

Off Campus Food Waste vs On Campus Food Waste

Which one produces more food waste?



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Environmental Seminar

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May 3, 2019

TABLE OF CONTENTS

1. Introduction
 - a. Project
 - b. Background
 - c. Literature Review
2. Methods
 - a. On-Campus Data
 - b. Off-Campus Data
 - c. Survey Set up
 - d. Case Study
 - e. Analysis Procedure
3. Results
 - a. On-Campus
 - b. Off-Campus
 - c. Case Study
4. Discussion
 - a. Discussion
 - b. Recommendations
5. Conclusion
6. References
7. Appendix

Acknowledgements:

We would like to thank the Director of Sustainability at BC Dining, Julianne Stelmaszyk, for agreeing to be our adviser for this project as well as helping us understand how BC acquires its food and disposes of it. Without her help, we would not have been able to acquire or analyze the data. We would also like to thank the professor for the environmental seminar, Tara Pisani Gareau. Without her drive and passion for the environment, we would not have conducted this project. Lastly, we would like to thank your friends, and loved ones who supported us during our project as well as for the individuals who participated in the project. They were the backbone that made this project possible.

Abstract

This project sets out to see if students who live off-campus produce more food waste than students who live on-campus. We believe that this is plausible as off-campus students have to juggle groceries, cooking, cleaning, and waste management for the first time while also completing school work and maintaining social ties. In order to conduct this research, on-campus data was sent over by the Sustainability Director at BC Dining, Julianne Stelmaszyk. Off-campus data was collected through a 15 question survey on Google Forms that asked them questions about shopping and eating habits. The survey had 52 individuals respond. A case study was also conducted that had 6 individuals participate. 80% of off-campus students do no compost while the averaged perceived consumption rate for off-campus students was 86.5%. We were unable to draw a conclusion for the question, but we were able to shed some light on off-campus food habits. We have come out with some recommendations for BC to implement.

INTRODUCTION

Project

On BC's campus, there has been a focus on what dining facilities has done and the strides that they are making to shift towards a more sustainable model. However, these efforts have not taken into account what students off-campus do and how this compares to students on-campus. By not looking into off campus food waste, BC is missing an opportunity to help reduce their carbon footprint and the strain on earth's finite resources. This project seeks to rectify that and provide potential solutions for BC to implement.

We believe that students who live off-campus waste more food because they are on their own for the first time, and consequently, this is the first time that many students are responsible for cooking their own meals. We hypothesize that this inexperience with cooking coupled with heavy workloads and packed social schedules leads to higher amounts of food going to waste as

opposed to students who live on campus and eat at BC dining facilities. However, BC is also a large operation trying to feed thousands of students and has to respond to what students' tastes are. This can lead to dining facilities overbuying food on some occasions. We would like to get to the bottom of this

Background

The world is in the midst of a food crisis with 805 million people worldwide not having adequate access to enough food to lead a healthy life yet, we are wasting 40% of it (Balkan and Cabrera 2019). This equates to roughly 133 billion pounds of food and more than \$161 billion of that goes to waste. Food waste can happen along all parts of the food supply chain. It starts in production and continues into handling, processing, and packaging. Many farmers and growers throw out perfectly good produce because it is blemished and consumers would not want to buy it (Gustavasson et al 2011). Even after it is distributed and bought, Americans end up eating only 70% of what they buy (Gustavasson et al 2011). Other studies have this number for total consumption as low as 60% (Gunders 2011). This wastes both the resources and land needed to grow the food as well as consumer money needed to purchase the food.

Growing crops and raising livestock for consumption is a very resource intensive process, especially for livestock because water and resources are used to grow the feed as well as the resources that go towards raising the livestock. So when an individual doesn't eat the meat that they bought, this has a double hit on earth's resources. This is compounded by the fact that due to the high demand for meat products, more and more forest and rainforests have been cleared in order to make space for the livestock in countries like Brazil (UNFAO 2013). By cutting down the rainforests, vital ecosystem services and habitats for endangered species and the planet are erased. In addition, by clearing the forests, the likelihood for desertification to take place increases, thus reducing the amount of fertile land available. Lastly livestock, especially cattle, produce large amounts of methane that contribute to GHG emissions that are warming the earth beyond the 2.0 C threshold set by the UN (UNFAO 2013).

