candy Wrappers	1
Plastic Wrap	0

Data Sheets: Dinner

	Small Amount	Medium Amount	Large Amount	Frequency
Bread	4	3	2	H
Cookies	1	0	0	L
Muffins	2	0	0	L
Pizza	5	2	1	H
Fries	4	2	1	H
Rice	1	0	0	L
Potatoes	3	2	0	H
Noodles	2	1	0	M
Pasta	3	1	0	M
Chips	0	0	0	Z
Crackers	1	0	0	L
Pastries	0	0	0	Z
Pie	0	0	0	Z

Vegetables/Fruits (Raw)

	Small Amount	Medium Amount	Large Amount	Frequency
omatoes	4	1	0	M
ettuce	2	0	0	L
eans	0	0	0	Z
ucumbers	1.5	0	0	L
arrots	2	0	0	L
elery	0	0	0	Z
ixed Veggie alad	4	0	0	M
ixed Fruit alad	1	0	0	L
pples	1	0	0	L
ranges	3	1	0	M
ears	0	0	0	Z
ananas	1	0	0	L

Vegetables/Fruits Cooked

	Small Amount	Medium Amount	Large Amount	Frequency
Carrots	1	0	0	L

Peas	2	0	0	L
Cauliflower	**1**	0	0	L
Yams	0	0	0	Z
Broccoli	1	0	0	L

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Meats /Other alternative protein

	Small Amount	**Medium Amount**	**Large Amount**	**Frequency**
Pork chops	0	0	0	Z
Hamburger	3	0	0	L
Steak	0	0	0	Z
Beef jerky	0	0	0	Z
Turkey	1	0	0	L
Chicken	1.5	1	0	L
Tofu	0	0	0	Z
Ham	2	0	0	L
Eggs	0	0	0	Z
Bacon	2	0	0	L

Dairy /Dairy Alternatives

	Small Amount	**Medium Amount**	**Large Amount**	**Frequency**
Chocolate Milk	.5	0	0	L
Milk	0	0	0	Z
Cheese	0	0	0	Z
Soy Milk Vanilla	0	0	0	Z
Soy Milk Chocolate	0	0	0	Z
Ice-cream	0	0	0	Z

Other Foods

	Small Amount	**Medium Amount**	**Large Amount**	**Frequency**
Gummy Candies	0	0	0	Z
Gum	0	0	0	Z
Pretzels	0	0	0	Z
Pop	0	0	0	Z
Juice	0	0	0	Z
Hard Candies	0	0	0	Z
Corn-nuts	0	0.	0	Z

Drink Containers Recyclable

	Amount
Plastic Bottles	2
Milk cartons Small	4
Milk cartons Big	3
Glass Bottles	6
Tin Cans	4

Drink Containers Non Recyclable

	Amount
Paper/Wax Mix	9
Styrofoam	3
Cardboard/Paper	7.3
Plastic Lids	6

Condiments

	Amount
Mustard	1
Salt	5.6
Straws	0
Pepper	3
Ketchup	3
Cutlery	12
Vinegar	0
Sugar	3
Wooden Stir Sticks	2
Napkins	22
Gravy containers	1

Other Trash

	Amount
Paper Plates	3
Styrofoam Plates	2
Paper food Containers	6
Styrofoam Food Containers	11
Chip Bags	4
Candy Wrappers	1
Plastic Wrap	0

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