By wasting produce that required fertilizers and pesticides to grow, we are ruining our soil in addition to throwing food out. Nitrogen runoff from fertilizers and livestock waste leads to toxic algal blooms, both of which are starting to cause large biome-level tragedies through climate change and anoxic zones (UNFAO 2013). Toxic algal blooms have killed off large

swaths of nearshore ecosystems as a result of their toxins. Alongside food waste there is also the issue of increased trash when containers that food and drinks come in are not recycled.

Solving the issue of food waste, even on a small scale also provides a economic incentive for the individual because it can translate to financial savings. This could mean that instead of spending \$100 and only eating \$70 worth of food while wasting \$30 a week, the individual can just spend \$70. This equates to an annual savings of \$1560 off of just \$30 a week. The question comes down to a matter of the finite resources here on earth and if we can allocate the resources better, we prevent over drawing from the water tables and clearing vital rainforests for pastures.

Literature Review

When evaluating sources for this research project two things stood out that supported the need for us to continue with this project. One was that food waste is a problem, especially among young adults ages 18 to 24. Secondly there has been an increasing number of composting initiatives at universities across the United States but little acknowledgement of the waste off campus students produce.

“Wasted Food: A Qualitative Study of U.S. Young Adults”

In an article published in *Appetite*, “Wasted food: A qualitative study of U.S. young adults’ perception, beliefs, and behaviors”, 60% of all consumer food waste is avoidable (Nikolaus et al 2018). This project studied student habits and gauged awareness of food waste through 75-minute focus groups. They attempted to address existing knowledge of the issue, factors that determine and influence behavior and then had students suggest interventions as a three step approach to getting a view of the problem of food waste specifically. An estimated 31% of food available at retail or consumer levels is wasted (Nikolaus et al 2018).

The research team found that waste stems from having too much on plates, spoiling, and then poor planning, like excess purchasing. There is a difference between being aware of food poverty somewhere in the world and taking action. Similar to our hypothesis about off-campus students the researchers believed off campus students were faced with new responsibility by no longer living in a dorm, having to manage the finances and consequences of waste more directly. The majority of their subjects, similarly to ours, estimated they only wasted between 3% -15% while assuming the general population wastes 20%- 40% (Nikolaus et al 2018). The article focused on uneaten food and does not address off campus composting but ultimately makes strong conclusions about the factors that influence food waste behaviors: sensory/value of food,

reuse value, management of food, body, and schedule, personal values, portions, disconnection with cost or preparer, sharing, prioritization and newness, and finally concerns about food safety and expiration dates (Nikolaus et al 2018). This study concluded that low awareness was a major reason for waste and suggest off campus students receive practical suggestions for food shopping and meal planning but nothing is mentioned about the inevitable reality of food that goes uneaten; and the feasibility of and opportunity for composting (Nikolaus et al 2018).

“Lack of Awareness Leads to Abundance in Food Waste Among Young Adults”

“Lack of awareness leads to abundance in food waste among young adults” by Samantha Boyle continues on the same theme of young adults living on their own and the food waste associated with it. People tend to underestimate how much they waste which is why awareness can be so powerful in changing habits. The University of Illinois article references EPA data that claims the average person throws out 20 pounds of food every month and the average American family spends over \$1000 on wasted food each year (EPA 2019). An interesting point this study brings up as well is the levels there are to food waste. Beyond just wasting of food, in turn the money and all the labor associated with it becomes wasted as well (Boyle 2019). This article addresses buffet style on campus dining which BC does not have because students are charged for every item but the system is still somewhat the same. Beyond BC, buffet dining is at the root of much of the on-campus dining waste that is produced and focused on with other universities composting programs. Off campus waste remains an afterthought.

“Recycling Food Waste 101”

“Recycling Food Waste 101” by Dan Sullivan is a study that looked at the composting projects at 30 different schools. All of them looked at on-campus dining halls. A new idea used at many of the schools examined are university gardens that are associated with the composting. This source reports in “nearly every instance a portion or all compost is utilized in campus gardens, farms and landscaping” (Sullivan 2010). Dickinson College plants 6 acres of vegetables at their campus garden. At Cal State Chico students are in charge of bringing compost to the university farm. The University of Pennsylvania takes everything to an off-site facility 40 miles away but still elects to compost rather than dispose of food waste in the trash. In all 30 campus composting cases costs were decreased at the universities (Sullivan 2010).

“Evaluating Students’ Knowledge of Food Waste and Food Insecurity”

“Evaluating Students’ Knowledge of Food Waste and Food Insecurity on College Campuses” was relevant to us because we saw the angle of food insecurity as a potential obstacle to our research. People can be self-conscious about what they eat or what they spend and may not want to reveal that information despite the anonymity of our research. Yet again this research was done in a dining hall, providing questionnaire to participants before and after they ate. Nothing significant was found in this study except for about a 10% increase in awareness for the amount of food waste on-campus per customer (King et al 2018). From our sources we concluded that awareness is a recurring theme that starts the conversation and leads to action.

METHODS

The project was conducted in two parts. For this project, the parameter for food waste was any food that was bought but not consumed, including food that was sent to compost or trash. The data for on campus data was provided by BC dining while off campus data was collected via surveys. On-campus housing was defined as any residential building that is within a 10-minute walk of a BC dining hall. Off-campus housing was any residential building that had access to their own kitchen and were not within a 10-minute walk of a BC dining hall. As a result, despite being owned and operated by BC, the Reservoir Apartments were counted as off-campus housing because they were not near a dining hall.

On-Campus Data

The Sustainability Director at BC dining, Julianne Stelmaszyk, was the primary point of contact for on-campus data and provided the data for on-campus food waste and annual transactions at one of their locations: Corcoran Commons. Julianne was able to provide the total amount of food BC dining bought at Corcoran Commons for the 2017-2018 academic year as well as the total number of transactions at Corcoran Commons in the same time span. The on-campus food waste provided was Lean Path data which is the data that they capture behind house whenever students throw away their food or if BC produces too much food for a day. This food waste is then weighed, recorded, packaged and shipped off for composting. BC dining rarely throws anything into the trash so the Lean Path data was used as a proxy for BC on-campus food waste. The total number of transactions at Corcoran Commons was 21000. The total food collected at Lean Path was divided by the total number of transactions in order to obtain the amount of food waste in a month associated with each swipe.

Off-Campus Data

For the off-campus portion, a survey was made on Google Forms and was posted on BC's senior, junior, and sophomore class Facebook pages as well as sent to friends who lived off campus. Anyone who was at least 18 and had lived off campus for at least a semester were allowed to take the survey. The survey was not just restricted to students who currently live off campus because many of the current seniors still live in housing that has a full kitchen and it was believed that they would retain their habits from off-campus.

Survey

In total, the survey had 15 questions (Table 1) that took 3-5 minutes to complete. The surveys were completed at the sole discretion of the surveyee on their own time with their own devices. The questions were modeled and inspired by questions from the Natural Resources Defense Council's report on "Tackling Food Waste in Cities" (Mugica and Rose 2019).

The informed consent procedure was a disclaimer at the beginning of the survey which stated that the purpose of the survey was to collect demographic data and that the responses will be analyzed for the purpose of answering the question about food waste off-campus. There was no physical risk to completing the survey and only a potential minor risk to emotional health through stress. Some participants may be hesitant or sensitive about revealing their dietary habits but the purpose of this project was waste associated with food, not analyzing how much or little individuals eat. The only benefit for the participants was that students will be able to reflect on their spending and eating habits and potentially discover how well they are budgeting, where they can save on groceries, and whether or not they are producing a large amount of waste. There will also be a general benefit to the Boston College population by providing evidence for where BC can reduce its carbon footprint and how BC can improve conditions for off campus students.

Survey Questions		
Demographics	Eating Situation	Core behavioral questions
<ul style="list-style-type: none"> ● Class year (Q1) ● Gender (Q2) ● Living location (Q3) ● Number of roommates (Q4) 	<ul style="list-style-type: none"> ● Possession of a meal plan (Q5) ● Diet (Q6) ● Fridge cleaning frequency (Q4) 	<ul style="list-style-type: none"> ● Whether they compost (Q7) ● How often they plan out their meals (Q8)

	<ul style="list-style-type: none"> ● Frequency of usage of take out/food delivery services (Q13) ● Percentage of takeout food eaten (Q14) ● Occurrence of recycling after a party (Q15) 	<ul style="list-style-type: none"> ● How often they go grocery shopping (Q9) ● Amount spent on monthly groceries (Q10) ● In pounds, the amount of groceries bought (Q11) ● The percentage of food eaten before it goes bad (Q12)
<p>Table 1: Survey questions used to collect data from 52 respondents</p>		

Case Study

In addition to the survey data collected, 5-gallon buckets were distributed to three different households. Each household had two individuals who contributed all of their food waste to the bucket. After a week, the buckets were weighed, recorded, and extrapolated to find month and year data. The waste from two of the buckets were deposited in BC's new composting because they contained no animal products while the third bucket's contents were thrown in the trash. No animal products were composted because BC's initiative excludes them.

Analysis of Off-Campus data

For most of the survey questions, they were only analyzed by using bar charts or pie charts in order to help visualize the responses. The two questions that were looked into in depth were "Q11: In pounds, how much groceries would you estimate you buy in a month?" and "Q12: Of all the groceries that you buy, how much do you eat before it goes bad?". The results of the two questions were combined by multiplying the lower total of the response of Q11 by the average of the percentages for Q12. The total lower total represented the total amount of food if everyone bought the low end of the responses; likewise, for the upper total. The procedure was

repeated for the upper limit of the question. The lower and upper limits of Q11 and the common percentages of Q12 were then compared to the NRDC and UNFAO food consumption numbers.

RESULTS

On-Campus

For the on-campus waste data, we were unable to break the waste down by per capita so the results ended up being calculated as total pounds of solid food waste for 2017-2018 being divided by total transactions at Corcoran Commons for 2017-2018 (Figure 1).

This yielded 2.27 pounds

of solid food waste being associated with each transaction at Corcoran Commons over the course of a year (Table 2).

Corcoran Commons (Lower) Solid Food Waste per Transaction	
Total Pounds of Solid Food Waste*	47610.28
Total Transactions*	21000
Pounds per transaction	2.27
Table 2: Amount of waste associated with every transaction	

Off-Campus

When asked, 42/52 respondents do not compost on a weekly basis (Figure 2). In addition, 39 (75%) of respondents do not have a meal plan (Figure 3). The survey showed that most students believe that they buy around 10lbs-15lbs of food a month (Figure 4). From the survey data we found that students 32/52 students (80%) believe that they eat 80% or more of the food that they purchase (Figure 5). When the responses were averaged, the perceived average consumption rate for off-campus students was 86.5%. The total amount of food bought if every student bought on the lower end was 485 lbs. while the upper total was 745 lbs. These totals were then combined with the perceived 86.5% consumption rate and compared against the rates of the UNFAO and NRDC (Figure 6). Lastly, the total food waste per month was derived from the total consumed and dividing by the total number of surveyees (Table 3)

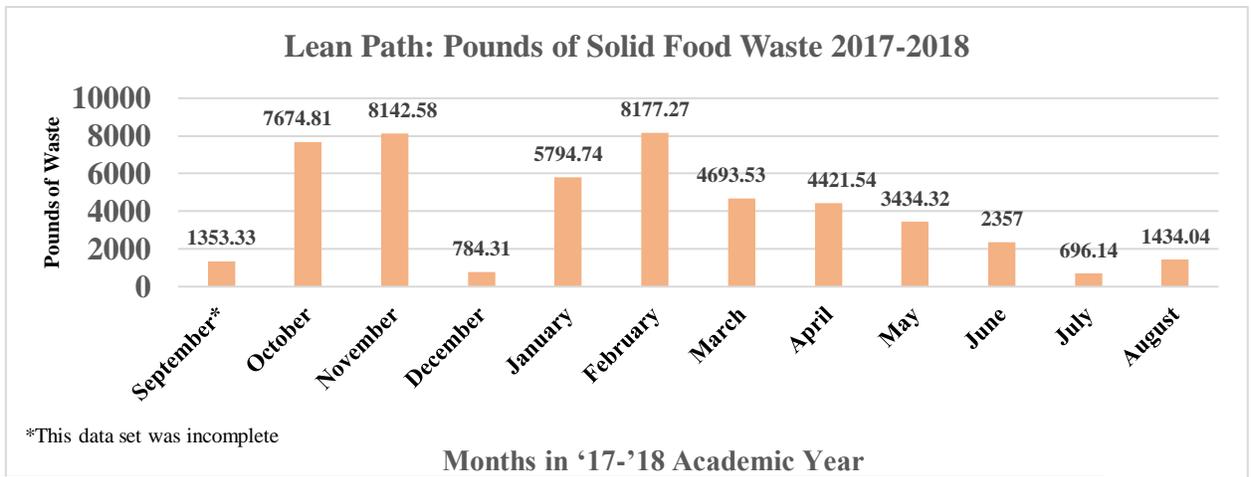


Figure 1: Total Lean path over the '17-'18 school year at Corcoran Commons

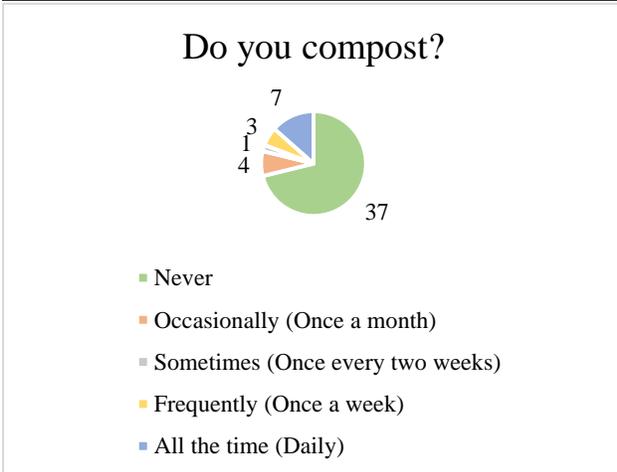


Figure 2: Responses for Q7

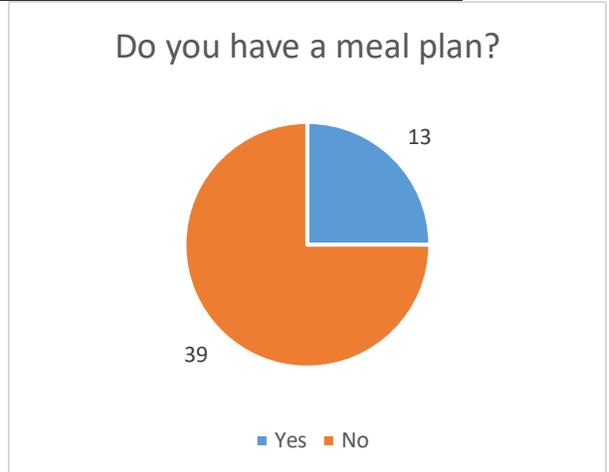


Figure 3: Responses for Q5

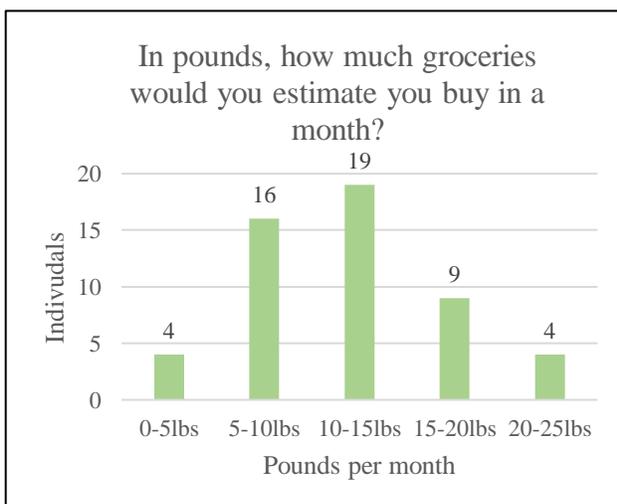


Figure 4: Responses for Q11

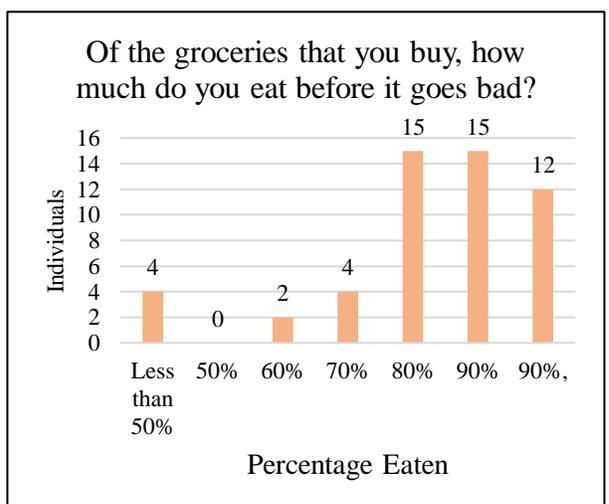


Figure 5: Responses for Q12

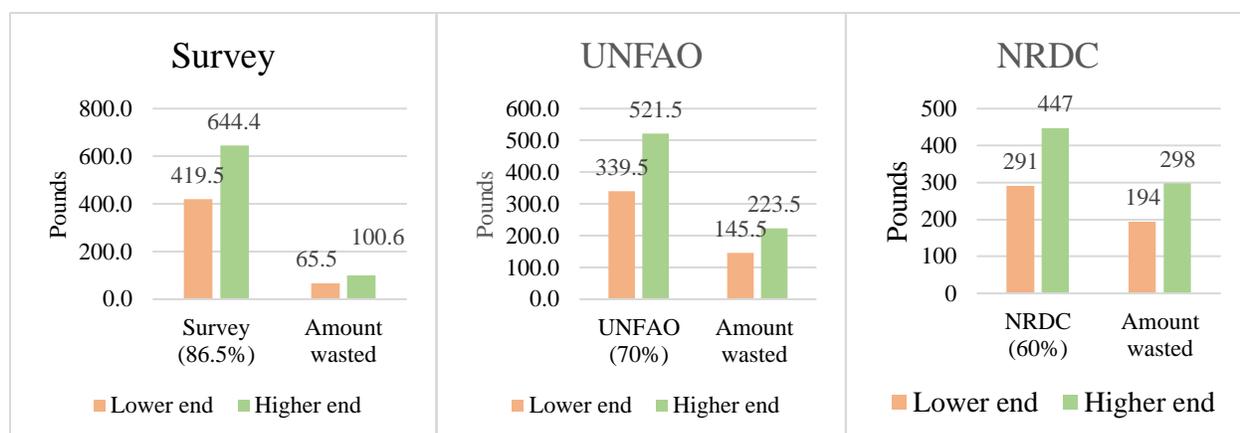


Figure 6: Side by Side comparison of consumption and food waste at perceived 86.5%, UNFAO global consumption rate of 70%, and NRDC consumption rate of 60%.

Waste Per Student per Month		
	Lower consumption end waste (lbs.)	Upper consumption end waste (lbs.)
Survey (86.5%)	1.26	1.93
UNFAO (70%)	2.80	4.30
NRDC (60%)	3.73	5.73

Table 3: Amount of waste students believe that they produce every week compared to UNFAO and NRDCS rates. Lower and upper consumption end represents the lowest and highest possible food amounts that students bought.

Off-Campus Case Study

Participant	Total weight	Weight of Bin	Weight of food waste	Waste per person for a week	Waste for a person for a month *	Waste for a person for a year *
Hung and Individual 1	11.6	2.2	9.4	4.7	18.8	225.6
Davis and Individual 2	12.8	2.3	10.5	5.25	21	252
Individual 3 and 4	9.6	2.2	7.4	3.7	14.8	177.6

Table 4: Data collected from off campus food waste case study *Extrapolated

The identities of each individual other than the researchers were hidden for privacy concerns. The case study found that the per capita waste per week was 3lbs-5.5lbs. This results in around 15lbs-20lbs of food waste being generated each month by each person (Table 4).

DISCUSSION

Comparing on-campus and off-campus food waste was difficult because we were unable to narrow both sides down to a metric that allowed comparison. While we were able to get off campus food waste down to a percentage and number, we were unable to do so with on-campus food waste. When Julianne provided us the Lean Path data, she also provided us the data for how much food BC buys over the course of a year. However, we were unable to figure out how much food BC bought. In addition, while BC was able to record the number of transactions, they were unable to pin down the exact number of individuals who comes and goes through Corcoran Commons, making it almost impossible to nail it down to a per-capita level.

It was difficult to get an exact idea on how much students were wasting because through our survey, the respondents were essentially guessing. Naturally we expect that waste numbers were registered lower than in reality because people generally assume they are less wasteful than they truly are. If we had more time, we would have widened the case-study. Much of the data from the survey would still be relevant but having tangible weights of food/compost collected from the residences and the number of people living at each home could have given us a completely different scope for our research. From our case study, we can see that each household and individual ends up throwing out around 3lbs.-5lbs. of food waste a week, which is much higher than what the survey takers said. This highlights how this project would have benefitted from implementing the case study since the beginning of the project.

In the end, we were unable to find anything conclusive. But, we were able to find initial behavioral statistics that would help BC improve off-campus food waste. Looking back on it, we probably should have shifted focus away from the on-campus portion and just focused solely on the off-campus aspect. There is so much there that we believe BC could make a very large impact through raising awareness and educating students on sustainable ways to live their lives.

We estimate that a four-week study where food waste is collected at the end of each week would be the best strategy for this study. Beyond the pounds of food waste collected in house per week divided by residents, it would be great to have specific meal cost and size data from each participant. To add another degree to our study, or as a completely different study it would have been interesting if we were able to track the waste of food and drink containers and packaging with food purchased both from grocery stores and restaurants. This would have given us a look at the other element of potentially recyclable waste related to food consumption. Something else we could have done better was add questions to our survey to unveil student attitudes toward food. How much more likely they are to save something from a sit down restaurant versus something they make at home, or pick up at a fast casual place. Or whether or not they even care about the environment or believe what they do can make an impact.

On our survey there could have been a misinterpretation of the meal planning question (Q8). It could have been understood as how often an individual plans a meal, like meeting someone for dinner. It also could have been understood as meal prepping for a week or getting supplies from the grocery store for an ex amount of meals. Our On Vs Off campus population comparisons were difficult to quantify so maybe on campus students should have more targeted as part of the study. General household waste data for a family of four in America when compared to student living could have also potentially shown a stark difference in how young adults manage food versus a “standard” family.

Recommendations

We have immediate, short-term (6-12 months), mid-term (1-3 years) and long-term (3 years) recommendations that Boston College can implement to reduce the amount of food waste students produce when living in off campus housing. The first step is **awareness** of the problem or lack of action. 75% of the students that took our survey do not have a meal plan (Figure 2). Generally, everyone that lives on campus has a meal plan. In the immediate future (by the start of next semester or even before the start of summer programs which students often live off

campus for), the Office of Residential Life should include information on composting and recycling in any standard email blast or pamphlet.

- **Immediate:** A virtual informational pamphlet attached to off-campus email blast from ResLife at the beginning of each semester that outlines the basics of composting to bring consciousness to the simplicity of composting and increase participation.
- 80.8% (42/52) participants said they do not compost regularly (Figure 1)

For now, the pamphlet could just be in the form of bullet points somewhere on the email message but eventually we hope that it links to a more specific and significant platform that will be addressed in future steps. Some bullet points could be information on the benefits of composting and the basics of actually composting. For example, the EPA states that “food scraps and yard waste currently make about 30 percent of what we throw away” and “by keeping these materials out of landfills will reduce the space they unnecessarily take up and the release of methane into the atmosphere” (EPA 2019). A page run by BC would be a better for Boston College’s dining and overall school’s green initiatives.

80.8% of the students surveyed believe they eat 80% or more of the food that they purchase (Figure 4). Although 80% is reasonable estimation, we believe if students actually tracked their waste it would more closely resemble the 10/52 people who estimated they only eat 70% or less of the food they buy. With 80% of the pool not composting there needs to be a program in place that makes composting off campus more accessible.

- **Short Term:** The BC community can draw inspiration from a student led initiative between the student government and the office of sustainability at Temple University (Houck 2019). Students there volunteer to bike to the common neighborhoods of off campus residences and collect compost to transport and tow the a community garden. Getting buckets with lids into apartments and houses will increase the likelihood that students compost.
- To enter into the off campus composting program students would pay a \$5 deposit and receive a bucket and be included on the route for weekly pickups which could be done on foot, bike, or in a vehicle.

An initiative like this would be inexpensive and relatively simple to put into motion. Any volunteering, or environmentally conscious student clubs could help collect. Despite BC's new composting initiative, these efforts have only been focusing on dorms, excluding students off-campus. This collection initiative will help close the gap. The program could also be implemented into and extension of the off campus community cleanups.

Although there is already a community garden at BC, it would benefit the off-campus community if one were established closer to the Foster Street neighborhood where many students live. One potential sight could be behind the 2000 Commonwealth Ave apartments.

- **Mid-Term:** Establish a community garden closer to off campus residences where collected compost can be used for soil.
- A community garden or green roof would be a great gathering place where students will be able to see and experience the tangible results of their composting efforts.

In the long term we hope that our immediate, short-term and mid-term solutions can be expanded upon and evolved into major programs. Particularly the off campus compost collection that deposits at the off-campus community garden program. Educating and raising awareness of these programs will be essential. The culmination of this would be a potential farmers market for off campus students to shop locally during the Spring and Fall. The garden would still be effective simply as a comfortable social space that students can take pride and ownership in. Additionally, to manage all of this, we recommend a new department at Boston College within the Office of Sustainability or Environmental Studies department.

- **Long Term:** An online resource center that gives students information on living off campus as an extension of the immediate action pamphlet. Similar to the University of Colorado's Environmental Center.
- A farmers' market held by and sourced from the community garden fueled by compost collection.

The office of sustainability does have a "A Student Guide to Sustainable Living" that was published in 2016 and provides some great information and tips but does not address actions, like composting, that off campus students can take. A revised and updated version of this PDF could

become more effective. A live page with outside links could also be more extensive and informative as well as easier to actively update than a PDF.

CONCLUSION

At the beginning of this project, we set out to see answer the questions of whether living on-campus or off-campus produces more food waste. This was going to be done through analysis of BC Dining data and off-campus surveys. Ultimately, we were unable to answer this question. We did find that every transaction at Corcoran Commons is associated with 2.27lbs of solid food waste. It is difficult to say if each transaction directly contributes 2.27lbs of food waste. We found that there is certainly room for improvement among the Boston College community to increase off campus student involvement in environmental initiatives as 80% of students do not compost regularly (Figure 2). The case study showed that the six students studied produced around 4lbs.-5lbs. of food waste a week (Table 4).

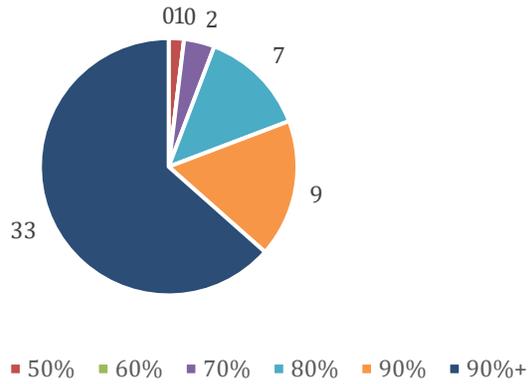
Our hope is that the office of sustainability or the office of environmental studies incorporates new programs based off our recommendations and some if not all our ideas are used to some extent. The students we surveyed were generally inactive as composters and unaware of how much food they waste. As we addressed in our discussion this made it difficult for us to assume with much certainty that the numbers reported to us via our survey were accurate. If we had been able to collect weekly food waste, we would have had better data to analyze in comparison to national waste averages. Going forward awareness will be the catalyst to set student composting in motion. The off campus 5-gallon bucket and volunteer pick up system is an inexpensive and active way to reduce the amount of food waste going to landfills. Once an off campus garden is established the system will be complete and rewarding for those who elect to opt in.

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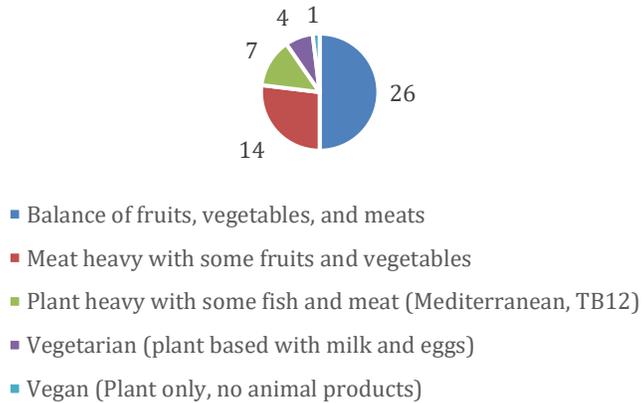
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APPENDIX

Of the food you order, how often do you finish the food?



How would you describe your diet?



How often do you use a food delivery service?

